European Commission

Guidelines for the waste audits before demolition and renovation works of buildings

EU Construction and Demolition Waste Management

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Foreword

Construction & Demolition Waste (CDW), when measured in volume, is the largest waste stream in the EU. Even though a vast majority of CDW is recyclable, one common hurdle to recycling and re-using C&D waste in the EU is the lack of confidence in the quality of C&D recycled materials.

This guideline is aligned with European strategies for Construction sector and waste management. The guideline is aligned with the objectives of the Waste Framework Directive 2008/98/EC which establishes a target of 70% of CDW to be recycled by 2020.

The guideline is also aligned with the Construction 2020 strategy[1], and the Communication on Resource Efficiency Opportunities in the Building Sector[2]. In addition, it forms part of the more recent and ambitious Circular Economy Package presented by the European Commission in 2015[3] that includes revised legislative proposals on waste to encourage the EU's transition towards a circular economy. In this Circular Economy Package, Construction and Demolition Waste is identified as a key aspect and the preliminary assessment is an essential part of construction and demolition waste management.

It is one of three actions assigned in the Circular Economy Action Plan[4] (CEAP), Annex 1. The present guideline is intended to provide a methodology to perform this assessment in order to support national authorities for the actual achievement of the EU 2020 target for CDW recycling.

1. Introduction

This document provides guidance on best practices for the assessment of construction and demolition waste streams prior to demolition or renovation of buildings and infrastructures, called "waste audit". The aim of the guidance is to facilitate and maximize recovery of materials and components from demolition or renovation of buildings and infrastructures for beneficial reuse and recycling, without compromising the safety measures and practices outlined in the European Demolition Protocol. This protocol states that:

- Any demolition, renovation or construction project needs to be well planned and managed in order to reduce environmental and health impacts while providing important cost benefits.
- Waste audits (or pre-demolition audit as defined in the European Demolition Protocol) are to be carried out before any renovation or demolition project, for any materials to be re-used or recycled, as well as for hazardous waste.
- Public authorities should decide upon the threshold for pre-demolition audits (which is currently highly variable in the EU).
- Waste audits take full account of local markets for C&D waste and re-used and recycled materials.
- A good waste audit must be carried out by a qualified expert (the auditor).

The scope of the Guideline includes waste from construction, renovation and demolition works. It excludes, however,

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1 Strategy for the Sustainable competitiveness of the construction sector and its enterprises, COM (2012) 433, http://eur-lex.europa.eu/procedure/EN/201859

2 COM (2014) 445 final, http://ec.europa.eu/environment/eussd/pdf/SustainableBuildingsCommunication.pdf

3 http://ec.europa.eu/environment/circular-economy/index_en.htm

4 http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1517483791000&uri=CELEX:52015DC0614

the design phase, as well as excavating and dredging soils. With regard to geographic coverage, this document has been developed for its application in all 28 Member States of the European Union. It includes good practice from across the EU that can be the source of inspiration for both policy makers and practitioners.

The guideline has the following target groups of stakeholders:

- Industry practitioners; construction sector (including renovation companies and demolition contractors), waste treatment, transport and logistics as well as recycling companies;
- Public authorities at local, regional, national and EU levels;
- Quality certification bodies for building and infrastructure.

1.1. Purpose of the waste audit

A waste audit before demolition or renovation of buildings and infrastructures is a specific task within the project planning. It is necessary to understand the type and amount of elements and materials that will be deconstructed and/or demolished, and to issue recommendations on their further handling. An assessment of the viable recovery routes for materials can also be given (including reuse and the potential reuse value, recycling on- and offsite and the associated cost savings and energy recovery).

The waste audit should also consider any relevant legislation such as the requirements for environmental permits if waste is to be used on-site or any waste that may be hazardous and which needs to be managed in accordance with specialized waste legislation. Ideally, waste audits should be performed before the call for tenders, and should be a part of the specifications for tenders. But at a minimum they should be performed before applying for the demolition or renovation permit. The audits' findings support the decisions of the authorities to approve the planned work. The audit report should be revised in the light of final results of the construction, demolition or refurbishment process.

Performing a waste audit presents a series of advantages - both economic and environmental - providing important added value to the whole project:

- Waste audits are the first step towards recycling.
- Waste audits promote fair competition amongst contractors.
- Waste audits increase awareness and ease traceability processes. It is of major importance to know the materials that will be set free; especially the hazardous ones to avoid unexpected costs during the works.
- Environmental and technical quality of materials can be steered.
- Environmental aspects that will be improved include:
    - Specification of contaminants present
    - Contribute to the assurance that these are removed in an environmentally responsible manner.
    - The achievement of higher environmental quality for recyclable waste materials.
    - Technical quality aspects that will be improved include the identification of "higher quality" batches of recycled materials (for example concrete).

Waste audits contribute to better demolition waste management. Knowing the quantities and nature of materials expected leads to the optimisation of works (how many containers; on-site versus off-site sorting; etc.).

1.2. Participants in the waste audit

Figure 1 illustrates the waste management process, showing actors involved and relations between stages and responsibilities. The actors involved are:

- The **property owner** is responsible for appointing an auditor to draw up a waste audit for the identification and classification of waste as well as preliminary planning of its handling;
- The **authority** issues demolition or renovation permits and should establish mechanisms to ascertain (directly or with the intervention of third parties) that waste audits are performed including a quality check system and their recommendations followed;
- The **auditor** or **Auditor team** is an expert responsible for the waste audit. The auditor must be a qualified expert with appropriate knowledge of current and historical building materials (including hazardous materials), current and historical building techniques and building history and familiar with demolition techniques, waste treatment and processing as well as with (local) markets;
- The **contractor** is responsible for demolition/deconstruction/renovation operations defined in the contract with the owner. The contractor should contribute to the traceability aspects of waste;
- The **waste manager** is responsible for the appropriate management and disposal of the waste received from the waste holder or producer. The waste manager should also contribute to the traceability aspects of waste;
- The **products manufacturer** may contribute to the waste audit providing solutions and/or requirements for the reused/recycled materials and components.

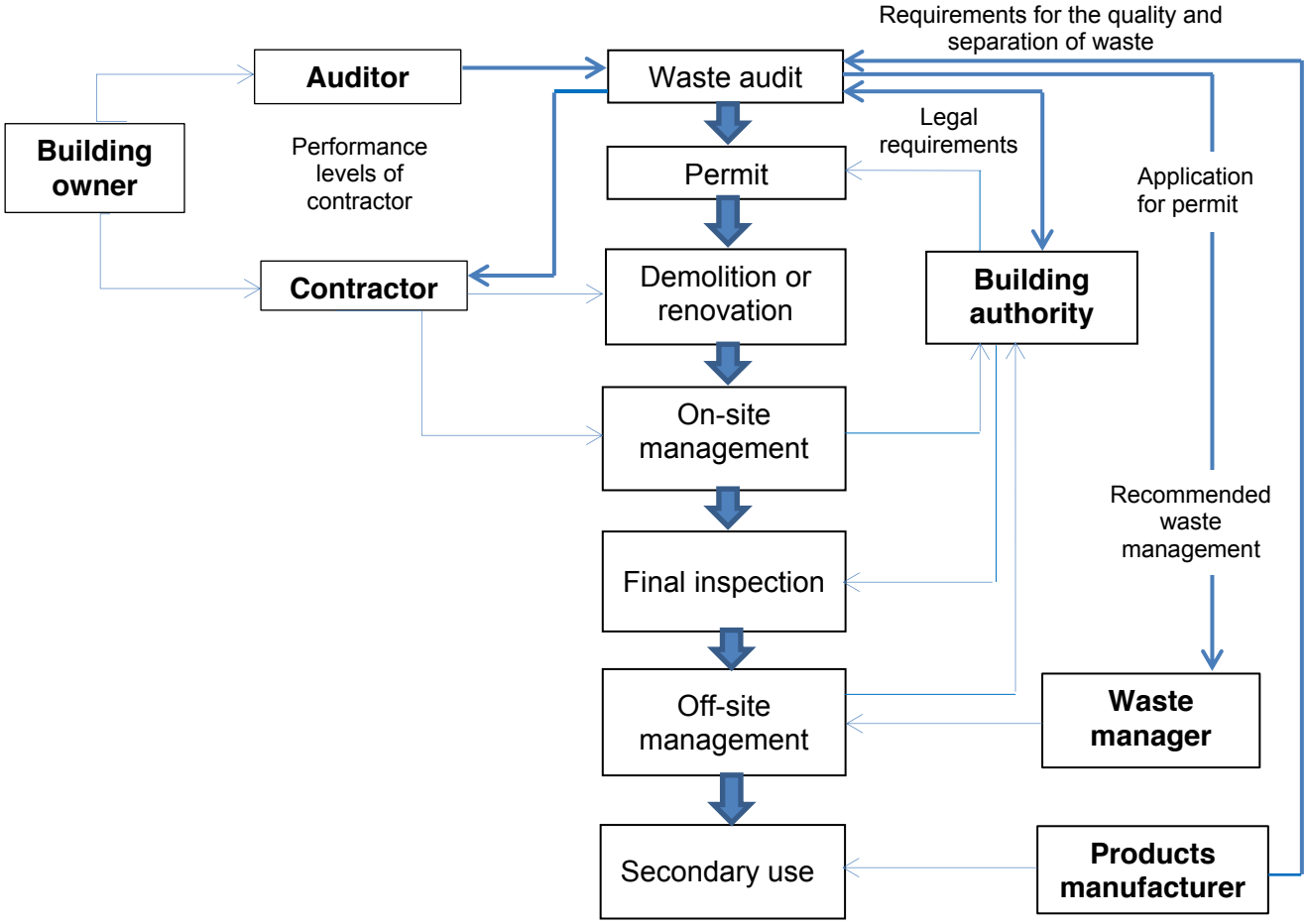

Figure 1: Role of waste audit actors in the waste management process

2. Waste audit

The waste audit aims to deliver a clear idea of the "to-be-demolished" building infrastructure, including estimates of waste materials that will be set free and recommendations for the waste management. It is a first step towards recycling and proper waste management. The auditing process aims to deliver the documents that the owner must attach to a demolition or renovation permit application to open a call for tenders. Furthermore, the outcome of the audit should also provide reliable estimates of waste materials to contrast them with the results from the waste management report.

