Interreg North-West Europe NWE-REGENERATIS

European Regional Development Fund

D.T1.1.3. Guidelines of the new methodology for Historical Studies oriented to identify the potential valuable raw materials on PMSD

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Version 2

TABLE OF CONTENTS

ACRONYMS

PCS : Potentially contaminated sites

PMSD: Past Metallurgical Sites and Deposits

UNFC : United Nations Framework Classification

INTRODUCTION

With the increase in the world's population and the global standard of living, the need for ferrous and non-ferrous metals is on the rise (MULTIPICK, 2021). At present, Europe is heavily dependent on foreign countries for its mineral raw material needs. The largest import comes from China, which supplies a total of 98% of the EU's rare earth elements and is also the world's largest producer of aluminium (Simon, 2020). Imports of flat rolled aluminium from China into Europe increased from 171 kilotons in 2016 to 330 kilotons in 2020, which is a doubling of aluminium imports compared to five years ago (European Aluminium, 2021). In addition to the dependence on China, South Africa covers 71% of the EU's platinum needs (Simon, 2020). The European Commission has recently pointed out the drawbacks of this situation. Aluminium production in China is up to three times more carbon-intensive than aluminium made in Europe (Keating, 2019). In addition, many of the mineral materials currently imported could be produced or recycled in Europe, provided that Europe develops extraction, refining and recycling capacities in order to ensure its self-sufficiency (Simon, 2020).

In 2011, EU soil contamination was estimated at 2,8 million potentially contaminated sites (PCS), with metallurgical industries reported as significant sources of contamination (13 %) (EEA, 2019). This is also the case in Wallonia, where, born of its rich industrial and metallurgical past, 5,600 brownfield sites still need to be rehabilitated, representing a total surface area of 22,047 hectares (SPW, 2020). In France, there are approximately 6,800 polluted sites, which need immediate attention and resolution, with about 1,290 in the Rhône-Alpes, 963 in the Nord-Pas-de Calais regions respectively (BASOL, 2018). In UK, approximatively 300,000 ha of land is affected to some extent by industrial or natural contamination, which represents around 1.2% of the UK land area (UK Environment Agency, 1999). Payá *et al.* (2018) report that about 19% of registered and identified contaminated sites in the EU needs some level of intervention. It further indicates that some about 35,000 sites in Germany, 9,031 sites in Czech Republic amongst others need urgent remediation.

The old metal waste deposits (aggregate materials with a high content of ferrous metals, scrap metal, other metals, white and black slag and other fluxes[1]) are commonly found on brownfield sites with rich industrial and metallurgical past, which represents a source of pollution. The environmental stability of metal waste can be altered by changes in pH, interaction with water and the influence of the atmosphere, potentially leaching toxic metal elements into the environment (Pan *et al*., 2019).

Since 2001, regulations[2] have been introduced to allow the treatment and minimise the landfilling of metal waste streams, which still represent 22% of the total annual waste volume in Wallonia. These include residues from thermal operations (58%, slag, sand and dust), ferrous metal waste (22%, scrap, straw and shavings, off-cuts) and acid, alkaline or saline waste (8%) (ICEDD asbl, 2016). However, despite the high metal recovering potential of metal waste streams, current valorisation tracks do not focus on raw material recovering. The main reason being that recycling costs remain in many cases higher than other alternatives such as incineration, use in civil engineering works and landfilling (ICEDD asbl, 2016; SPW, 2007). Thus, in order to move towards a circular economy policy that is not only zero waste but also profitable, Wallonia is investing massively to improve recycling processes and provide more recovery opportunities for by-product stocks.

It is in this context that the Interreg NWE-REGENERATIS project takes place, which is dedicated to the extraction and reuse of raw materials from Past Metallurgical Sites and Deposits (PMSDs). Historical studies are important to conduct as they can provide valuable information regarding past industrial activities that were carried out on site. However, current traditional historical studies are more oriented towards environmental and health risks and does not consider the data collection to assess economic and valorization potential of material deposits present on site (e.g., Guide de bonne pratique pour études historiques by SPAQuE, 2010). Part of this project is to develop a new method

[1] Substances added to a furnace during metal-smelting or glassmaking which combines with impurities to form slag.
[2] Since 14 June 2001, Walloon Government decree allowed the use of BOFS, EAFS and LFS in road and civil engineering works (e.g. road pavements, sub-base work) (SPW, 2001). On 18 March 2004, Walloon Government decree prohibited the disposal of some wastes in landfill sites, including BFS, EAFS and LFS (SPW, 2004).

to conduct historical studies on PMSDs. The latter is focused on potential resource identification on PMSD, and contains the existing approach oriented environmental and health risks.

Each soil exploration study involves a step-by-step approach with different phases that have specific characteristics (WHO, 2021). Regardless of the objective of the research (prospection for raw materials, drinking water production, soil remediation, geothermal energy, *etc*.), a preparatory phase will always be carried out before large-scale research actions are planned. This method prevents large expenditures from being made without favorable results. The potential deployed resources must be justified based on expert assumptions, so that a minimum efficiency and effectiveness can be guaranteed.

Data collection is part of a stepwise approach and the following evaluation phases were distinguished in the Minea project (**Fig. 1**): Prospection, Exploration, Evaluation and Classification. Conducting historical studies is part of the step 1 – Prospection, which aims at identifying relevant secondary raw materials that are potentially present on site (Lederer *et al.*, 2017).

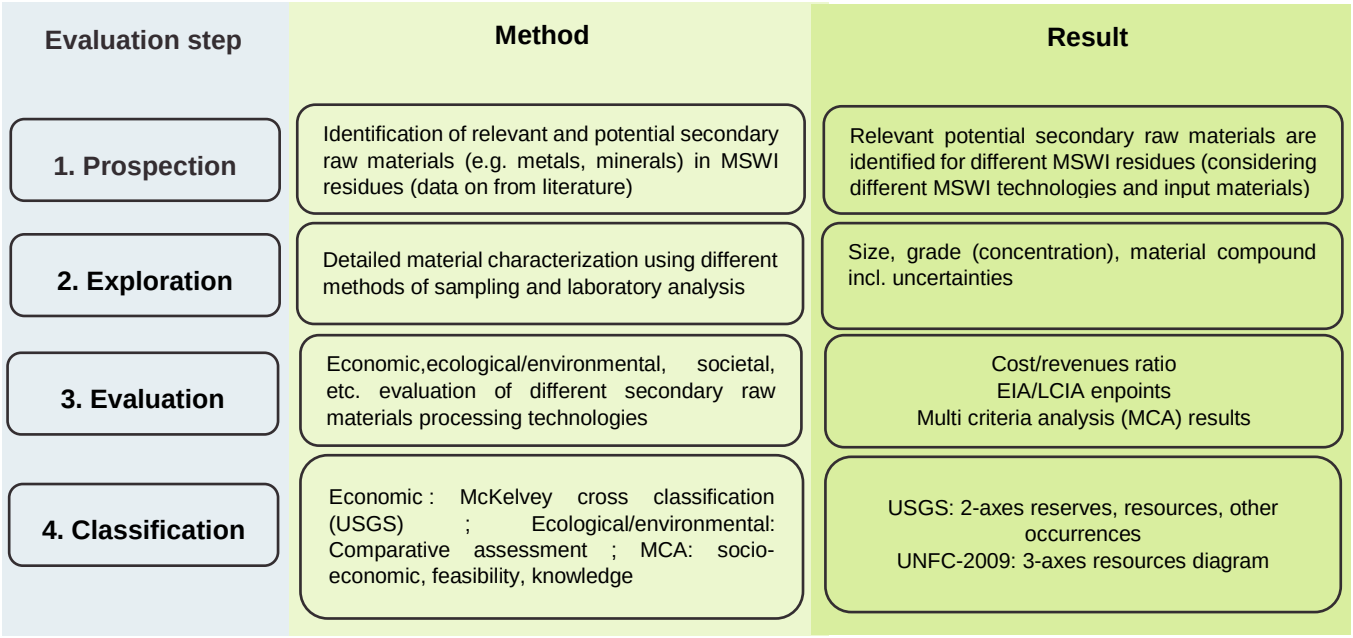


Figure 1 – Evaluation step of the Minea project (Lederer *et al*., 2017).

In addition, UNFC Classification provides valuable insights to assess the potential valorization of a site and the viability of a mining project.

In this report, new guidelines for the conduct of historical studies on PMSD sites are presented. The document is divided into three parts. The first part is dedicated to the presentation of the United Nations Framework Classification (UNFC) and conceptual site model. In the second part of the document, an overview of historical study methods used to collect data on polluted sites across North-West Europe regions (Flanders, Wallonia, Germany, France, UK) is given. This benchmark is complemented with a qualitative inquiry that was done based on historian expert's answers. The third part presents the new guidelines structure for historical studies oriented toward resource recovery, developed to facilitate the identification of PMSD where there is a high probability to find valuable recoverable resources.

1.1 THE UNFC[3] AND PMSD RECOVERY PROJECTS

The UNFC is a scheme to communicate the viability of material and energy recovery projects in a globally accepted way. In 2018, the UNECE approved new Specifications to apply UNFC to Anthropogenic Resources, which allows assessing residues as post-metallurgical sites as well. In detail, the risks of an extraction are assessed against the available information regarding uncertainties of the stock (G-axis; content), socio-economic and ecological preconditions (E-axis; context), and technical possibilities (F-axis; hardware) (**Fig. 2**). Uncertainties will be indicated and lowered. The UNFC provides project related information to all stakeholders, including regulatory bodies, industry, financial community and the public. UNFC compliant reporting helps to develop recovery project by managing investment risks, estimating the raw material supply from secondary sources and informing the public about project related impacts.

The recent UNFC version introduces the "degree of confidence" and replaces the former axis "geological knowledge". With regard to the NWE-REGENERATIS project, this confidence level is an important element in the decision making of the field surveying actions. Geophysical prospection[4] (see *Deliverable WP T1.3.1. Benchmark report on geophysics*) will increase this confidence level by delivering large-scale mapping and profiling reports. Based on these data combined with historical records, the organisation/planning of a more efficient and effective sampling campaign will be set up.