2.1. Inventory of materials and elements

It is the duty of the waste holder to gain knowledge about the objects and substances intended to be discarded and their potential hazardous nature and contamination. The inventory of the materials and building elements is therefore the basic output of the waste audit arranged by the waste holder (usually the owner of the building or infrastructure) and performed by the auditor. The inventory is typically based on the materials assessment provided by the desk study and/or the field survey (see Annex B).

The assessment of materials aims to present reliable data about the type and amount of the demolition waste. It is based on desk study, site visit and additional activities aiming to ensure the quality of data. The demolition waste is produced by deconstruction and demolition activities and it may also include materials due to operation and use of the property. Materials assessment should be complemented with the consideration of the ease of recovery of these materials. As regards buildings, it is advisable to perform an assessment of the materials for each floor.

The materials assessment should include at least:

- The **type of material** to be classified as inert waste, non-inert, non-hazardous waste or hazardous waste, detailing the Eural code (from the European list of wastes) and description (since Eural codes do not provide enough information);
- **Quantification** in tonnes, cubic meters and/or other relevant units of measurement.

Additional information can be required by the waste holder or building authority such as:

- An **inventory of elements** recommended for deconstruction and reuse. Materials of these elements should not be excluded from the waste inventory (exceptions may exist e.g. if the audit is part of the approved deconstruction plan);
- The **location** of the waste materials (and elements) in the building, in order to maximize the efficiency and safety of demolition or renovation.
- The **quality of the material** to assess the impurities that could be present. The fewer impurities in the waste fraction, the higher the value it can have.
- Its **reusability** in order to assess direct reusability of the material which depends on the nature of the material and material conditions.

Factors affecting recovery of materials in the demolition process

The extent to which materials may be recovered effectively in the demolition process depends on a range of factors, including the following ones:

- Safety, which may increase project costs;
- Time. Selective demolition needs more time than traditional demolition, so higher costs are expected. Optimal solutions regarding potential recyclability and re-use should be considered.
- Economic feasibility and market acceptance. The cost of removing an element (e.g. a roof tile) should be compensated for by its price, while, at the same time, the re-used element should be competitive and accepted by future users. For some materials, e.g. iron/metal/scrap, market prices fluctuate strongly depending also on seasonality.
- Space. When there is a space limitation on a site, separation of materials collected should take place in a sorting facility. Space limits specifically require good planning.
- Location. The number of recycling facilities in the surroundings of the project site or the local supply waste management services may limit the potential recovery of materials from a deconstruction project.
- Weather. Some techniques may be dependent on certain weather conditions that may not coincide with project timing.

Source: The Joint Research Centre/Directorate-General Environment, Best Environmental Management Practice of the Building and Construction Sector, 2015, p.28, http://susproc.jrc.ec.europa.eu/activities/emas *in English*

2.2. Waste management recommendations

The waste audit can be completed with recommendations on how to perform waste management on site. The issues to be considered may include the following:

- Recommendations on the safe removal of hazardous waste
- Recommendations regarding possible health and safety precautions to take during the deconstruction phase or the waste management phase must also be done.
- Identification of potential waste diversion of certain identified waste streams (reuse, recycling, backfilling, energy recovery and elimination) and estimation of the diversion rates[5]. Different alternatives can be provided for each materials group or waste streams;
- Identification of (economically or environmentally) beneficial on-site sorting activities that may include the

[5] Appendix 3 of Construction Waste Measurement Protocol, ENCORD 2013

description of the installation requirements for storage, handling, separation and for any other operation to manage the different waste streams.

Recycled materials - REACH
• Whereas registration based on REACH obligations do not apply to waste, such registration may become obligatory when waste ceases to be waste. The REACH regulation therefore only becomes of interest when such materials as recycled aggregates are no longer considered to constitute waste. In the specific case of recycled aggregates it is important to note that, even when they cease to be waste, REACH registration obligations do not apply. The reason for that is that recycled aggregates are regarded as an article, in the sense of REACH. Articles are exempt from the obligation to register. Due to article 7(2) and 33 of the REACH regulation, substances of very high concern (SVHC) in articles must be notified if they are present in a concentration higher than 0.1% w/w. Such substances are typically not identified in recycled aggregates. • • Source: ECHA guidance on waste and recovered substances, 2010, Appendix 1, chapter 1.4; • http://echa.europa.eu/documents/10162/13632/waste_recovered_en.pdf *in English*

2.3. Reporting

The final report of the audit should be prepared by the auditor. The waste audit report will be signed by the auditor ascertaining the accuracy of the content. It is advisable that a third party revises the report as stated in the quality assessment section. The report must include the information regarding the project itself, all the information collected during the desk study and field survey and any information that can be useful for the owner, the contractor or any other stakeholder involved in the value chain of the project.

3. Quality Assessment of waste audits

The level of the required monitoring of the process varies between countries or regions, from occasional inspections (e.g. Finland) to the detailed comparison of waste audit recommendations to the real outputs (e.g. Basque Country). It was observed, however, that in the countries or regions with the most demanding regulations, those requirements are not strictly followed. Many countries developed electronic reporting and notification systems in recent years (e.g. Scotland, Czech Republic) to increase the efficiency of the process. These systems are not specifically used to monitor the audit results, but incorporate some essential parts thereof (e.g. waste reporting in Czech Republic, responsibilities definition in Scotland), and therefore can be extended in the future. The quality assessment of the waste audit will be based in two main aspects as shown in the sections below.

3.1. Requirements for auditors

Auditors should meet a set of minimum requirements:

- Skills. Auditors should show combined knowledge and experience. Experience provides an important background that can complement the auditor's educational background and specific training.
- Adequate education and specific training. Auditors should have knowledge of current and historical construction, constructive systems, standardization, materials and hazardous substances. For instance, architects and designers have knowledge of building types, standardized details and compositions of multilateral elements (e.g. panel houses in Eastern Europe are highly standardized) and can perform the assessment efficiently, but they may lack knowledge of materials and hazardous materials identification that will contribute to a successful audit process.

- Independence. The expert has to be neutral and independent (at least independent from the demolition company performing the demolition works), so that the results obtained can be used by all the stakeholders involved in the process.

3.2. Traceability

Waste audits should be considered as living documents that are revised periodically. It is important to ascertain the quality of the audit performed and this should be done preferably in 3 stages.

- Stage 1: Initial assessment during the waste audit. After the waste audit is performed (and registered) it has to be checked for its quality (by third-party certified auditor, public bodies or professional associations).
- Stage 2: Verification after or during demolition works. It is important to consider:
  - what happens with hazardous waste (to ascertain that they are correctly removed and disposed of);
  - the presence of hidden hazardous wastes;
  - the amounts that were set free should be compared with what was estimated. Discrepancies found in the figures should be notified and justified.
  - Materials that were collected together and materials that were separated.

- Stage 3: Verification with the management process. Considering not only the amounts and separation rates, but also the type of waste management performed. Any discrepancy found should be notified and justified.
  - What happened to hazardous waste;
  - which materials were separately collected / selectively collected but put in a mixed container
  - how (and where) were the quantities measured?

4. Recommended waste audit process

An effective process for a waste audit should follow the steps depicted in Figure 2. A further description of each of the steps is provided in the following sections.