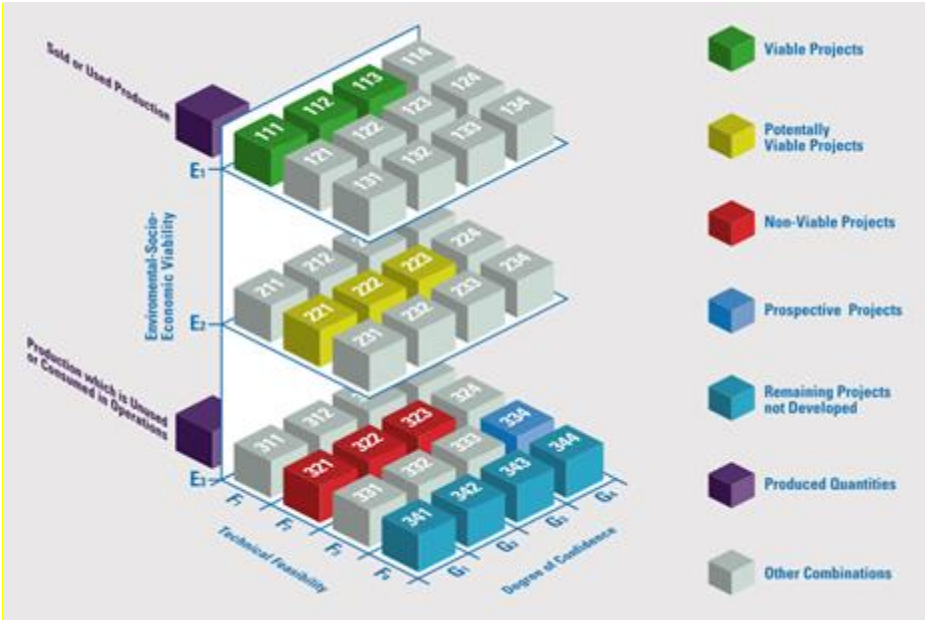


Figure 2 –United Nations Classification for Resources (UNECE, 2020).

When analyzing the Environmental-socio-economic viability factors, we can also refer to the Sustainable Development Goals (SDGs) because these objectives have also been agreed at a global level. Figure 3 shows the relationships between the objectives and the UNFC axes. Introducing sustainability in these revitalization projects is a main concern, which is also one of the goal of the NWE-REGENERATIS project.

Some UN Sustainable Development Goals (SDGs; UN General Assembly, 2015) are directly applicable to the concept of urban mining. For instance, Goal 9[5] contains the objective "striving for

[3] Ulrich Kral (Umweltbundesamt Austria, member NWE-Regeneratis Advisory board) contributed to this chapter.

[4] "The subsurface site characterization of the geology, geological structure, groundwater, contamination, and human artifacts beneath the Earth's surface, based on the lateral and vertical mapping of physical property variations that are remotely sensed using non-invasive technologies" (EEGS 2018).

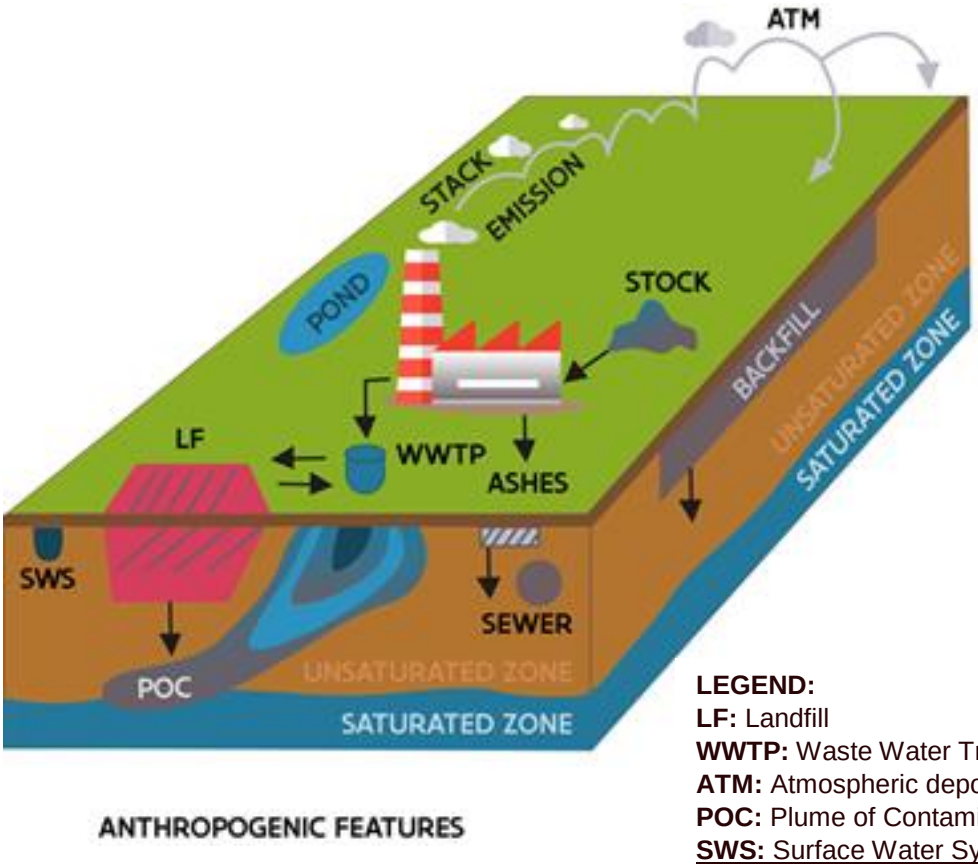
[5] Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

innovation" and Goal 11[6] is about the creation of sustainable cities. Many post metallurgical sites and deposits are nowadays located in cities, not on the edge, due to urban sprawl. Innovation will make it possible to find a solution for PMSD to re-enter the (economic) society, at the same time actively contributing to the sustainability of the surrounding community. Moreover, the NWE-REGENERATIS project supports the Goal 15[7] and its target 15.3. by restoring degraded land and soil.

1.2 CONCEPTUAL SITE MODEL

A Conceptual Site Model (CSM) contributes to a good visualization of the problem and points out additional elements of concern. The CSM is a valuable planning tool that must be used to support the site investigation planning and the decision-making process managing the remediation of contaminated land and groundwater on a large scale.

In contaminated site management, a CSM is mostly related to the traditional risk assessment approach and is described as a source-pathway-receptor model (e.g., contamination of ground or surface water though leaching, inhalation of volatile chemicals, direct contact with toxic substances etc.). The characterization of the source of pollution is often limited to the mobile parameters which could impact the vulnerable receptors. In PMSDs, run-off of solid particles (waste material) is seldom considered as an important contributor. This approach is, however, too limited in view of the NWE-REGENERATIS project objectives which aim to valorise metals, minerals, residues and soil on site. In **Figure 3**, an overview of the anthropogenic features is displayed and sets out the relation with the industrial facility and its environment.



LEGEND:
LF: Landfill
WWTP: Waste Water Treatment Plant
ATM: Atmospheric deposition
POC: Plume of Contaminants
SWS: Surface Water System

Figure 3 - A conceptual site model for a PMSD-site.

[6] Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable.
[7] Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

Specific attention is paid to the occurrence of landfills, backfills and waste treatment plants. In the perspective of resource management, the risk-based approach is not an adequate assessment method because basic information to evaluate the resource potential is unavailable as it was not the target of this approach. The valuable secondary raw materials should be identified from a mining perspective. This includes parameters which allow defining the grade of the waste deposit (e.g., concentration, physic chemical properties, volume, mass, accessibility).

The value of the metals or minerals in the PMSD must be weighed against the cost of extraction to determine whether it is of sufficiently high grade to be worth mining. In traditional mining, it is therefore considered as an ore. In the concept of urban mining, mining operations will be triggered by the aforementioned grade but additional drivers such as environmental risks, spatial demands and flooding potential enter the decision-making process. From this perspective, elements outside the PMSD-facility have a large influence on the valorization and these must be integrated into the CSM. Broadening the site concept to a system analysis is essential.

A Complex Adaptive System takes a broader view at the site and is considering several geometrical scales, timeframes, multiple systems and actions (**Fig. 4**). The final goal is the optimal reintroduction of the location and the waste streams in its environment. This can vary from a total removal of the landfilled waste deposits and polluted soils (including the impact on adjacent zones) to a monitoring system of low maintenance. This choice is based on the ecological and anthropogenic systems and can be directly applied on PMSDs.

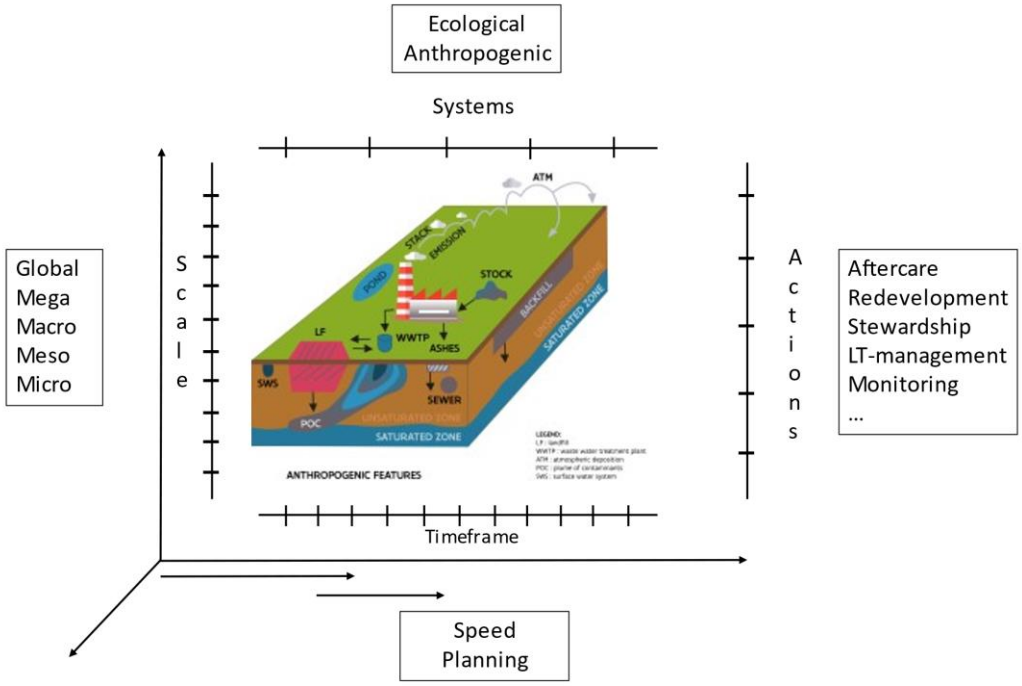


Figure 4 - Representation of a PMSD in a complex adaptive system.

A Dynamic PMSD Management-oriented complex adaptive system considers the broader context of the circular economy and Sustainable Development Goals. A Dynamic PMSD Management should take into account the following features :

- Defining the levels and impact ranges :
  - Internal processes of the PMSD and their impact: site specific - content
  - External processes impacting the PMSD: spatial aspects - context
- Concentric model (geographical characteristics):
  - Microscale : particle level
  - Mesoscale : PMSD level
  - Macroscale : PMSD and its immediate surroundings

    - Megascale : PMSD at a regional scale
    - Global scale : PMSD in a global context
- Systems and Barriers (ranking according to Timbre survey, 2012):
    - Economics
    - Legislation
    - Procedural administrative
    - Political
    - Information and know-how
    - Technological
    - Social cultural
- Actions and Positive impacts (ranking according to Timbre survey, 2012):
    - Restore environment
    - Raise local economic development
    - Reduce development pressure on green fields
    - Increase employment
    - Attract new investors
    - Dispose of negative stigma

Information retrieved from historical study are useful to set up a conceptual site model and implement a dynamic PMSD Management.

2 OVERVIEW OF THE HISTORICAL STUDY GUIDELINES ACROSS NWE

Historical studies for site rehabilitation have been paramount over the years across all regions in the EU and beyond. However, different regions have different legislations and approaches to historical studies. While some have a direct field search approach, most European regions deem source-based historical search essential. However, the historical study guidelines in these regions intended to meet the objectives at the time of their development, hence they are not entirely put into perspective other aspects of making a historical study. Before we zone down some of the North West European regions, we can first take a look at the general EU context about historical studies for contaminated site remediation.

In 2011, the European Environmental Agency (EEA) indicator assessment "progress in management of contaminated sites" proposed four management steps for managing and controlling soil contamination[8]. The first of these four steps is "site identification, preliminary studies and preliminary or historical investigations". This goes on to indicate that at the European level all sites are targeted to be kept as clean as possible in so much as they get contaminated, rehabilitative actions need to start with a historical investigation. Prior to this assessment, there had been other directives which aimed at remedying polluted sites and soils such as the 2004 European Environmental Liability with regards to the prevention and remedying of environmental damage (ELD), Directive 2004/35/EC**,** which operates emphasis on the need for remediation actions on polluted soils.

Drawing from some of these directives and legislations, many EU regions and most NWE regions like Wallonia, Flanders, France, UK and Germany created distinctive guidelines for historical studies.

2.1 HISTORICAL STUDIES IN WALLONIA

In Wallonia, the realisation of a historical study of a potential contaminated site is part of the procedure described in the 2018 decree on soil management and remediation (SPW, 2018). In

[8] Step 1: site identification; Step 2: preliminary investigations; Step 3: main site investigations and Step 4: implementation of risk reduction measures (EAA, 2011).

particular, it is one of the first steps of the orientation study, and, according to SPAQuE (2010), it aims to:

- Establish the historical perimeter of the potential contaminated site;
- Provide a detailed overview of the evolution of occupation and activities of the site;
- Delineate sources of potential pollution in order to determine the locations and types of analyses to be performed (sampling plan);
- Record information about the site that would be useful in case of intervention on the site. For example, information on the nature of the subsoil and the location of potential walls, tanks, pits, *etc*.

According to present Walloon legislation, the realisation of a historical study of a potential contaminated site is mandatory prior to the investigation of a pollution potentially present on the site. The historical study in Wallonia puts priority on the work done on the documentary. An inventory of historical sources and documents available in Wallonia is available and was established based on three criteria: relevance, accessibility and availability of the historical data (GREO, 2016). The inventory of historical sources and documents mostly gives a guide on gathering the needed information about the location of the site, and a chronology of the activities over a period. The historical sources and documents of this inventory gives ways to gather information about the location of the site and the chronology of its activities during a period.

The quality of the information retrieved for historical documents about the location and the past activities on site are assessed by a quality index between 1 and 5, with 1 depicting that the location or activity cannot be determined, and 5 defining a very definite location and the nature of all activities are well known. Further study on site is then carried out based on prior information gathered. This means contact with former managers, site owners, local authorities, neighbors and workers (if they are still alive)" are then established. These oral testimonies aims to corroborate all the information gathered so far. Most of the work of the experts is to make meaning out of the information that they have gathered and the relevance to the investigation project. By making a link between the spatial continuity and quality of the previous studies, they can therefore make some forms of projections in terms of future action plans or remediation strategies.

For that purpose, SPAQuE developed a methodology to conduct historical study in five successive stages (SPAQuE, 2010) :

1. The identification of the company names and of the nature of the activities implemented within the site ;
2. The description of the site and its vicinities, from its time as virgin land, before any human intervention until the time of the historical study ;
3. A commented chronological listing of the events related to the site and related to its activities, its infrastructures and their transformations, its developments and any accidents that have taken place there ;
4. A briefing note on the technologies related to the identified infrastructures and activities ;
5. Conclusions and the establishment of the overall inventory table of sources of potential pollution.

Moreover, the historical study can help to identify and localise the potential pollution sources resulting from geomorphological changes (foundation fill, backfilling, aerial deposits or other relief changes), resulting from accidents, war damage and other unintended harm. These assumptions should be confirmed with investigation study on site (also called orientation study in Wallonia) (SPAQuE, 2010).

2.2 HISTORICAL STUDIES IN FLANDERS

In Flanders, the historical study is included within the standard procedure for performing a preliminary soil investigation. The preliminary desk study[9] is one of the bindin2.3g elements that should be included in the report. Its goal is to determine the spatial boundaries of the soil investigation and to gather information to determine the investigation strategy. The historical study, one of the step of the preliminary desk study, is directed at gathering information about the past use of the site, the current and the former potentially polluting activities, the current and past permits, among others.

In the historical study, the soil expert should discuss all the available information that is relevant to the development of the sampling strategy. Hence, the historical study in Flanders is implemented to support the development of a site-specific sampling strategy in view of a preliminary soil investigation that should be performed on the site. Information includes damage cases, embankments, excavations, data from storage tanks, history of activities, information about current activities based on the recent environmental or environmental permits, relevant complaints or official reports about environmental nuisance. Especially at industrial sites with a long history of operations, interviews with former employees are useful to detect gaps in the site history and more specifically reveal incidents or calamities, which were not reported at the time.

Based on the gathered information, a chronological overview of the site use should be given in order to determinate locations and natures of the potential sources of soil contamination (i.e. description of the production processes used and the substances used, summary of the relevant permits, location and description of the potential contamination sources, non-compliance with restrictions on use). Also other potential contamination sources should be taken into account that lie outside the research location but are related to the operation. This off site contamination might be caused by natural spreading processes (atmospheric deposition, discharge to surface water and groundwater) but also anthropogenic actions will cause distribution of contaminants.

2.3 HISTORICAL STUDIES IN FRANCE

The plan to conduct a historical study in France as clearly outlined in the “Méthodologie nationale de gestion des sites et sols pollués” (2017) prioritises it as the very first thing to do in any site investigation. According to the French methodology, a historical study is more geared towards not only finding out the series of activities on the site to reconstruct the model for the project, but it goes further to try and identify the possible pollutants associated with these forms of activities.

Conducting such a study also is deemed to enhance the investigation process and also be able to size up the level of the nature of the pollutants, its concentration and even the reach in terms of environmental impact and for remediation purposes. The information is gathered quite similarly like in Wallonia with most of them being sourced for from Archives and local authorities believed to have trusted information. France also has BASOL[10] and BASIAS[11], online platforms that store historical databases of sites over the years that allows one to then create a chronological sequence of changes. However, regardless of the amount of information one will be able to gather it is still necessary for the expert to put these pieces together and make meaning out of them in regards to the project that is being conducted.

[9] Consist of (1) Demarcating the research location (mandatory); (2) Gathering environmental characteristics (e.g. topography, the land use of the surrounding parcels, …); (3) Conducting a historical study (mandatory);
(4) Collecting information from previous soil investigations (mandatory); (5) Field visit (mandatory); (6) Collecting geological and hydrogeological data (mandatory).
[10] BASOL (acronym for “Base de données sur les sites et sols pollués”): An online database for polluted sites and soils
[11] BASIAS (acronym for “Base de données des anciens sites industriels et activités de services”) is a public online inventory of historical industrial activities.

2.4 HISTORICAL STUDIES IN UK

The UK has a similar start as the French methodology for land contamination management starting also with a desktop study, site visits, with the aim of determining some indicators that allows for analysing the risk levels on site. Gathering relevant information about the nature and the history of the land is the first step of conducting risk assessment study. Desktop study is mainly done based on the examination of historical maps and datasets collected from local, regional and national bodies. It helps to define the location of potential contaminated site and its extent. Relevant information regarding the location of historic industrial activity is available on Historic Land Use Database. Followed by some radiological investigations and once the pollutants are identified with the level of pollution determined, then the necessary action plans are also taken into consideration with key indicators (e.g. age of the pollution) for determining the rate of remediation and completion of the work (Environment Agency, 2005).

2.5 HISTORICAL STUDIES IN GERMANY

The case in Germany is not quite different. Starting off with finding all legal restrictions that may guard access to the site under study, the working aid for area-wide surveys of contaminated sites and old deposits ensures a systematic procedure in various technical methodology of carrying out a site study. Comparatively it lays more emphasis to the technicalities of the area under survey. This ranges from the study of cadastral maps to aerial maps and images down to the field visit that experts ought to undertake. An extra to the German historical guidelines is the rules for indicating any polluted site. This considers the activities that were carried out on site and prior to the closure of the site. In the framework of a historical study the time of closure gives rise mostly to the suspicion that waste was neither properly treated nor deposited. As a case in point: if a waste deposit site was decommissioned before June 1972, the year which the Waste Disposal Act was enacted into force, the site is considered to be improperly managed.

2.6 QUALITATIVE INQUIRY CONDUCTED IN THE FRAMEWORK OF NWE-REGENERATIS PROJECT

As legislation and methodologies can potentially change from one country to another, it appears interesting to understand which parameters are important to most experts when conducting historical studies. To this end, a questionnaire was submitted to public bodies involved in industrial sites remediation. This questionnaire received a total of 11 responses from the following countries: two from the United Kingdom (UK), one from Germany, five from France (of which three from the same organisation[12]), two from Belgium (one from Flanders and one from Wallonia) and one from Austria. The experts interviewed have an average of 13 years of experience in writing and developing historical studies.

The complete analysis of the qualitative inquiry is available in **Appendix 1**, the questionnaire is displayed in **Appendix 2**.

The results of the study show that, in general, the historical studies carried out by all the European organisations are quite thorough. Indeed, the sources consulted by the experts proved to be very varied, with the majority of them not hesitating to collect the former testimonies of residents and former site workers. A large amount of information was generally collected by the organisations. 36% of the organisations collect information as far back as the documentation allows rather than from the beginning of the industrial activities on the site.

However, even if the historical studies have been generally well detailed, so far, their main goal was generally to focus on providing only the information necessary for site rehabilitation and remediation, such as potential areas of soil and water pollution. For example, the location of historic spills of

[12] As these three responses were found to be slightly different, they are considered hereafter as independent responses.

potentially valuable materials have often not been identified, except if they have been also considered as potential areas of soil and water pollution.

The results of the qualitative inquiry showed that, although the guidelines and context for conducting historical studies are similar for European countries (i.e. best practice guide and standards- technical guidance), methodologies vary widely among individuals, even within the same organisation. This author-related heterogeneity is difficult to control and could be related to the fact that some individuals tend to collect more information and be more meticulous than others. Other factors such as the lack of expert available, the budget dedicated to historical studies among the organisation, the complexity of the documentary research and the lack of time might also explained this discrepancy.

2.7 SIMILARITIES AND DISCREPANCIES ACROSS NWE

All historical study guidelines consulted in this benchmark aim to discover all past activities carried out on site which allows for either a reconstruction of a conceptual model or try to associate these activities to some prospective pollutants that may be present. They all point out the usefulness of documented information about sites and the need to ensure the accuracy of this information. Similarly parameters of interest that cut across them include the location of site, the type and nature of activity, chronology of these activities on site and the reasons leading to the closure of sites.