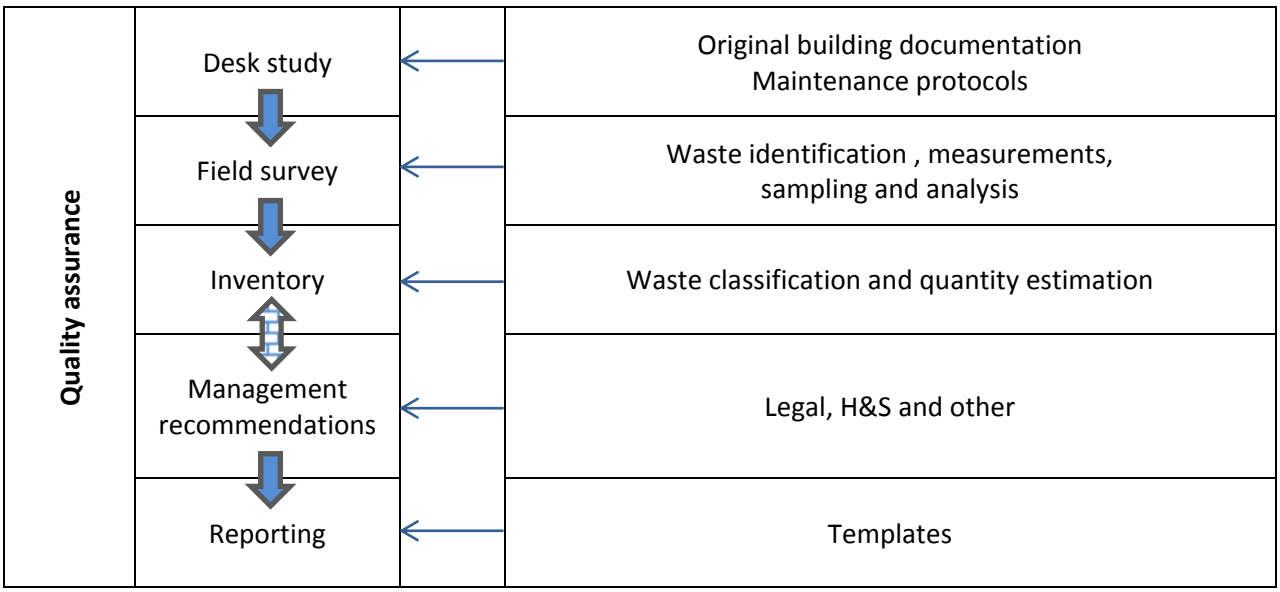

Figure 2: General scheme of the waste audit

4.1. Desk study

The desk study aims to gather all the relevant information from the documentation of the building or other work. It is of great importance to collect at least:

- The **age of the building or infrastructure** - information about the history of the building and the type of materials and construction techniques to expect. This knowledge is important if design documents are not available.
- The **design documents** - architectural plans and technical drawings contain information that is useful for planning the field survey and drawing up a waste inventory, whether or not they are accompanied by tender specifications or as-built documentation of the construction and/or renovation works. They serve for preliminary identification of construction date/period, dimensions, construction typology, composition, type of materials, location of machinery and installations, details of hidden or difficult to access spaces, as well as the planning of a field survey.
- The **documentation of use** - in particular the history of maintenance and renovations is essential as the materials may be different from the year of the first building completion. Descriptions of production activities and exploitation permits are a useful source for information on storage and use of hazardous products (that may have contaminated other materials).
- A **list of dangerous substances** - if the assessment of dangerous substances does not exist, the auditor will have to take relevant measures to ascertain that health and safety issues are covered when performing the site visit.
- The **surroundings and accesses** - The knowledge of the environments is essential to plan the best strategy to perform waste management.
- The **local facilities** – Knowing where to find a local salvage yard

At this stage, the auditor should collect as much information as possible to plan the site visit correctly. Based on the study of all documentation, a first draft of possible materials and uncertainties will have to be checked during the site visit. The information can be complemented by computer models or IT solutions or other tools developed by the auditors themselves. All the information collected at this stage of the audit should be part of the report or be annexed to the final report.

4.2. Field survey

During the field survey every room of the building to be demolished are visually inspected and inventoried on many occasions in a **destructive** manner. If necessary, samples are taken for analysis. Because every building is different, it is not possible to elaborate only one global method for data collection but it is important to work systematically and methodically.

A good and efficient approach consists of 4 parts:

- Site visit and general analysis of the building (checking what was learned during the desk study)
- General audit and inventory. The general audit and inventory is to have an idea (for every part of the building) of which materials occur and to collect the necessary information to identify, quantify and localize them in the building.
- Detailed audit and inventory. The different rooms are inventoried in detail (floor coverings, lighting units, interior walls, false ceilings, etc.)
- Sample taking and analysis (not all materials can be visually identified. Therefore, suspect materials need to be sampled and analysed)

The site visit consists of visual inspections, comparisons of findings with collected documents, planning of inspections and measurements, preliminary planning of deconstruction techniques and waste handling on site as well as communication between actors engaged by the owner to the process. The auditor should aim to:

- Evaluate the consistency of the design documents and documents of the property owners with the actual situation;
- Identify locations, different structure and technical systems and their materials, with special care for materials that can seem very similar, for instance in the cases of complex systems where a material can be covered by another material.
- Take measurements or confirm those obtained during the desk-study
- Make diagrams, take notes, take pictures of the different parts and include them in the report to ease the understanding of the final report.
- Make sure to identify all the materials. In covered areas, it is important to remove a small part of the covering to make sure that the materials underneath are those expected.
- Take samples of the materials to ascertain the nature and quantity of the materials being studied. These samples should be visually inspected at the moment of collection and observations reported.

The site visit must implement non-destructive or destructive techniques in order to correctly assess the whole range of materials. The destructive techniques will probably be: opening of false ceilings and walls, opening of technical shafts, making a hole in wall and floor coverings, (partial) disassembly of technical installations (ventilation ducts ...), removing coating from surfaces, drilling to observe the composition at different depths or any other operation deemed necessary for complete information of the materials. Since it is highly probable that destructive techniques should be required, the field survey is best carried out when the building is no longer in use.

If the desk-based study suggests the existence of hazardous substances at the site, or if at any stage it is suspected that hazardous substances may be present, protocols to work with hazardous substances should be established and worker protection measures applied during the site visit, mainly during destructive stages. The site visit should allow the auditor to complete the information collected during the desk-based study and take any sample required to perform the materials assessment.

The site visit can and should be complemented with some of the following operations:

- Chemical analysis of samples to confirm the identification of the materials.
- Mechanical testing to study properties of the materials in order to consider their reusability.
- Non-destructive testing performed on site to contribute to a better identification of materials and/or to find hidden materials. Possible techniques include NIR spectrometers, ultrasound equipment, metal detectors, flexible cameras for visual inspection of hollow areas inside walls, etc.

4.3. Inventory of materials and elements

The minimum set of data to be included under this section should be a summary of the information shown above for the whole building. The information about constructive and non-constructive elements (such as pillars, beams, walls, slabs, etc. and also furniture, lightning, electronics, paper, etc.) and corresponding materials should also be organized to provide not only the total amount of waste, but also the total amount of the different types of materials. Even if this set of data is considered as the minimum for a full materials assessment, to take advantage of waste audits' full potential we highly recommend to:

- Separate the source of waste by the different levels of the building
- Consider the feasibility of separation
- Include photographs showing details to make the report easier to read.

It is advisable to perform this materials assessment not only for each building but also for each floor of the building. This information will be of great importance in order to assess and decide the waste management procedure to be implemented.

Materials assessment should be completed considering the ease of recovery of these materials. This makes it very important to estimate if the waste will be technically and economically separable, to decide which different types of outlets should be proposed during the waste management planning stage of the waste audit.

All the information given above should be complemented with photographs to ease the work of the contractor when performing the construction, demolition or refurbishment activities. Photographs should be clear, and explicitly show the information they are intended to provide. (It is good practice to note on the photographs the location of the detail shown.)