Furthermore it is worth noting that all guidelines from various regions and countries emphasis on the need to do an actual survey on site. For quite obvious reasons, a survey on a site allows experts to fully observe the situation in reality and match it to information that has already been gathered from their sources. In some instances, one may find that some details as presented on paper may be slightly different or totally absent on site. Hence, in order to conduct a proper historical study it is imperative to visit the site under review.

On the other hand, it is observed that existing historical study guidelines are more focused on the identification of pollutants, triangulating sites and activities. Over the years these have been the guiding principles for contaminated sites. Heavily polluted sites which come off as very difficult to remediate or manage within the guiding principles are generally left unmanaged and seen to be of little or economic value.

Contrary to existing guidelines focusing mostly on pollutant identification, the NWE-REGENERATIS project whishes to consider other and unusual historical information which may be collected, with as ambition the economic exploitation of the site. In the framework of this project, new historical guidelines proposal must be able to assist with making economic use of sites also, especially Past Metallurgical Sites and Deposits (PMSD). The guidelines provided by this project sets out to prove and go further than what existing guidelines achieve on a regular basis. In regards to the NWE-REGENERATIS project, there should be a standardised guide which considers more parameters and information that not only allow experts to have complete historical information about a site, but will also provide adequate information if economically it’s interesting to make use of these deposits on site.

3 NEW HISTORICAL GUIDELINES STRUCTURE FOR PMSDS

Conducting a historical study is a very important step to make decisions about how economically valorise materials extracted from PMSD. Hence, in accordance with the NWE-REGENERATIS project the following structure is proposed. This structure is developed based on the benchmark of historical study guidelines in NWE and on the careful analysis of various key parameters which were selected in consultation with NWE-REGENERATIS project partners and experts. This ensures a well-rounded guideline which is set to identified the valorization potential of the PMSD.

This approach can be done in five steps in order to ensure overall efficiency of the project and that all the various information are well represented in the study. The steps are outlined as follows:

- Step 1 – Site identification ;
- Step 2 – Legal and administrative procedures ;
- Step 3 – Site documentation review ;
- Step 4 – Deposit investigation ;
- Step 5 – Previous investigation campaigns.

All the steps are described in detail in the following sections.

3.1 STEP 1 - SITE IDENTIFICATION

The location of the site where the project is to take place is the main thing to first note. As part of this information will include the GPS coordinates of the site, maps, and any other document that will allow a precise location of the site. It is also important to consider the nature of the activities carried out on the site. For sites that have an indexed database, the reference number of the site must be included.

The following checklist provides some general and specific information from the site that will allow for a precise site identification.

- Site name: The name of the site where the project is being done.
- Corporate name: The name of the organisation/company/institution that owns the site.
- NACE[13] code (old): It is a statistical classification of the economic activity. Hence, the code provided for the site/company under review can be provided if applicable.
- NACE code (new): It is a statistical classification of the economic activity. Hence, the code provided for the site/company under review can be provided if applicable.
- Regional code: to help identify the region where the site is located (e.g., NUTS code).
- Period of industrial activity (beginning and end): This refers to the date or time of active production or work to the time when activities ceased or closure of the site.
- List and dates of permits: All permits acquired by the company for their operations, and activities. If available these should be provided with the date of acquisition, renewal and or expiration.
- Names of known operators with period of operation: All operators, partners and companies that worked directly on the site.
- Site area (Ha): The total size of the site, in Hectares. Please note that this area can be far larger than the deposit area(s) and vice versa.
- Site status: The state of the site in terms of the nature of the deposits in order qualify and classify it as a Past Metallurgical Deposit Site for applying the NWE-REGENERATIS methodology.
- Presence of deposits: Description of the presence of landfill, slags, backfilling material or pond and their location. There should be a significant amount of metallic, waste, sludge or other forms of industrial deposits on site for which the project will be taken effect on.

[13] *Nomenclature statistique des Activités économiques dans la Communauté Européenne.*

- Rehabilitation status: This parameter indicates the lever of the restoration of the contaminated site / area, leaving a stable environment that is conducive to the establishment of landscapes characteristics to the area / site. This identifies the level of after care that has taken place on site. Is the site fully or partially rehabilitated or not at all.
- Current site use: Presently what is the use of the site. Any form of existing activities still ongoing on the site.
- Intended future site use: The future plans and prospects for the site after the project is completed and the site is rehabilitated.
- Relevant change of the topography (anthropogenic): Any significant changes in the landscape caused by anthropogenic activities.
- Soil and groundwater restriction (related to the presence of hazard): Refers to any outstanding restrictions regarding the use/disturbance of the groundwater or the soil on site due to existing pollutants which pose a hazard.
- Location of activities on site and plan of the site: The precise location of buildings, factories, office spaces and production lines on the site, including both existing and demolished structures.
- Site accessibility: The existence of roads and other means of getting in and out of the site.
- Visible infrastructure *in situ*: All readily noticeable structures that are present on site and mostly will serve as a point of interest for investigation.
- Reason for which the site was abandoned: The main cause for closing the site or stopping the activities on site.
- Description of the site prior to any anthropogenic activity: Where applicable and available, a detailed description of the site before any form of industrial activity was started.

Should no landfill/deposit/backfill still be present on site or nearby, the methodology developed by NWE-REGENERATIS project partners is not adapted, and the site should only be investigated as usual, regarding human health issues, environmental issues, and redevelopment perspectives.

Once all the information regarding where the site is located and their physical accessibility is evaluated, it will become necessary to check for all legal restrictions concerning the site in order not to break any laws or any form of encroachment. Also grant a more solidified access to the site and some areas that may somewhat be restricted.

3.2 STEP 2 - LEGAL AND ADMINISTRATIVE PROCEDURES

All legalities regarding the site must then be checked. In this section we look out for any form of prohibitions to the site, owner or authorities in charge of the site. This will help in terms of site investigations that are likely to be done later on.

- Acts of Protection: Existing acts that controls access to sites and contaminated areas.
- Environmental protection status of the site: this will provide information on the presence of rare and threatened species on site. Additional mitigation measures might be required to start an urban mining project on the site.
- Regional Laws regarding contaminated sites: Any law within a specified region pertaining to contaminated sites and management. This may be a localized decree or directive.
- State Laws protection for contaminated sites: A statutory law which applies all over the country or region where the site is located. This can be analysed together with the regional or local directives.
- Access and Work Permits: An authorization from the local or regional authority that allows access and also for work, investigations, sampling and other technical evaluations to actually be done on the site.

3.3 STEP 3 - SITE DOCUMENTATION REVIEW

The site documentation review will check for all information regarding the detailed activities about the site. In this section, archived documents about the activities, their chronology, production period, production inputs and outputs, external products used, waste generated, method of waste deposit management so far as available all relevant documents should be reviewed.

This review can be done in two parts:

First, all documents regarding the start of activities on site must be reviewed. This includes, among others:

- Historical cadastral documents (ancient maps and matrices): Any old maps of the sites, indicating the topography of the area over time.

- Historical cartographic documents: Old cultural maps, or graphic representations of certain physical features on site. This includes charts, photomaps, etc.

- Historical photo-cartographic documents: Photographic images of different areas of the sites at different periods. It can provide information on the type of activities and their location as well as the presence of ancient deposits.

- Iconographic documents (photos): Any images showing a representation of an object of interest or attraction on site. Either a legendary object or any object of significant historical or cultural heritage.

- Existing databases and inventories: All available structures used to keep records and information

- Internal oral testimonies (e.g., former executives, workers, employees): Interviews of workers, present or past workers of the old factory or production.

- External oral testimonies (e.g., residents, subcontractors): Interviews and records of other people who were not directly workers on the site.

- Other media supports (e.g., films, videos): All forms of existing media documentary about the site, its operations and activities.

- Municipal archives: Stored information of the site under review that are available at the municipal authority which details plans and prospects for the site.

- Internal factory's archives: report from the company, parent company, subsidiary, business buyer, liquidator.

- Primary literatures: Every document that can be considered as primary source of information, it includes industrial catalogues, exhibition catalogues, ancient technical publications.

- Secondary literatures: Documents that are based on primary literatures such as books or articles about industrial archaeology or local history.

- Environment Police files: records from the Environment Police which aims at protecting the environment.

- War damages files: Following the Second World War, for the purpose of compensation claims for the damages caused by the WWII, the owners drafted detailed lists and descriptions of the damages to their properties. The files contained photographs, proof of purchase, certificates, maps, postcards, etc. In Belgium, about 800,000 of such individual war damages files are conserved (State Archives of Belgium, 2021). They are a great source to identify areas where bombing took place during the second World War. If the PMSD is

located in a sensitive area, additional measurements should be taken into account in case of excavation of the waste materials.

• Mines and Quarries Administration files

The second part is to review all documents on in-depth activities on the site. A thorough description of industrial processes and waste management, industry technologies and processes related to infrastructures and activities:

- Processing details and description: The description of the industrial processes used on the site during the lifetime of the industry.
- List of inputs: List of elements, products, chemicals and materials used in the production process. If minerals were used in the processes, any information regarding their origin, the geological conditions of the deposits (for primary ores) or their industrial preparation (for co-products), their chemical and mineralogical composition should be indicated.
- List of outputs: Any products, coproducts and waste that were generated during and after the production process. If some outputs were valuable or of some economic interest, it should be mentioned whether the outputs were already recycled inside or outside the site.
- Degree of hazard: The level of hazard threat associated with any part of the production process or related to any of the outputs from the activities.

- Period of output production: The length of time that active production was done on the site.
- Metal content: Total concentration of metals available in the outputs.
- Output valorisation: The form of output valorisation chosen over the period or at the time of production in the past.
- Potential final products specifications: A detailed description of the final products, such as their physico-chemical characteristics where applicable.
- Waste management: Methods by which all generated wastes were treated on-site or off-site.
- Characterization of the deposits present on site:
    - Location (from e.g. maps, aerial photography, historical written records)
    - Expected surface and volume
    - Period of activity
    - Origin of the waste: was the deposit dedicated to the concerned industry or open to other waste suppliers?
    - Composition of the main types of waste
    - Any analysis and documentation related to the waste

- Movement/displacement of waste/soil deposits: A review to know if there was a change in waste depositing area or if there was any kind of movement of waste material on site. If applicable, both sites will need to be investigated.
- Presumed Pollutants/Estimation of soil pollution: The total concentration of pollutants that is likely to be on site or in the deposit.
- Waste processing: All forms of treatment for waste generated on site.
- Presence of a wastewater treatment plant: To know if sewage water was treated on site.
- Location of wastewater discharge points: All exit points for waste effluents on the site.
- Did the site received waste from other industries?: Where applicable, the type of waste, the place of deposit, treatment process must be investigated.
- Any cases of "industrial" damage/loss: Records of any form of accident or mass damage on site must be checked as well as the date of the accident and how the incident itself occurred. If there was the release of any form of pollutant into the soil or water on or near the site, these are also verified.
- Presence of Hazardous Materials on site other than the ones related to output products
- Previous excavations : Have previous excavation (e.g. archaeological dig, for site characterisation purpose) been done on the site ? If yes, explain when, the purpose of the excavations and the outcomes.
- Were there some attempts in the past for redevelopment project?: answering this question will help to identify the barriers to launch a redevelopment project on site after its remediation.

All information gathered in this section, if they are available, will serve as a decision support system to:

1. Identify all potential pollutants and historic spills of potentially valuable materials as they may be present on site, where they are likely to occur, their quantities/volume.
2. Delineate where these deposits were stored and the period of storage as this will help to know the changes that may have occurred over time.
3. Assess the first idea of the economic value of the deposits present on site.

3.4 STEP 4 - DEPOSIT INVESTIGATION

Since the aim of this historical guide is to allow for making use of past metallurgical sites and deposits, a detailed description of the deposits on site will need to be carried out. In the case of metal deposits, it will be interesting to check the ore grades, concentration, homogeneity and the overall economic viability of these metals. However, the investigation regarding the deposits will be case specific as the composition of deposits on site can evolve depending on the period of production. The aim is still the same and in order to have a complete review, the following checklist will be of help.

- Type of deposited material: Refers the actual characteristics of the output deposit
- Waste deposit location (estimation): The area where the deposits were dumped on site, if there has been any change or movement over time, all previous locations must be provided.
- Origin of the deposited material: A classification of the source of the deposit e.g., raw materials, end products, wastes etc.
- Exploitation/production period: The time length of active production of the deposit.
- Estimated volume: Total volume of the deposits expected to be on site.
- Estimated area: Total space in hectares, occupied by the heap of the deposit.
- Estimated average thickness: The average height of the deposit heap on site.
- Estimated average height (above natural ground)
- Estimated average depth (below natural ground)
- Estimated metal content (per metal): The estimated average metal concentration on site.
- Expected main chemical and mineralogical composition: The mineral and chemical characteristics of the deposits on the site.
- Estimated homogeneity: The physical characteristics of the deposits, if there are different deposits mixed up (heterogenous) or the same set of deposits (homogenous).
- Ease of access to each deposit: All physical means of getting location of the deposits. e.g, Access roads.

In the case there is a deposit on site, the following parameters will be interesting to consider as part of the historical investigation:

- Presence of a drainage system: All systems of collecting liquid wastes/ leachates and effluents from the landfill.
- Presence of a cover layer and/or bottom layer: Where applicable, the presence of any artificial cover must be indicated on either the top or bottom of the landfill.
- Presence of topsoil layer: In a case of a natural cover of soil on top of the deposit. This must be indicated.
- Changes in cover over time: The different layers used over the period; natural covers, artificial membranes as applicable must be indicated.
- Description: A detailed description of the landfill and its general structure.
- Presence of a control system: A secondary system in place to serve as a check for spillage, or defects in the main system of the landfill.
- Presence of biogas: Where applicable the presence of gases generated on the landfill must be indicated as well as their nature (when it is possible).
- Presence of venting/gas drainage system: A detailed description of the laid down pipes and vents in the landfill must be indicated.

- Presence of monitoring wells: Monitoring wells installed to check air quality, gas generation on site must be checked.
- Leaching: Leaching into the subsoil and possibly groundwater contamination must be checked.

As part of the study, there is the need to have a technical view of the site: from the soil components to the physico-chemical analysis of the deposits on site. In order to do that, the next step is to have information regarding previous investigations that were carried out on site, which mainly deal with technical analysis of the site, such as sampling, laboratory testing and result analysis. This is further explained below.

3.5 STEP 5 – PREVIOUS INVESTIGATION CAMPAIGNS

A detailed technical investigation must be conducted on the site to ensure accuracy in all the prospective materials for valorisation. The following could be a general checklist of some of the parameters to look at in this section.

- Soil investigation
  - Date of soil investigation fieldwork
  - Type of soil investigation
  - Location of the samples
  - Borehole description
  - Lab analysis performed
  - Results

- Geotephysical tests
  - Date of geophysical investigation studies on site
  - Type of geophysical method applied
  - Location of the studies
  - Lab analysis performed (if any) for geophysical properties of soil/land
  - Results

- Restoration/rehabilitation actions
  - Date of the restoration/rehabilitation
  - Type of restoration/rehabilitation
  - Summary of decisions
  - Residual contamination
  - Restoration/rehabilitation strategy

After all the desktop work is completed, it is imperative to go on site and check if all the documented information matches. Any historical study is deemed incomplete without a site visit.

3.6 STEP 6 - SITE VISIT

The objective of the site visit is to be able to have a closer view of the site and also to observe what has been gathered already. This will serve as confirmation for all the maps, archived documents, photos, *etc*. This is a crucial part of the investigation process because it will allow project managers and experts to ascertain for sure that all the situation is well known. If not, the actual situation on the ground can be detected and the appropriate cause of action is taken to ensure efficiency.

During a site visit, the following checklist can serve as a guide (non-exhaustive) for some of the things to look out for and compare with all information gathered. However, it must be noted that all the information that will be gathered during the historical investigation, both desktop work and on-site, must be evaluated by experts to apply them in their case or current project.

Check-list:

- Refurbishment
- Presence of embankments
- Presence of backfill soils
- Presence of pipes
- Presence of storage tanks
- Nature and condition of the pavement
- Presence of large structures
- Presence of drainage
- Type of surface cover
- Homogeneity of the deposits
- Any infrastructure of historical, architectural or aesthetic (or potential) heritage interest.
- Surrounding environment

4 CONCLUSIONS

As highlighted in the benchmark of historical study methodologies used across EU, historical studies are not oriented towards secondary raw material recovery but mostly focus on pollutants present on site. In the new historical study guidelines developed within the framework of the NWE-REGENERATIS project, the objective is to identify the potential valuable deposits present on site. This methodology consists in five steps: Site identification, Legal and administrative procedures, Site documentation review, Deposit Investigation and Previous investigation campaigns. This methodology provides valuable insights to set up PMSD conceptual site model and sampling plan for further investigation on site.

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APPENDIX

APPENDIX 1 – QUALITATIVE INQUIRY

Introduction

As legislation and methodologies can potentially change from one country to another, it appears interesting to understand which parameters are important to most experts when conducting historical studies. To this end, a questionnaire was submitted to public bodies involved in industrial sites remediation.This questionnaire received a total of 11 responses from the following countries: 2 from the United Kingdom (UK), 1 from Germany, 5 from France (of which 3 from the same organisation[14]), 2 from Belgium (1 from Flanders and 1 from Wallonia). The experts interviewed have an average of 13 years of experience in writing and developing historical studies. The following paragraphs summarise their responses and methodology.

1. Legislative content of historical studies

Under the 2004 European Environmental Liability with regards to the prevention and remedying of environmental damage (ELD), Directive 2004/35/EC which operates on the “polluter pays principle” emphasize on the need for contaminated sites to be remediated. Under Article 5 -7 of the directive ensures that the competent authorities analyses all forms of remedial actions that can be taken place on a site, taking into account all the necessary information about the site activities from the operator.

In 2011, the European Environmental Agency (EEA) indicator assessment; progress in management of contaminated sites, proposed four management steps for managing and controlling soil contamination. The first of these four steps is site identification, preliminary studies and preliminary or historical investigations. This goes on to indicate that at the European level all sites are targeted to be kept as clean as possible in so much as they get contaminated, rehabilitative actions needs to start with a historical investigation.

This European directive is directly translated in the regional/national legislation. Based on the results of the questionnaire, experts from Wallonia, Flanders, UK, France and Germany state that their national and regional legislation requires a historical study to be carried out prior to any intervention (investigations, rehabilitation) within a site (industrial wasteland, landfill, metallurgical plant). They consider it to be very important (91%) or quite important (9%) in the rehabilitation study process (mapping, surveys, drilling, sampling and analysis, etc.). 91% of the companies find that the cost and the time required for historical study is justified whereas 9% consider it a barrier for site redevelopment and resource recovery.

The methodology used to carry out historical studies is well defined and requires the use of several documents and legal texts, commonly used in combination with each other, but these texts may differ according to the institutions. The survey results (Fig. 1) show that technical standard procedures (73%) and good practice guides (55%) are the most used, followed by national (36%) or regional (18%) legal text .

[14] As these 3 responses were found to be different, they are considered hereafter as independent responses.

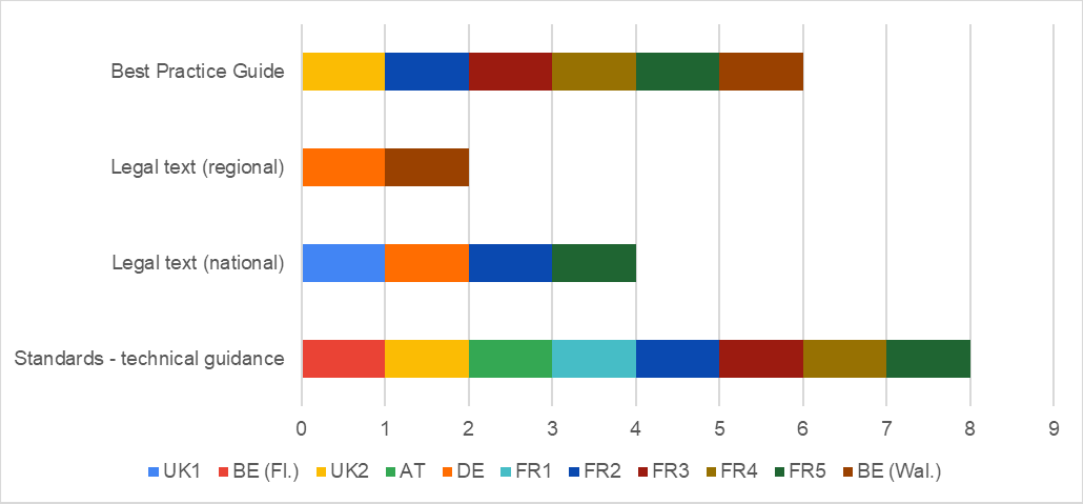

Figure 1- Legislation/ documents used to conduct historical studies.

2. Methodology and outputs

Several European countries have varying methods and approaches to undertaking a historical survey. The first of which mostly run through is the desk study, or background investigation as enumerated at the European levels. In France, a historical study aims at identifying various activities, accidents, practices and potentially polluted areas (DGPR, 2017). This allows experts to know the magnitude of the pollution and to know what they are dealing with in terms of pollutant levels.

These methods are carried out through a collection of various documents from different sources and levels of administrative authorities such as DREAL, the environmental office of the Prefecture for the ICPE just to mention a few; archives, site plans, old maps are some of the important documents used to reconstruct the history of the site (DGPR, 2017). There are also other decision support tools that are used to compare activities to the most likely pollutants that can be found on sites. BASOL and BASIAS are key sites that provides information and historical changes on site for chronological comparison.

In as much these desk studies may be complete in themselves, the French method of historical studies in never complete without a site visit to see things as they are, these visits are done within the earliest times possible in order to orientate the documentary research of the site. Lastly having discussions with locals, old employees and officials of the site concerned serves as a valuable means of retrieving information for further decision and action plans (DGPR, 2017).