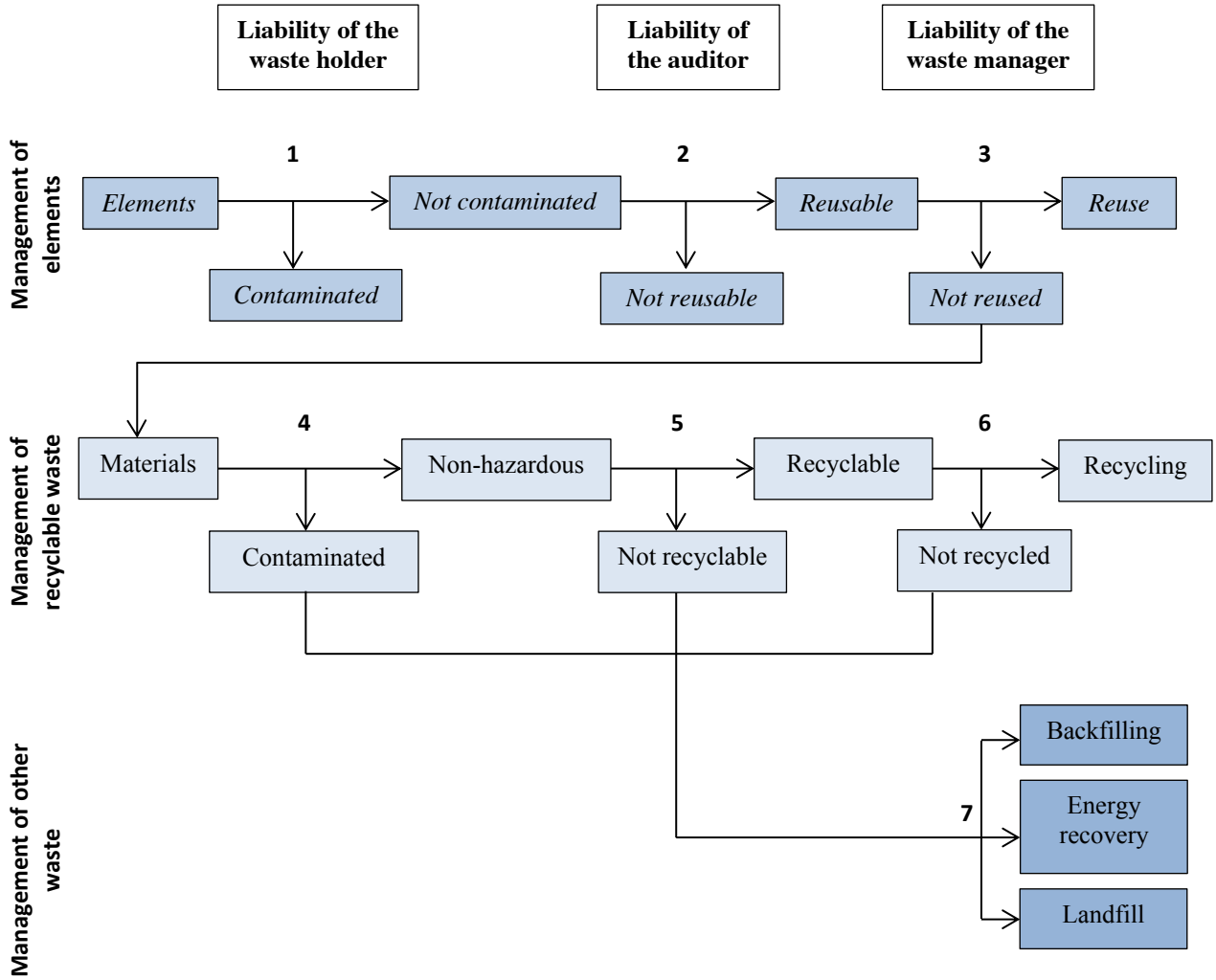

Figure 3: Decision-making process in the formulation of the inventory and management recommendations

5. Waste management recommendations

These recommendations can include advise and guidelines for the safe removal of hazardous waste materials, re-use or recycling possibilities for certain (high value) materials present in the building, (legally binding) conditions for storage, transport and treatment of certain materials, recommendations deriving from the limitations of the field survey, etc. The waste audit should specify the areas of the building potentially affected by contamination and the best way to deal with them before beginning the other activities of the project. If possible, a selective dismantling should be recommended in order to maximize the waste. Materials containing asbestos should be specifically considered and the waste audit should include a reference to the national legislation regulating the way to handle this waste material. It is advisable to prepare an environmental health and safety control plan describing the operations that should be performed to avoid contamination of the surrounding materials and environment including risk mitigation measures to be applied to minimize the exposition of workers and the environment. Any possible risk for workers should be specifically considered and reported to be included in a health and safety plan.

5.1. Reporting

The final report is based on the desk-study report, minutes of the site visit; report of materials assessment and possibly on the report of site management recommendation. The main section of the final report includes the following information:

Scope of the report (essential)

Presentation of the project: short description of the project with detailed information of the works to be performed including not only parts directly affected by the works, but also those parts that should be kept.

- General description of the project
- Basic information about the owner and the property
- Location of the site, incl. information about neighbourhood when relevant
- History of major renovations and previous use(s)
- Summary and conclusions of the desk study

Summary of the waste audit (essential)

Summary of the data collected during the audit including, but not limited to:

- Waste fractions arising (in tonnes, m^3 or other units)
- Total waste arising (absolute in tonnes, m^3 or other units)
- Summary of hazardous wastes identified in the building or infrastructure
- Description of the methodology followed, including the steps performed and the techniques employed.
- List of documents that were available, for instance hazardous substances assessment, any information on the building or the construction materials used originally, etc.
- Other supporting materials where available (pictures, site-plans and any other documents that could be useful for the correct performance of the project).

Inventory (mandatory)

The inventory of waste fractions and elements is the core part of the waste audit report. It can be reported using the templates in section 8 and section 9 E and may contain the following parts:

- Inventory of materials (essential) is recommended to compile according to the reporting levels outlined in the Construction Waste Measurement Protocol[6] with the following options:

Basic data	Hazardous	Non-hazardous	
Intermediate data	Hazardous	Non-hazardous (non inert)	Non-hazardous (inert)
Detailed data	Type of material + waste code (EWC + EURAL)		

Figure 4: Levels of reporting of waste fractions

- Inventory of elements (optional) can follow a similar structure. It should be noted that the materials of the elements listed in this part cannot be excluded from the inventory of waste materials (with the exception of "certain reuse").

Basic data	Hazardous	Non-hazardous		
Intermediate data	Hazardous	Non-hazardous (not reusable)	Non-hazardous (reusable)	
Detailed data	Hazardous	Non-hazardous (not reusable)	Possible re-use	Some re-use

Figure 5: Levels of reporting of waste elements

If a more detailed assessment has been performed, a summary by floor/level can be included. The documents filled in with full details should be included as annexes to the report.

Waste management recommendations (optional)

- Summary by type of outlet and recommended management of each waste stream.
- Assessment of the reachable recovery targets and disposal rates that can be filled using recommended template (see section 10).
- List of local waste management facilities (if possible) specifying their services.
- Waste traceability process including recommended templates to be used (see section 11) and when possible person(s) or organization(s) responsible to perform waste traceability until the final outlet.
- Other information of interest for stakeholders involved in the project, included but not limited to legislative framework in the country and summary of responsibilities and liability of each of the stakeholders guidelines / advise / focus of attention regarding the selective demolition works planned, for example: advise and guidelines for the safe removal of hazardous waste materials, re-use or recycling possibilities for certain (high value) materials present in the building, (legally binding) conditions for storage, transport and treatment of certain materials, recommendations deriving from the limitations of the field survey, etc.

[6] Construction Waste Measurement Protocol, ENCORD 2013

6. European Waste Catalogue[7]

The catalogue establishes a list of waste defined by a six-digit code. The different types of wastes are divided into 20 chapters. The numbers of these chapters are the first two-digit numbers of the waste code.

Chapter 17 groups together "Construction and demolition wastes (including excavated soil from contaminated sites)", but some waste that can be found on a jobsite can be linked to other chapters. Regardless of type, it is important to state that other sorts of waste should be present in the building as furniture, fire safety equipment, etc. that has to be recorded in the waste audit.

The different types of waste that need to be identified should fit in one of the following groups:

- Inert waste - waste that does not undergo any significant physical, chemical or biological transformation. Inert waste will not affect other materials, even if they come into contact in any way likely to produce environmental pollution or harm to human health. Leachability and pollutant content of this waste need to be negligible.

- Non-inert non-hazardous waste - This group of wastes can be divided into:

  Metals - In general metals are easily recyclable, but if they are polluted or there is a big mixture of metals, they may not be recyclable and could need to be landfilled.

  Wood - Wood should be further divided in untreated (clean) wood; wood treated without hazardous substances and wood treated with hazardous substances (which should be treated as hazardous materials)

  PVC - PVC can be mechanically recycled easily, but an appropriate sorting is the way to optimize PVC recycling rates. Main types of PVC identified are: stiff PVC and soft PVC

  Plaster - Mainly represented by gypsum-based construction materials.

  Packaging materials - Packaging wastes are subject to specific regulation (Directive 94/62/EC and amendments)

  Mixed non-hazardous waste - has the same characteristics as household waste and can be treated by the same processes.

  Hazardous waste - Hazardous waste was defined in Directive 2008/98/EC as that showing one or more of the hazardous properties listed in Annex III. Hazardous waste is subjected to specific precautions for their disposal, and is regulated all along Europe.

Considering the different regulations in the different Member States, this section represents only the most common situation in European Countries and should be considered merely as a recommendation.

A non-exhaustive list of materials that can be present in construction and demolition activities is given below.

[7] 2014/955/EU: Commission Decision of 18 December 2014 amending Decision 2000/532/EC on the list of waste pursuant to Directive 2008/98/EC of the European Parliament and of the Council.