The UK has a similar start for land contamination management, beginning with a desktop study, site visits, with the aim of determining some indicators that allows for finalising the risk levels on site. This is followed by some radiological investigations and once the pollutants are identified with the level of pollution determined, then the necessary action plans are also taken into consideration with key indicators for determining the rate of remediation and completion of the work (Environment Agency, 2005).

With regards to the methodology amongst the project partners, **Figure 2** shows the experts' responses regarding the implementation of the methodology. Most experts (73%) consider that the terms and conditions of a historical survey are defined by the sponsor of the soil survey, such as public authorities, private industry, owners. The survey should follow the requirements of the legislation in force and may include additional points. According to 45% of the experts consulted, the modalities of a historical study can also be specific to the rehabilitation project (the nature of the future allocation of the site), when a future use of the site is already forecasted. 36% of the experts think that terms and conditions depend on the nature of the site or can be defined specifically by the design office/consultant/expert in charge of the soil study. Finally, one respondent commented that

it was also possible for the modalities to be defined by the national methodology or by specific requests from the project leader and specified in advance.

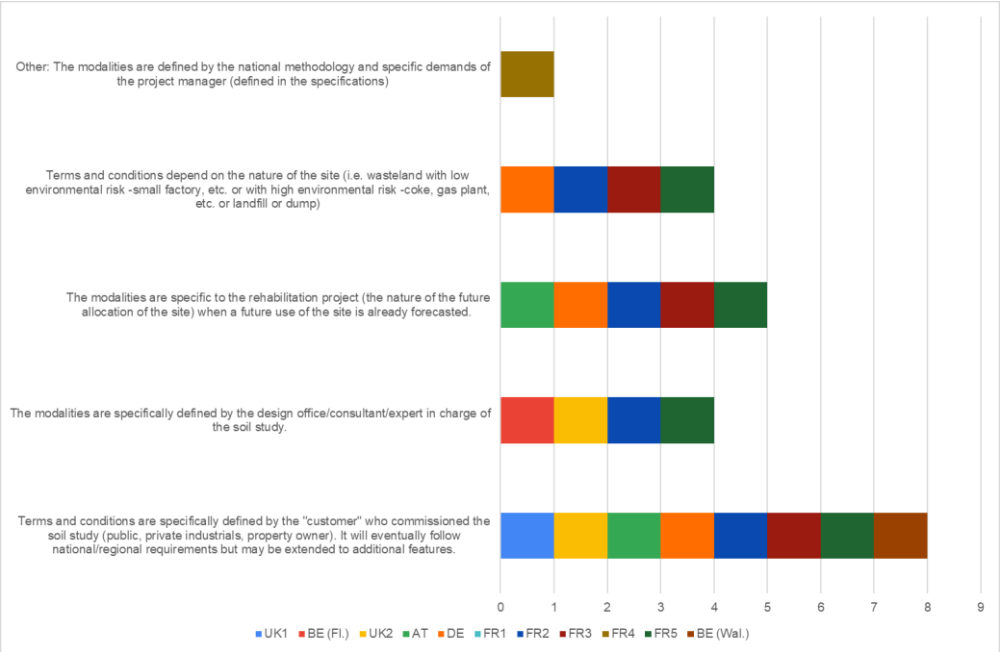

Figure 2- Definition and implementation of the methodology.

All experts consider that the expected results of a historical survey are to identify activities that may have polluted the soil or created risks to ground/surface water and to provide the contractor with enough information to make the most appropriate sampling plan. For more than most experts, a historical survey also aims to build inventories of industrial sites (55%), identify and locate sources of soil and water pollution (91%), identify activities that may have created risks to human health (82%) and ecosystem (64%), and identify areas for which there are no known documentary sources of past potentially polluting infrastructure or activities (55%). On the other hand, the experts consider it less important to carry out historical studies for fundamental research (36%), to know the history of the site for social or historical purposes (36%) or to locate the places of historic spills of potentially valuable materials (45%) (**Figure 3**).

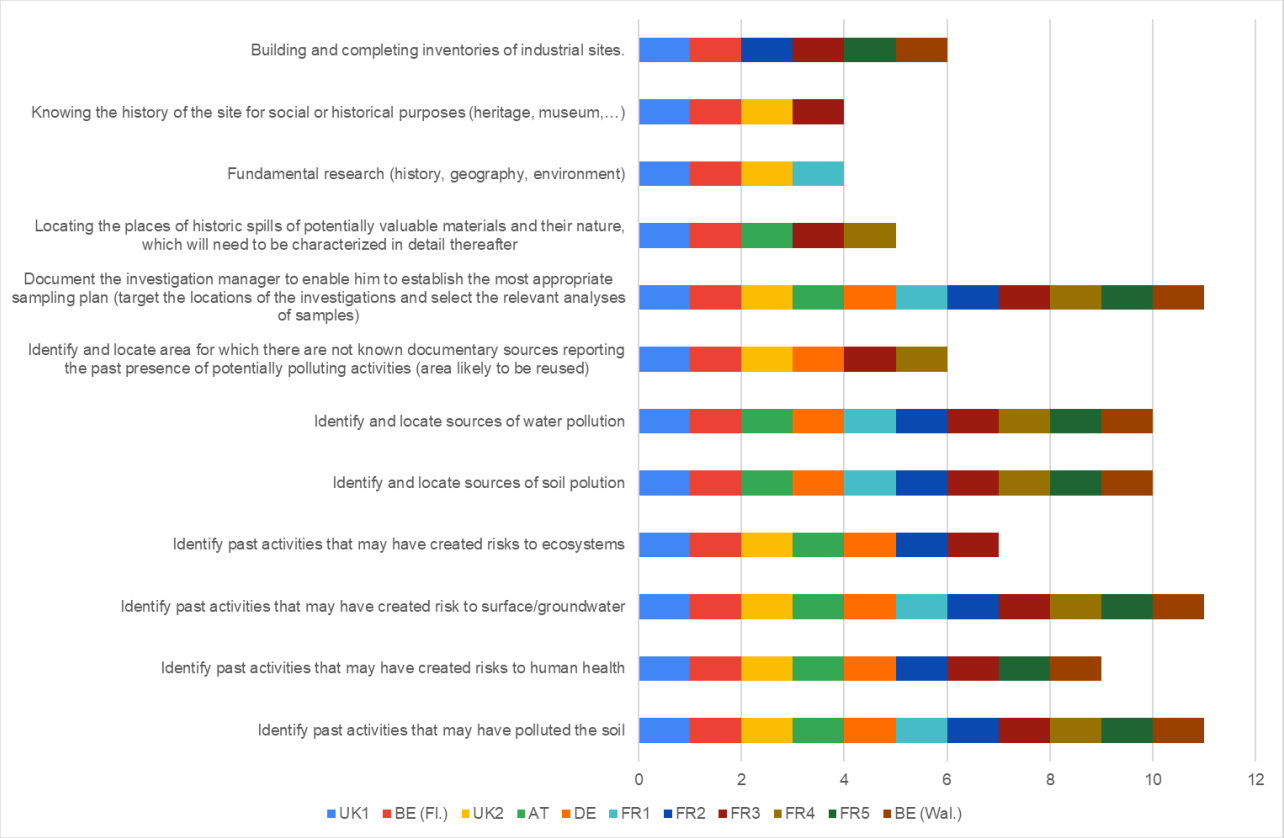

Figure 3- Expected output of historical studies.

At the end of the historical study, the deliverables provided by all the experts are the location of the site, its surface, a description of the site in its current state and a map showing the potential pollution areas. Most organisations also provide a detailed description of the industrial processes and the materials used or coming out of these processes (waste), administrative data on the site, aerial images of the site, the nature, chronology and census of activities/infrastructure and historical geomorphological changes. Plans of installations, production facilities, storage facilities, dumps/dumps, substructures are also provided. Four deliverables are not provided by the majority of experts in historical studies, these are industrial production data during the lifetime of the installation, data concerning war damage, land reserves and railway poses (**Figure 4**). 9% of the experts consider that the historical study is only general, 46% of them assume that it is rather in-depth and 45% state that the study can be general or in-depth, depending on the stage of the rehabilitation (**Figure 5**).

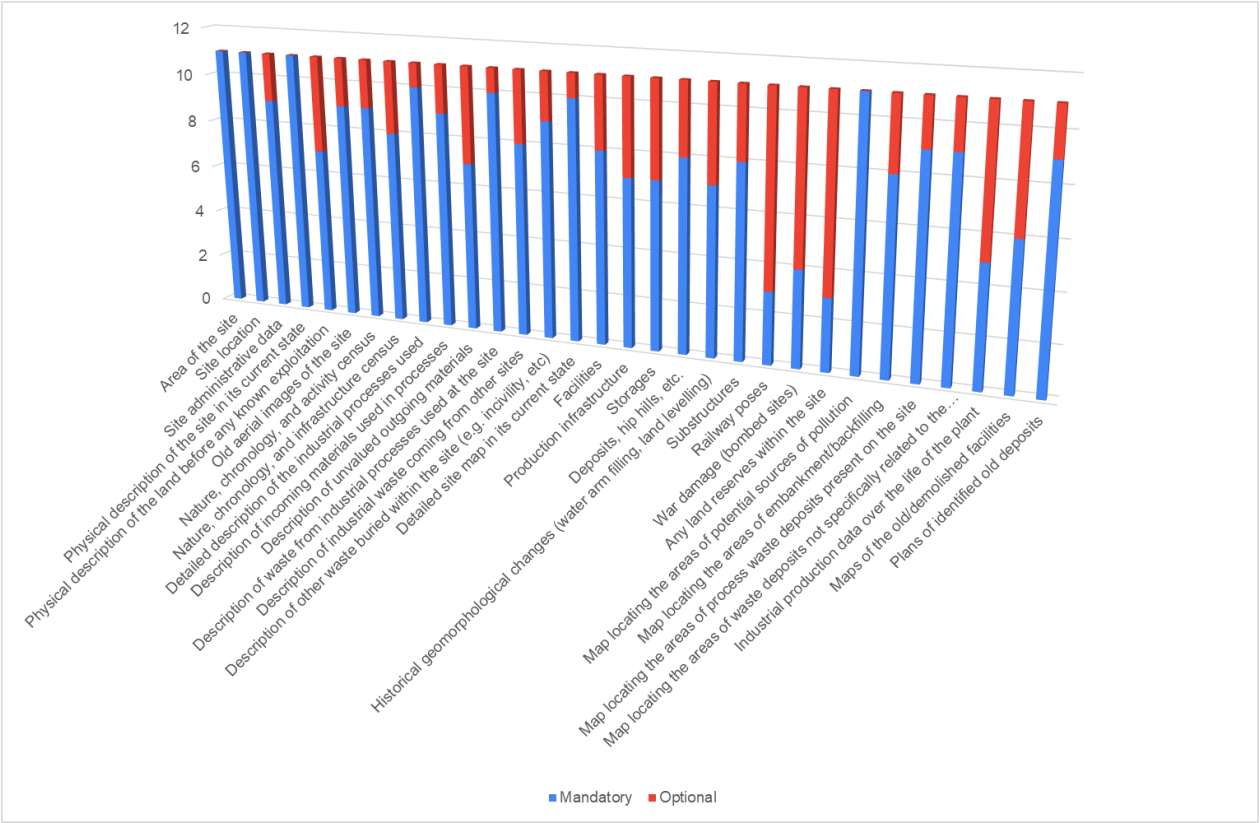

Figure 4- Mandatory and optional deliverables at the end of historical study.