17 CONSTRUCTION AND DEMOLITION WASTES (INCLUDING EXCAVATED SOIL FROM CONTAMINATED SITES)

17 01 concrete, bricks, tiles and ceramics
17 01 01 concrete
17 01 02 bricks
17 01 03 tiles and ceramics
17 01 06* mixtures of, or separate fractions of concrete, bricks, tiles and ceramics containing dangerous substances
17 01 07 mixtures of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06
17 02 wood, glass and plastic
17 02 01 wood
17 02 02 glass
17 02 03 plastic
17 02 04*[8] glass, plastic and wood containing or contaminated with dangerous substances 17 03 bituminous mixtures, coal tar and tarred products 17 03 01* bituminous mixtures containing coal tar 17 03 02 bituminous mixtures other than those mentioned in 17 03 01 17 03 03* coal tar and tarred products

17 04 metals (including their alloys)

17 04 01 copper, bronze, brass
17 04 02 aluminium
17 04 03 lead
17 04 04 zinc
17 04 05 iron and steel
17 04 06 tin
17 04 07 mixed metals
17 04 09* metal waste contaminated with dangerous substances 17 04 10* cables containing oil, coal tar and other dangerous substances 17 04 11 cables other than those mentioned in 17 04 10

17 05 soil (including excavated soil from contaminated sites), stones and dredging spoil

17 05 03* soil and stones containing dangerous substances
17 05 04 soil and stones other than those mentioned in 17 05 03
17 05 05* dredging spoil containing dangerous substances
17 05 06 dredging spoil other than those mentioned in 17 05 05
17 05 07* track ballast containing dangerous substances
17 05 08 track ballast other than those mentioned in 17 05 07

17 06 insulation materials and asbestos-containing construction materials

17 06 01* insulation materials containing asbestos
17 06 03* other insulation materials consisting of or containing dangerous substances 17 06 04 insulation materials other than those mentioned in 17 06 01 and 17 06 03 17 06 05* construction materials containing asbestos (7)

17 08 gypsum-based construction material

17 08 01* gypsum-based construction materials contaminated with dangerous substances 17 08 02 gypsum-based construction materials other than those mentioned in 17 08 01 **17 09 other construction and demolition wastes** 17 09 01* construction and demolition wastes containing mercury
17 09 02* construction and demolition wastes containing PCB (for example PCB-containing sealants, PCB-containing resin-based floorings, PCB-containing sealed glazing units, PCB-containing capacitors)
17 09 03* other construction and demolition wastes (including mixed wastes) containing dangerous substances 17 09 04 mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03

[8] Extract from COM/2000/532

2 WASTES FROM AGRICULTURE, HORTICULTURE, AQUACULTURE, FORESTRY, HUNTING AND FISHING, FOOD PREPARATION AND PROCESSING

2 **01 wastes from agriculture, horticulture, aquaculture, forestry, hunting and fishing**

2 01 08* agrochemical waste containing dangerous substances

3 WASTES FROM WOOD PROCESSING AND THE PRODUCTION OF PANELS AND FURNITURE, PULP, PAPER AND CARDBOARD

3 **03 wastes from pulp, paper and cardboard production and processing**

3 03 08 wastes from sorting of paper and cardboard destined for recycling

4 WASTES FROM THE LEATHER, FUR AND TEXTILE INDUSTRIES 04 02 wastes from the textile industry

4 02 22 wastes from processed textile fibres

08 WASTES FROM THE MANUFACTURE, FORMULATION, SUPPLY AND USE (MFSU) OF COATINGS (PAINTS, VARNISHES AND VITREOUS ENAMELS), ADHESIVES, SEALANTS AND PRINTING INKS 08 01 wastes from MFSU and removal of paint and varnish

8 01 11* waste paint and varnish containing organic solvents or other dangerous substances 08 01 12 waste paint and varnish other than those mentioned in 08 01 11

8 01 13* sludges from paint or varnish containing organic solvents or other dangerous substances 08 01 19* aqueous suspensions containing paint or varnish containing organic solvents or other dangerous substances

8 02 wastes from MFSU of other coatings (including ceramic materials)

8 02 02 aqueous sludges containing ceramic materials

8 04 wastes from MFSU of adhesives and sealants (including waterproofing products)

8 04 09* waste adhesives and sealants containing organic solvents or other dangerous substances 08 04 10 waste adhesives and sealants other than those mentioned in 08 04 09

12 **WASTES FROM SHAPING AND PHYSICAL AND MECHANICAL SURFACE TREATMENT OF METALS AND PLASTICS 12 01 wastes from shaping and**

12 01 09* machining emulsions and solutions free of halogens

12 01 14* machining sludges containing dangerous substances

13 OIL WASTES AND WASTES OF LIQUID FUELS (except edible oils, and those in chapters 05, 12 and 19)

13 **02 waste engine, gear and lubricating oils**

13 02 05* mineral-based non-chlorinated engine, gear and lubricating oils **13 05 oil/water separator contents**

13 05 02* sludges from oil/water separators

14 WASTE ORGANIC SOLVENTS, REFRIGERANTS AND PROPELLANTS (except 07 and 08)

14 **06 waste organic solvents, refrigerants and foam/aerosol propellants**

14 06 02* other halogenated solvents and solvent mixtures

14 06 03* other solvents and solvent mixtures

15 WASTE PACKAGING; ABSORBENTS, WIPING CLOTHS, FILTER MATERIALS AND PROTECTIVE CLOTHING NOT OTHERWISE SPECIFIED

15 **01 packaging (including separately collected municipal packaging waste)**

15 01 01 paper and cardboard packaging

15 01 02 plastic packaging

15 01 03 wooden packaging
15 01 04 metallic packaging 15 01 05 composite packaging 15 01 06 mixed packaging
15 01 10* packaging containing residues of or contaminated by dangerous substances

15 02 absorbents, filter materials, wiping cloths and protective clothing

15 02 02* absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated by dangerous substances

16 WASTES NOT OTHERWISE SPECIFIED IN THE LIST

16 01 end-of-life vehicles from different means of transport (including off-road machinery) and wastes from dismantling of end-of-life vehicles and vehicle maintenance (except 13, 14, 16 06 and 16 08)

16 01 07* oil filters 16 01 13* brake fluids
16 01 14* antifreeze fluids containing dangerous substances

16 02 wastes from electrical and electronic equipment

16 02 09* transformers and capacitors containing PCBs
16 02 11* discarded equipment containing chlorofluorocarbons, HCFC, HFC
16 02 13* discarded equipment containing hazardous components (2) other than those mentioned in 16 02 09 to 16 02 12
16 02 14 discarded equipment other than those mentioned in 16 02 09 to 16 02 13

16 05 gases in pressure containers and discarded chemicals

16 05 06* laboratory chemicals, consisting of or containing dangerous substances, including mixtures of laboratory chemicals

16 06 batteries and accumulators

16 06 01* lead batteries 16 06 02* Ni-Cd batteries

18 WASTES FROM HUMAN OR ANIMAL HEALTH CARE AND/OR RELATED RESEARCH (except kitchen and restaurant wastes not arising from immediate health care)

18 01 wastes from natal care, diagnosis, treatment or prevention of disease in humans

18 01 09* medicines other than those mentioned in 18 01 08

20 MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS 20 03 other municipal wastes

20 03 01 mixed municipal waste 20 03 07 bulky waste.

7. Recommended template for inventory of materials

Minimum content:

BUILDING:

Relevant information:

Type of material	Material identification	Waste code (EWC and EURAL)	Location	Quantity	Unit	Observations or other information

Summary table

Building	Type of material	Material identification	Waste code (EWC and EURAL)	Quantity	Units	Total quantity
	Inert waste					
	Non-inert, non-hazardous waste					
	Hazardous waste					

Recommended content. Detailed assessment.

BUILDING:

Level:

Other relevant information:

Construction unit:									
Type of material	**Material identification**	**Waste code (EWC and EURAL)**	**Location**	**Quantity**	**Unit**	**Possible outlets[1]**	**Recommended outlet[2]**	**Precautions to take during the deconstruction phase[3]**	**Pictures and notes**

1 Reuse; recycle; backfill; energy recovery; elimination
2 The recommended outlet must be identified taking into account the hierarchy of waste treatment and the potential possibilities in the proximity of the jobsite
3 Ex: do not leave the frame on the plasterboards; be careful to remove the power plugs, etc.

Recommended content. Summary

Building	Level	Material to evacuate	Construction units	Quantity/ weight	Unit	Recommended outlet
Building	Ground floor, Level 1, Level 2					
		TOTAL OF INERT WASTES				
		TOTAL OF NON INERT NON HAZARDOUS WASTE				
		TOTAL OF HAZARDOUS WASTES				

8. Recommended template for inventory of building element

BUILDING:

Level:

Other relevant information:

Construction unit:								
Element	**Units**	**Location**	**Reusable**	**Possible markets**	**Quantity**	**Materials identification and Waste codes**	**Precautions to take during the deconstruction phase**	**Pictures and notes**

Materials present in the different elements should be detailed using the templates provided in section 8.

9. Recommended template for waste management recommendations

BUILDING:

Level:

Other relevant information:

Construction unit							
Type of material	**Waste code (EWC and EURAL)**	**Location**	**Possible outlets[1]**	**Recommended outlet[2]**	**Precautions to take during the deconstruction phase[3]**	**Handling precautions**	**Legal storage /transport/ treatment conditions**

4 Reuse; recycle; backfill; energy recovery; elimination
5 The recommended outlet must be identified taking into account the hierarchy of waste treatment and the potential possibilities in the proximity of the jobsite
6 Ex: do not leave the frame on the plasterboards; be careful to remove the power plugs, etc.

SUMMARY BY TYPE OF OUTLET AND POTENTIAL RECOVERING **RATES CALCULATION**

Type of material	Material/ Waste	Quantity	Unit	Comments
Reuse				
Total tonnage of material reused				
Percentage of material reused				
Recycling				
Total tonnage of material recycled				
Percentage of material recycled				
Backfilling				
Total tonnage of material backfilled				
Percentage of material backfilled				
Energy recovery				
Total tonnage for energy recovery				
Percentage for energy recovery				
Elimination				
Total tonnage of material eliminated				
Percentage of material eliminated				

Rate of reuse	%
Rate of recycling	%
Rate of backfilling	%
Rate of energy recovery	%
Rate of elimination	%

10. Recommended template for waste traceability

Waste audit	Week 1	Week 2	Week 3
Waste stream			
Waste code (EWC and EURAL)			
Type of material			
Previewed in waste audit			
Sorting			
Need to separate			
Generated			
Deviations			
Management			
Reuse			
Valorisation			
Disposal			
Managed			
Deviations			
Justifications and supporting documents			

11. Annexes

11.1. Examples of international, EU and national policy and framework conditions

Example 1: Circular Economy package on backfilling[9]

By 2020, the preparation for re-use, recycling and backfilling of non-hazardous construction and demolition waste in the list of waste will be increased to a minimum of 70% by weight in all Member States. An exclusion is made for naturally occurring material defined in category 17 05 04.
For the purpose of verifying compliance with Article 11 (2) (b)[10], the amount of waste used for backfilling operations shall be reported separately from the amount of waste prepared for re-use or recycled. The reprocessing of waste into materials that are to be used for backfilling operations shall be reported as backfilling.

Source: European Commission, 2016, http://ec.europa.eu/environment/circular-economy/index_en.htm *in English*

Example 2: Private and/or national systems for sustainable construction

The **LEED** (Leadership in Energy and Environmental Design) Rating Systems is a voluntary programme meant to measure objectively how sustainable a building is in several key areas: a) environmental impact on site and location; b) water efficiency; c) energy efficiency; d) material selection; e) indoor environmental quality. The system also encourages innovation.
Source: http://www.usgbc.org/leed *in English*
BREEAM (Building Research Establishment Environmental Assessment Method) is a sustainability assessment method for master-planning projects, infrastructure and buildings. It addresses a number of lifecycle stages such as new construction, refurbishment and in-use.
Source: http://www.breeam.com/ *in English*
HQE™ (Haute Qualité Environnementale / High Environmental Quality) is a French certification awarded - also internationally - to building construction and management, as well as urban planning projects. HQE™ promotes best practices, sustainable quality in building projects and offers expert guidance throughout the lifetime of the project.
Source: http://www.behqe.com *in English and French*

Example 3: Recycling of PVC

PVC (polyvinyl chloride) compounds are easily recyclable physically, chemically or energetically. After mechanical separation, grinding, washing and treatment to eliminate impurities, it is reprocessed using various techniques (granules or powder) and re-used in production. Main elements made of PVC in buildings include piping/fitting and window frames. Throughout Europe there are Member States and regions where PVC window frames are separated at source and collected separately. In some instances window frames can be given away at collection sites at no cost. PVC is recycled into new window frames and the technology for recycling PVC tubes into new tubes has also been developed. Indeed, this has been done at industrial scale since the beginning of the century.

Source: Fédération Internationale du Recyclage (FIR), 2016 and www.vinylplus.eu *in English and French*

Example 4: Wood recycling into wood-based panels

Wood can be recycled into particle boards. In 2014, the European particle board industry in the EPF member countries consumed 18.5 million tonnes of wood raw material. The average share of recovered wood was 32%, the other raw material categories being processed round wood (29%) and industrial by-products (39%). Recovered wood continued to be used as the major raw material source in Belgium, Denmark, Italy and the United Kingdom. Austria, Germany, Spain and France also used important quantities of recovered wood for particle board manufacturing, reflecting the encompassing problem of wood availability. Other European countries still use primarily roundwood and industrial residues due to the lack of an efficient collecting system or thanks to less pressure from the incentivised bioenergy sector. The share of CDW in the recovered wood fraction used for panel production is currently rather low but rising with the improvement of appropriate source separation and collection from C&D sites.

Source: European Panel Federation (EPF) and Europanels, www.europanels.org, 2016 *in English*

9 Circular Economy package, COM(2015) 595 final
10 Circular Economy package, COM(2015) 595 final

Example 5: Recycling and re-use of mineral wool

Mineral wool can be recycled into new mineral wool products and it can serve as raw material for bricks and ceiling tiles, for example. Mineral wool construction waste arises in very small quantities at construction or renovation sites. As mineral wool is flexible by nature, often rest material will be re-used on-site immediately to fill gaps for example, resulting in low quantities of remaining waste. Recycling of this clean waste stream is technically possible, but is a costly and infrastructure-driven process as for all stakeholders. Requirements for selective demolition and separation of waste streams are a pre-requisite, whereas after-sorting will often be necessary to guarantee sufficiently clean waste stream.

Today's release of mineral wool demolition waste is rather small but the quantities will increase in the future, as the buildings from the 1970's or 80's get old and the average renovation time is 30+ years. Collection and recycling of mineral wool demolition waste thus very much relies on demolition and sorting techniques as well as economic viability and regulatory frameworks. Mandatory separation, after-sorting obligations and training could improve this situation, although the small quantities (as well in weight) of mineral wool demolition waste remain a barrier for cost-effective solutions.

Information Sheet on Waste Handling of Mineral Wool Insulation:
http://www.eurima.org/uploads/ModuleXtender/Publications/151/Eurima_waste_handling_Info_Sheet_06_06_2016_final.pdf Mineral Wool - Deconstruction in Practice video: https://www.youtube.com/watch?v=H4amG-f69mA

Source: European Insulation Manufacturers Association (EURIMA), 2016, http://www.eurima.org/ *in English*

Example 6: EMAS - Best Environmental Management Practice in the Waste Management Sector

The EU Eco-Management and Audit Scheme, EMAS, is a voluntary environmental management scheme for all types of private and public organisations to evaluate report on and improve their environmental performance.

An increasing number of local, regional and national governments prepare Integrated Waste Management Strategies.

The European Commission's Joint Research Centre (JRC) - in consultation with EU Member States and other stakeholders - identifies, evaluates and documents Best Environmental Management Practices (BEMPs) for different sectors, including the construction sector[11]. The JRC is currently developing the document "Best Environmental Management Practice in the Waste Management Sector", which will cover three waste streams: C&D waste, municipal solid waste and medical waste. The document will cover the following waste activities: waste management, prevention, re-use, collection and treatment.

Source: The background document for the EMAS Sectorial Reference Documents (SRDs) on Best Environmental Management Practices (BEMPs) for the waste management sector (p. 273), http://susproc.jrc.ec.europa.eu/activities/emas/waste_mgmt.html *in English;*
The Joint Research Center, 2016, http://susproc.jrc.ec.europa.eu/activities/emas/index.html *in English*

Example 7: List of C&D materials that need to be removed from the building before demolition - example of the Austrian standard ÖNORM B3151

C&D materials representing or containing dangerous substances:

- Loose artificial mineral fiber (if hazardous);
- Components or parts containing mineral oil (such as an oil tank);
- Smoke detectors with radioactive components;
- Industrial smoke stacks (for ex., fireclay boxes, bricks or lining);
- Insulating material made up of components containing Chlorofluorocarbon ((H)CFC) (like sandwich elements);
- Slags (for ex., slags in inserted ceilings);
- Oil-contaminated or otherwise contaminated soils;
- Fire debris or otherwise contaminated debris;
- Isolations containing polychlorinated biphenyl (PCB);
- Electrical properties or equipment with pollutants (for ex., vapor discharge lamps containing mercury, fluorescent tubes, energy-efficient lamps, capacitors containing PCB, other electrical equipment containing PCB, cables containing insulation liquids);
- Cooling liquid and insulations from cooling devices or air-conditioning units containing Chlorofluorocarbon ((H)CFC);
- Materials containing polycyclic aromatic hydrocarbon (PAH) (like tar bitumen, tar board, cork block, slags)

[11] The Joint Research Centre, http://susproc.jrc.ec.europa.eu/activities/emas/construction.html

- Components containing or impregnated with salt, oil, tar, phenol (e.g. impregnated wood, cardboard, railway sleepers, masts);
- Material containing asbestos (for ex., asbestos cement, sprayed asbestos, night storage heaters, asbestos flooring);
- Other hazardous materials.

Source: https://shop.austrian-standards.at/action/de/public/details/532055/OENORM_B_3151_2014 *in English and German*

Example 8: Bulgarian Ordinance on C&D waste used for backfilling

According to the Bulgarian Ordinance on construction and demolition waste management and use of recycled building materials construction and demolition waste can be used for backfilling only if:

- The construction and demolition waste used complies with the requirements of the project;
- The person responsible for the material recovery holds a permit for recovery; operation code R10.

According to the same Ordinance, backfilling can be material recovery only if the C&D waste is inert and is treated.

Source; Ministry of Environment and Water of Bulgaria, 2016

Example 9: The French example of identifying waste from demolition and refurbishment of buildings

The French regulation for construction and building projects specifies how to identify waste from demolition and refurbishment of buildings. The buildings concerned are those with a surface area of more than 1000 square meters for each floor or farm, industrial or commercial building that has been exposed to hazardous substances. The works concern the reconstruction and/or demolition of a major part of the structure of the building. The contracting entity has to carry out the identification before applying for the demolition permit or before accepting estimates for contracting.