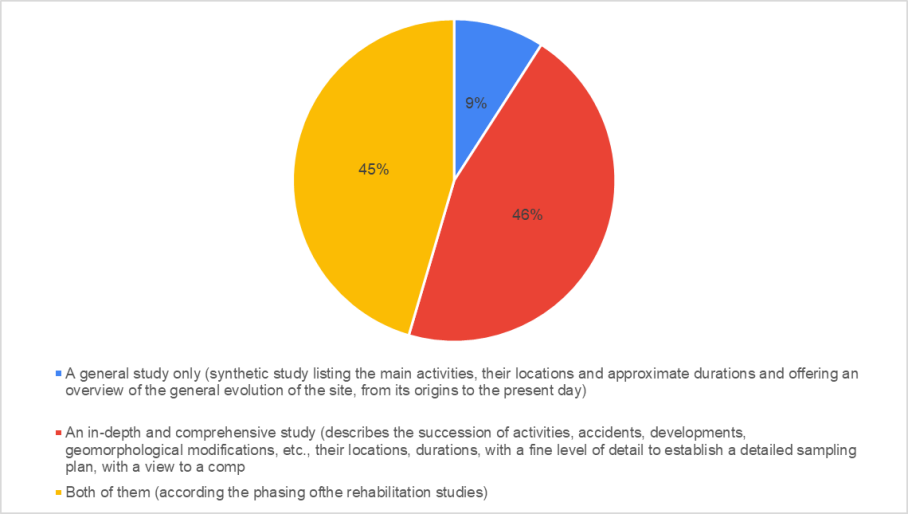

Figure 5- Level of details of the completed and final study.

3. Sources consulted and time frame

Almost two thirds of the organisations state that they consult the available documentation from the beginning of the industrial activities on the site, while the remaining third consult all available documents as far as the documents allow (**Fig. 6**).

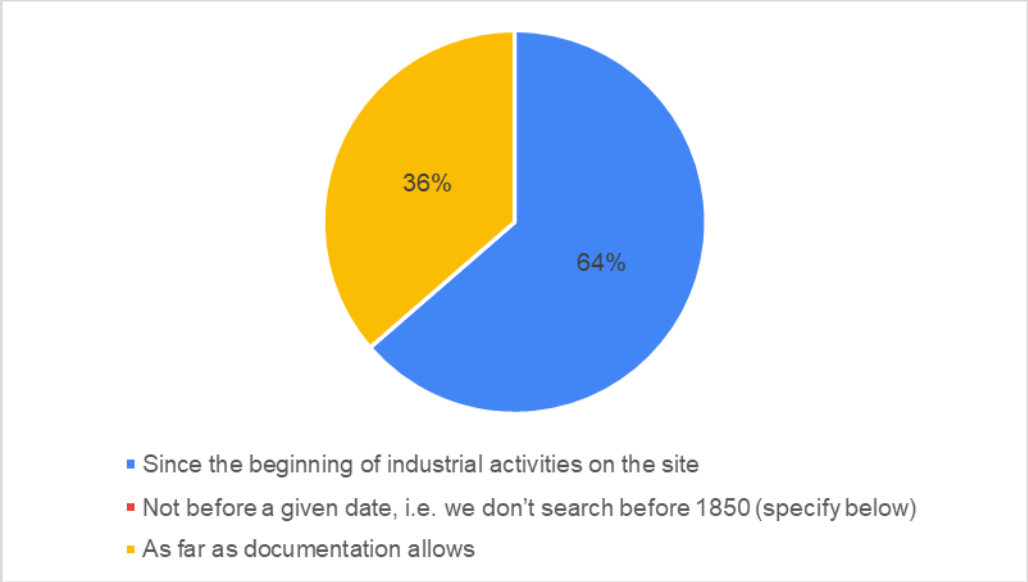

Figure 6- Period considered to conduct historical studies.

More than 90% of the experts search for official archives and examine the land matrix, old maps and photographs available. 73% of organisations consult historical works (e.g. monographs), search for local archives (e.g. postcards, photographs) and review plans of facilities and surrounding areas. Finally, 64% of them collect testimonies from e.g. residents, former staff working in the site (**Fig. 7**). The types of sources used by experts are shown in **Figure 8**. According to the majority of organisations, the sources used are described as fairly accessible and are mostly free (**Fig. 9**).

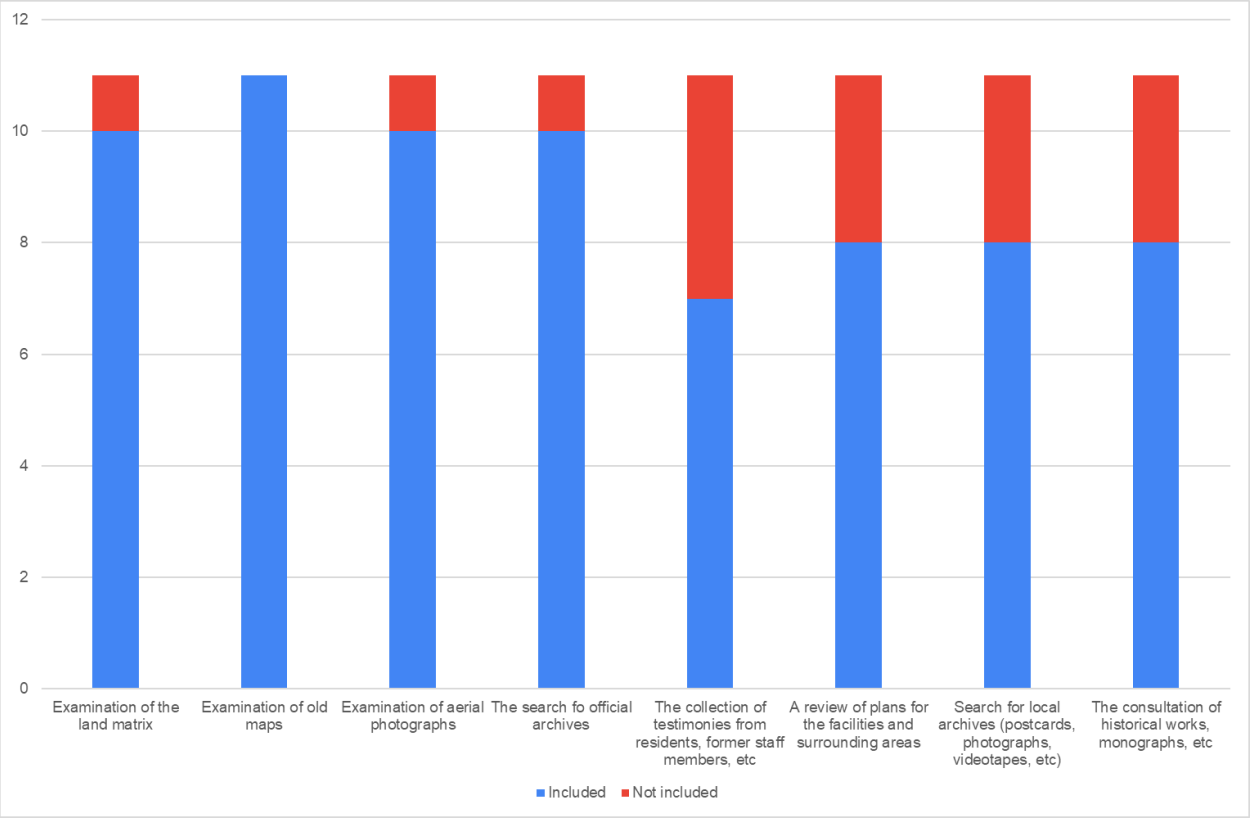

Figure 7- Sources included in historical studies.

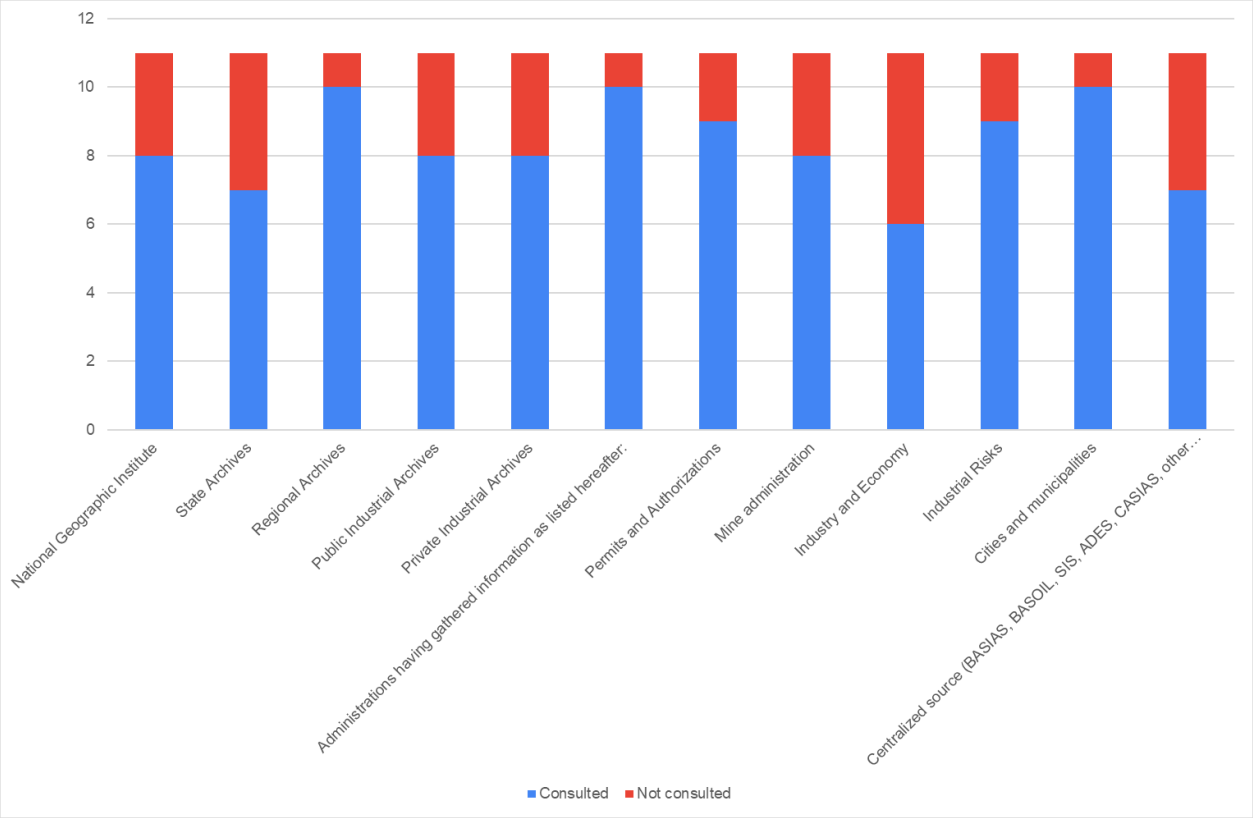

Figure 8- Type of sources consulted to conduct historical studies.