The identification lists the nature, the amount and the location of material and waste and their means of management, notably of those which are re-used on site, recovered or eliminated. This list is provided to anyone involved in the demolition works.
At the end of the works, the contracting authority writes an assessment of works indicating the nature and the amount of material actually re-used on site and that of waste that is recovered or eliminated. The contracting entity sends the form to the French Environment and Energy Management Agency which presents a yearly report to the Ministry in charge of construction.

Source: Cerema, 2016, https://www.legifrance.gouv.fr/eli/decret/2011/5/31/DEVL1032789D/jo *and* https://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000025145228

Example 10: The French environmental assessment approach to waste in road engineering

Since the beginning of the year 2000, the French Ministry for Sustainable Development has been studying the possibility of a single and harmonized approach to improve the use of alternative materials made from non-hazardous waste for road engineering. The process, carried out in collaboration with the economic stakeholders of the sector, has led to the development of a method, published in March 2011 by the SETRA (now Cerema). This method provides an approach to the environmental assessment of alternative materials in road engineering which takes into account:

- The improvements of European standards for leaching tests;
- The feedback from evaluation and feasibility studies regarding the use of certain types of recycled waste in road engineering;
- The approach selected in the framework of the European decision 2003/33/CE which has allowed the creation of a European harmonized process and storage.

This approach has been applied to 3 sources of waste: demolition waste, bottom ash from incinerators of non- hazardous waste and steel slag waste. It is currently applied to dredged sediments, foundry sands and ashes from thermal power plants.

Source: Cerema, 2016, http://www.centre-est.cerema.fr/guides-nationaux-r361.html *in French*

Example 11: Decentralised taxes on sand, gravel and rock - the case of Italy

In Italy the application of taxes on sand, gravel and rock are decentralised and have been applied since the early 1990s. There is no common national rate of tax being applied. Instead every region applies different rates at provincial and municipal levels, per cubic meter of sand, gravel and rock extracted. The revenue from the taxes are accrued by the municipalities and legislation prescribes they are earmarked for 'compensatory investments' in localities of quarrying activity. In Italy, the charge on aggregates is only one element of a very complex planning, authorisation, and regulation system related to quarrying activities.

Extraction charges are not primarily aimed at reducing the quantity extracted or at promoting recycling. Instead their purpose is to contribute to the external costs associated with quarrying activities through financing land conservation investments implemented by municipalities and other institutions that share the revenues, which mostly accrue to municipalities. Results from the analysis suggest that the effect of the extraction charge has been very limited. The level of tax is generally too low (around EUR 0.41-0.57/m3) to have had any real effect on demand.

Source: EEA, Effectiveness of environmental taxes and charges for managing sand, gravel and rock extraction in selected EU countries, No 2/2008, https://www.eea.europa.eu/publications/eea_report_2008_2/ *in English*

Example 12: The Netherlands' history of recycling C&D waste

Recycling of C&D waste in the Netherlands started in the 1980's. The main driver was the contaminated soil issue arising from landfills. In response, the Netherlands developed its Waste Hierarchy. The new policy consisted of implementing landfill bans and recycling targets. A national plan was developed for C&D waste by all stakeholders, assigning tasks and responsibilities to each stakeholder. A specific task for the recycling industry was the development of quality assurance schemes.

Recycling started off by relatively simple crushing of inert C&D waste into recycled aggregates. These were used for various applications, including what now is seen as "backfilling". Crushing of inert C&D waste has been the prime activity for many years. As also the landfilling of mixed C&D waste was prohibited, new plants for sorting of this material were started up. These plants recover materials such as wood, metals, plastics and inert materials. The residual fraction is partially used to produce a secondary fuel.

The quality of recycled aggregates improved over the years. Processes improved and so did quality control. For many years now, recycled aggregates are prescribed by the Ministry of Transport purely on the basis of its outstanding technical characteristics. The environmental quality is fully assured through certification schemes that include the requirements of the Soil Quality Decree. Increasingly, recycled aggregates are also used in the production of concrete. Recycling of asphalt has gone through a similar process. Nowadays, almost all asphalt is recycled into new asphalt. Wood recycling is also frequent, although a main alternative outlet for wood is still biomass for power generation (energy recovery).

Recycling of several other materials has proven to be more difficult. These materials constitute smaller fractions of C&D waste and recycling of these fractions usually requires more input. Other materials, which are being recycled progressively, are:

- Flat glass; A collection scheme exists for flat glass initiated by the glass industry and the glass can be delivered to collection points for free. PVC windows: A collection scheme exists for PVC windows, and also these can be delivered for free to collection points.
- Gypsum; A few years ago an agreement was made between government and industry to make the Netherlands a leader of the recycling of gypsum. Gypsum is kept separate mainly in order to not affect the quality of recycling of inert C&D waste.
- PVC pipes; One recycler has developed a recycling process for PVC pipes. PVC is micronized in order to meet the requirements for use in new PVC pipes.
- Roofing material. Bitumen roofing material can be recovered and processed, and used partly in new roofing constructions and partly in asphalt.

Source; European Panel Federation (EPF), 2016, http://www.fir-recycling.com/ *in English*

Example 13: The Asbestos Abatement Programme in Poland (2009-2032)

The aims of The Programme for Asbestos Abatement in Poland 2009-2032 are:

1) Removal and disposal of products containing asbestos;
2) Minimising adverse health effects caused by the presence of asbestos in Poland;
3) Eliminating negative effect of asbestos on the environment.

The programme groups together the activities scheduled for the implementation at a central, regional area (or province) and local level in five subject areas:

a. Legislative activities;
b. Education and information activities addressed to children and youth, trainings for employees of government and self-government administrations, development of training materials, promotion of technologies for the destruction of asbestos fibres, organisation of national and international trainings, seminars, conferences, congresses and participation therein;
c. Activities related to the removal of asbestos and products containing asbestos from the constructions, public amenities and sites of former asbestos products producers, cleaning the premises, building landfills;
d. Monitoring of the programme implementation by means of electronic spatial information system;
e. Activities in the area of exposure assessment and health protection.

The Programme for Asbestos Abatement in Poland is published in English on website:
http://www.miir.gov.pl/media/15225/PROGRAM_ENG.pdf

Source: Polish Ministry of the Environment, 2016

Example 14: Swedish guidelines for resource and waste handling in construction and demolition

The guidelines for resource and waste handling in construction and demolition were originally published in 2007 by the Swedish Construction Federation. The latest updated version of the guidelines from year 2016 contains normative industry texts for the following processes:

- Pre-demolition audit, together with procurement;
- Lists of examples and guides for specific materials, commonly encountered at demolition, which should be specified in pre-demolition audit documentation;
- Re-use, waste sorting at source and waste management, together with procurement of contractors for demolition;
- Waste sorting at source and waste management, together with procurement of contractors for construction.

Source: Sveriges Byggindustrier, 2016, https://publikationer.sverigesbyggindustrier.se/Userfiles/Info/1094/160313_Guidelines.pdf *in English and Swedish*

12. Best practice examples

12.1. Waste logistics

Example 1: Tracimat - a Belgian example of a C&D waste tracking

Tracimat[12] is a non-profit, independent demolition management organization recognized by the Belgian public authorities that issue a "certificate of selective demolition" for a specific C&D material that has been collected selectively at the demolition site and subsequently gone through a tracing system. The demolition certificate shows the processor whether the C&D material can be accepted as "low environmental risk material" which means that the purchaser (recycling plant) can be quite sure that the C&D material meets the quality standards for processing at the recycling plant. Therefore the “low environmental risk material” can be processed separately from ”the high environmental risk material”. Because of the unknown origin and/or the unknown quality the “high environmental risk material” must be controlled more stringently than the “low environmental risk material” so the processing will be more expensive. All this will boost trust in the demolishing contractors and the recycled product, resulting in improved and more widespread marketing of recycled C&D materials. In the future, other demolition waste management organizations could be recognized by the relevant public authorities.

Tracimat does not issue a certificate of selective demolition until the waste has gone through the traceability system. The tracing process starts with the preparation of a demolition inventory and waste management plan prepared by an expert prior to the selective demolition and dismantling work. To guarantee the quality of the demolition inventory and waste management plan, they must be prepared according to a specific procedure. Tracimat will check the quality of the demolition inventory and waste management plan and issue a declaration on its conformity. Tracimat checks whether both the hazardous waste and the non-hazardous waste that complicates the recycling of the specific demolition C&D material, have been selectively and properly disposed of. Tracimat initially focused on the stony fraction, which in terms of weight by far represents the greatest portion of the construction and demolition waste and will deal with other C&D materials at a later stage.

The 'eenheidsreglement' is a certification regulation for recycled aggregates that consist of an internal control and an external control by an accredited certification organisation. 'Clean input gives clean output' is the general motto of this policy. It also explains the distinction between streams with a Low Environmental Risk Profile (LERP) and streams with a High Environmental Risk Profile (HERP). In fact the Tracimat-system is one way for the crusher to accept debris as LERP, beside other possibilities. So the 'eenheidsreglement' stands on its own and is a management system and certification regulation for recycled aggregates. Tracimat is a type of tracing system for debris derived from selective demolition.