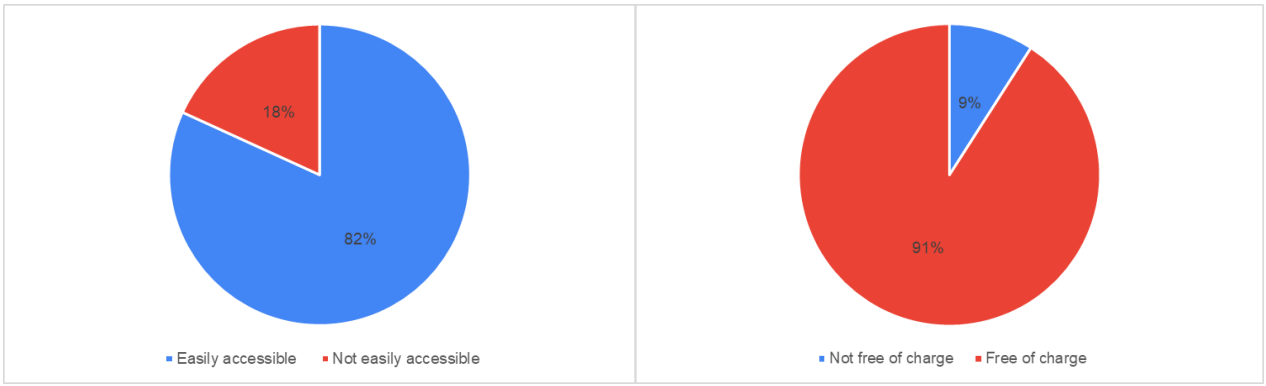

Figure 9- Accessibility of the sources consulted.

Conclusion

The results of the study show that, in general, the historical studies carried out by all the European organisations are quite thorough. Indeed, the sources consulted by the experts proved to be very varied, with the majority of them not hesitating to collect the former testimonies of residents and former site workers. A large amount of information was generally collected by the organisations. 36% of the organisations collect information as far back as the documentation allows rather than from the beginning of the industrial activities on the site.

However, even if the historical studies have been generally well detailed, so far, the experts generally focused on providing only the information necessary for site rehabilitation and remediation, such as potential areas of soil and water pollution. For example, the location of historic spills of potentially valuable materials have often not been identified. In the guidelines defined for the NWE-REGENERATIS project, it will therefore be necessary that these be added to the mandatory deliverables of a historical study.

It can also be noted that, although the guidelines and context for conducting historical studies are similar for European countries (i.e. best practice guide and standards- technical guidance), methodologies vary widely among individuals, even within the same organisation (as a reminder, this survey collected three responses from the same French organisation, and these were very different from each other). This author-related heterogeneity is difficult to control and is due to the fact that some individuals tend to collect more information and be more meticulous than others.

References

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Environment Agency. (2005). *Indicators for Land Contamination*. 60–71.

APPENDIX 2 – QUESTIONNAIRE ON HISTORICAL STUDIES SENT TO EUROPEAN INSTITUTIONS

You, your organization and your implication in historical studies

1. Organization :
2. Name *
3. What is your experience with historical studies?
4. Position :
5. Mail: *
6. Phone:
7. In order to complete this survey, you must confirm that you have read and agree to the information above *

   Plusieurs réponses possibles.

   ☐ I confirm that I have read and agree to the information above

8. 1. Does your national/regional environmental legislation require the completion of a historical study as defined above prior to any intervention (investigations, rehabilitation) within a site (industrial wasteland, landfill, metallurgical plant)?

   Une seule réponse possible.

   ◯ Yes

   ◯ No

9. 2. Should this historical/desk study be carried out according to a well-defined methodology?

   Une seule réponse possible.

   ◯ Yes

   ◯ No

10. If so, which one ?

Plusieurs réponses possibles.

- ☐ Standards – technical guidance
- ☐ Legal text (national)
- ☐ Legal text (regional)
- ☐ Best Practice Guide
- ☐ Other (precise below)

11. Other methodology (please give a short description)

12. 4. Can you provide us with the methodological/technological guidance used? (please send them to renaud.derijdt@atrasol.eu)

Une seule réponse possible.

- ◯ Yes
- ◯ No

13. How is defined and implemented the methodology ?

Plusieurs réponses possibles.

- ☐ Terms and conditions are specifically defined by the "customer" who commissioned the soil study (public, private industrials, property owner). It will eventually follow national/regional requirements but may be extended to additional features.
- ☐ The modalities are specifically defined by the design office/consultant/expert in charge of the soil study.
- ☐ The modalities are specific to the rehabilitation project (the nature of the future allocation of the site) when a future use of the site is already forecasted.
- ☐ Terms and conditions depend on the nature of the site (i.e. wasteland with low environmental risk - small factory, etc. or with high environmental risk (coke, gas plant, etc. or landfill or dump)
- ☐ Other or Comment (precise below)

14. Other or Comment:

15. 6. How important is the historical/desk study in all rehabilitation studies (mapping, surveys, drilling, sampling, and analysis, etc.)?

Une seule réponse possible.

- ◯ Very important
- ◯ Quite important
- ◯ Not important

16. Is the cost of historical /desk study justified or a barrier for site redevelopment and resource recovery?

Une seule réponse possible.

- ◯ Yes, justified
- ◯ No, it is a barrier

17. Is the time required for desk study a barrier?

Une seule réponse possible.

- ◯ Yes, it is a barrier
- ◯ No

18. What are the expected results? (select all options that apply as widely as possible)

Plusieurs réponses possibles.

- ☐ Identify past activities/infrastructure that may have polluted the soil
- ☐ Identify past activities/infrastructures that may have created risks to human health
- ☐ Identify past activities/infrastructures that may have created risks to surface and/or groundwater
- ☐ Identify past activities/infrastructures that may have created risks to ecosystems
- ☐ Identify and locate potential sources of soil pollution
- ☐ Identify and locate potential sources of water pollution (surface or groundwater)
- ☐ Identify and locate areas for which there are no known documentary sources reporting the past presence of potentially polluting infrastructure or activities within them (areas likely to be more easily reused).
- ☐ Document the investigation manager to enable him to establish the most appropriate sampling plan (target the locations of the investigations and select the relevant analyses of soil or water samples).
- ☐ Locating the places of historic spills of potentially valuable materials and their nature, which will need to be characterized in detail thereafter
- ☐ Fundamental research (history, geography, environment...)
- ☐ Knowing the history of the site for social or historical purposes (heritage, museum...)
- ☐ Building and completing inventories of industrial sites

19. What is the level of details of the completed and final study?

Une seule réponse possible.

- ◯ A general study only (synthetic study listing the main activities, their locations and approximate durations and offering an overview of the general evolution of the site, from its origins to the present day)
- ◯ An in-depth and comprehensive study (describes the succession of activities, accidents, developments, geomorphological modifications, etc., their locations, durations, with a fine level of detail to establish a detailed sampling plan, with a view to a complete orientation or characterization of the condition of the basement and groundwater);
- ◯ Both of them (according the phasing of the rehabilitation studies)

20. What are the deliverable at the end of the historical study? For each of them, please specify whether it is mandatory or optional.

Une seule réponse possible par ligne.

	Mandatory	Optional
Area of the site	☐	☐
Site location	☐	☐
Site administrative data (list and chronology of social reasons, owners, operators, curators, etc.)	☐	☐
Physical description of the site in its current state	☐	☐
Physical description (geological/geomorphological) of the land before any known exploitation	☐	☐
Old aerial images of the site	☐	☐
Nature, chronology, and activity census	☐	☐
Nature, chronology, and infrastructure census	☐	☐
Detailed description of the industrial processes used	☐	☐
Description of incoming materials used in processes	☐	☐
Description of unvalued outgoing materials	☐	☐
Description of waste from industrial processes used at the site	☐	☐
Description of industrial waste coming from other sites	☐	☐
Description of other waste buried within the site (e.g. waste from wild spills or incivility, which occurred in situ after operations ceased and site was abandoned)	☐	☐

Detailed site map in its current state, layering and orientation of the scaled layers, then "transferred" by transparency on a current map, including:		
Facilities		
Production infrastructure		
Storages		
Deposits, hip hills, etc.		
Historical geomorphological changes (water arm filling, land levelling)		
Substructures		
Railway poses		
War damage (bombed sites)		
Any land reserves within the site		
Map locating, based on the historical study, the areas in which the presence of potential sources of pollution of soil and water is established thanks to the history		
Map locating based on the historical study the areas of embankment/backfilling present on the site with their probable origins		
Map locating, based on the historical study, the areas of process waste deposits present on the site with their probable origins		
Map locating, based on the historical study, the areas of waste deposits not specifically related to the process present on the site with their probable origins		
Industrial production data over the life of the plant		
Maps of the old/demolished facilities		
Plans of identified old deposits		

21. What is the period taken under consideration for the historical study?

Une seule réponse possible.

- ◯ Since the beginning of industrial activities on the site
- ◯ Not before a given date, i.e. we don't search before 1850 (specify below)
- ◯ As far as documentation allows

22. Not before a given date: specify

23. Is a physical visit to the site mandatory as part of the study?

Une seule réponse possible.

- ◯ Yes
- ◯ No

24. Does the study include:

ne seule réponse possible par ligne.

	Yes	No
Examination of the land matrix	◯	◯
Examination of old maps	◯	◯
Examination of aerial photographs	◯	◯
The search for official archives	◯	◯
The collection of testimonies from residents, former staff members, etc.	◯	◯
A review of plans for the facilities and surrounding areas	◯	◯
Search for local archives (postcards, photographs, videotapes, etc.)	◯	◯
The consultation of historical works, monographs, etc.	◯	◯

25. What sources are consulted?

ne seule réponse possible par ligne.

	Yes	No
National Geographic Institute	◯	◯
State Archives	◯	◯
Regional Archives	◯	◯
Public Industrial Archives	◯	◯
Private industrial archives	◯	◯
Administrations having gathered information as listed below:	◯	◯
Permits and Authorizations	◯	◯
Mine administration	◯	◯
Industry and economy	◯	◯
Industrial Risks	◯	◯
Cities and municipalities	◯	◯
Centralized source (please specify below)	◯	◯

26. Please specify other sources or centralized source

27. Are these sources easily accessible?

ne seule réponse possible.

◯ Yes, for most of them

◯ No

28. Do these sources request money to supply information?

Une seule réponse possible.

◯ Yes, for most of them

◯ No