[12] This project has received funding from the European Union’s Horizon 2020 research and innovation programme, https://ec.europa.eu/programmes/horizon2020/, under grant agreement No 642085

Source: Flemish Construction Confederation, 2016, http://hiserproject.eu/index.php/news/80-news/116-tracimat-tracing-construction-and-demolition-waste-materials *in English*

Example 2: Ivestigo – a French Electronic Traceability System

Ivestigo is traceability software for C&D waste. Launched by the French Demolition Association (SNED), this online platform aims to ease traceability work and respect the French wastes regulations for companies. More specifically, a user can create, edit and print waste tracking forms for all C&D waste (inert, non-hazardous, hazardous and asbestos), and keep a waste register for each demolition works according to French regulations. A dashboard and several indicators allow companies to follow thoroughly the wastes they produce and improve communication with clients. Finally, Ivestigo is free of charge for the French Demolition Association's members.

Source: Ivestigo, 2016, http://www.ivestigo.fr/ *in French*

12.2. Waste processing and treatment

Example 3: Re-use of construction materials in a temporary construction site - example of the London 2012 Olympic Park

The Olympic Delivery Authority (ODA) set demanding sustainability targets for the Olympic Park demolition, including an overall target of at least 90% by weight of demolition material to be re-used or recycled. The ODA's overall target was exceeded by 8.5%, with less than 7,000 tonnes landfilled. The key lessons learned from this project include:

1) Undertake a pre-demolition audit and include a reclamation survey.
2) Use this data, and consultations with reclamation specialists, to set headline targets for re-use and reclamation for key materials before issuing tenders, ideally linked to carbon targets.
3) Include clear reclamation and re-use targets as separate and additional to the overall recycling target and state them clearly in the tendering process and in contracts. Make explicit the responsibility for demolition.
4) Incentivise use of specialist contractors and achieving of re-use targets.
5) Require the project to measure the total carbon impact of the demolition process and the new construction on the site.
6) Require re-use to be entered into a materials database and included in Site Waste Management Plans.
7) Design team workshops and communication with other local regeneration projects are recommended; regular site visits are vital.
8) Include use of site-won re-used materials in the design and construction contracts for the new build.
9) Sufficient storage space is vital to enable re-use of construction products.

Source: BioRegional, 2011, https://www.bioregional.com/reuse-and-recycling-on-the-london-2012-olympic-park/ *in English*

Example 4: OPALIS - online inventory of the professional sector in salvaged building materials around Brussels

The OPALIS project is website that builds a bridge between second-hand dealers and commissioning agents such architects, and building contractors by providing an online inventory of the professional sector in salvaged building materials, and in so doing increasing the potential, both in terms of collecting salvaged materials and in offering these materials for sale.

The site contains detailed information and photos from all dealers within a one-hour drive radius around Brussels (but also provides some names of companies in France and the Netherlands), as well as information about different types of materials. Given the local nature of the project, the website is bilingual in French and Dutch.

Source: Opalis, 2016, http://www.opalis.be/ *in French and Dutch*

12.3. Quality management and assurance

Example 5: Dutch certification scheme for demolition processes (BRL SVMS-007)

The BRL SVMS-007 is a voluntary (not legally binding) instrument to encourage a quality demolition process.
Customers who prescribe to this certification scheme of procurement and tendering are assured of environmental and safe demolition on site. The scheme is controlled by third parties and the Council of Accreditation. The certified demolition process follows four steps:

- **Step 1 Pre-demolition audit**: The demolition contractor carries out an advanced inspection of the demolition project and an inventory of the materials (hazardous and non-hazardous) to get insight into the nature, quantity and any contamination of the extracted demolition materials. An inventory is made of the risks to occupational safety and safety risks to the surroundings.
- **Step 2 Waste management plan**: A waste management plan is drawn up that includes a description of the method of selective demolition and environmentally-friendly demolition, processing and removal of released material flows, safety measures that have to be taken and implementation requirements of the customer.
- **Step 3 Execution**: The execution of the demolition occurs in accordance with the waste management plan. Experts in the area of safety and environmentally-friendly demolition are involved and certified demolition contractors work with approved equipment. The demolition contractor must ensure that the demolition location is safe and well organised and that the released material flows do not contaminate the soil and the surroundings.
- **Step 4 Final report**: The delivery of the project takes place in consultation with the involved parties. A final report of the released demolition materials is drawn up by the demolition contractor, and it is supplied to the customer upon request.

Source: BRL SVMS-007, 2016, www.veiligslopen.nl/en/home *in English and Dutch*

Example 6: Standards for recycled wood

Since more than 15 years, manufacturers apply industry standards for the use of recycled wood for the production of wood-based panels. A first EPF standard aims at ensuring that wood-based panels are as safe as toys and are environmentally friendly. It is based on European standards on safety of toys that lay down limit values for the presence of potential contaminants. The second EPF industry standard describes the conditions under which recycled wood can be accepted for the manufacturing of wood-based panels. This standard comprises general requirements on quality and chemical contamination, classes of unacceptable materials (e.g. wood treated with PCP) as well as reference methods for sampling and testing.

Source: European Panel Federation (EPF), 2016, www.europanels.org *in English*

Example 7: QUALIRECYCLE BTP, a French audit tool designed for C&D waste management companies

The voluntary French Management and Audit Scheme, QUALIRECYCLE BTP, is a management scheme developed by Syndicat des Recycleurs du BTP (SR BTP) for waste management companies to evaluate, report and improve their performance in the compliance, environment and safety fields and show their commitment to recovering issues.

The framework of the scheme contains 5 sections with mandatory and recommended parameters to assess the level of:
- Governance and transparency
- Regulatory compliance
- Monitoring of the environmental effects of the activity
- Safety of people and work conditions
- Performance in terms of sorting and recovering rates.

The label is delivered by the follow-up committee of the Syndicat des Recycleurs du BTP (professional organization linked to the French construction association), after a labelling audit carried out by an independent consultant.

Source: SR BTP, http://www.recycleurs-du-btp.fr/quali-recycle-btp/ *in French*

13. Glossary

Auditor means the expert or the team of experts (auditors team) performing the waste audit. It can be represented by the building owner or consultant (e.g. an architect or structure engineer) acting on behalf of the owner.

Authority means the national or regional administration responsible for granting the demolition or renovation permits and supervision of the demolition or renovation process.

Property owner means the owner of the building or infrastructure, the developer or the party stated by the national legislation as the original waste holder.

Deconstruction means removal of building elements from a demolition site in order to maximize their recovery and reuse.

Hazardous waste is a waste that due to its (intrinsic) chemical -or other- properties poses a risk to the environment and/or human health. Wastes listed as hazardous in the European List of Waste are marked with and asterisk in the List of Waste.

Recovery means any activity carried out for the purposes of reclaiming, recycling or reusing the waste.

Recycling means a process where materials are collected, processed and re-manufactured into new products or use as a raw material substitute.

Reuse means using materials or building elements on more than one occasion, either for the same or for a different purpose, without the need for reprocessing.

Selective demolition means removal of materials from a demolition site in a pre-defined sequence in order to maximize recovery and recycling performance.

Waste means any substance or object that the holder discards or is required to be discarded[13] with the following exceptions: (a) uncontaminated soil and other naturally occurring material excavated in the course of construction activities where it is guaranteed that the material will be used for the purposes of construction in its natural state on the site from which it was excavated and (b) waste waters (such as trade effluent disposed of via tankers, foul sewers, surface water drains, water courses, etc.). Object is here the complete element or its part removed from the building or infrastructure during the demolition, deconstruction or renovation process, substance means the waste material that can be classified according to the European Waste Catalogue.

Waste audit means assessment of construction and demolition waste streams prior to demolition or renovation of buildings and infrastructures. It assesses both qualitatively and quantitatively the waste that will be produced from a building to be demolished or refurbished. In addition to the inventory, the waste audit may include recommendations for specific management options for these waste materials, depending on different issues (such as legislation, economics or availability of treatment infrastructure). It is important that the term 'waste audit' be considered in the broad sense of the word, and include at least every initiative that results in a documented work.
For the purpose of this document, a waste audit should be considered as a qualitative and quantitative assessment of waste that will be produced from the construction, demolition/deconstruction or refurbishment activities including residual waste that is not part of the building. An important part of the waste audit is also the identification and removal of materials/components containing hazardous substances.

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13 Directive 2008/98/EC on waste and repealing certain Directives

Waste holder means the waste producer or the natural or legal person who is in possession of the waste[1]. The waste holder is the owner of the building or infrastructure, if not specified otherwise in the national legislation or the demolition/renovation contract. It is the duty of the waste holder to gain knowledge about the objects and substances intended for to discard and about their hazardous nature and contamination.

Waste producer means anyone whose activities produce waste[1]. The waste producer is the person or legal entity that executes the demolition/renovation work.

Inventory means the list of waste types and quantities.

CHECK LIST

Identification and statistics

(key aspects are highlighted in grey)

Building information

Name, ID and contact details of the building / structure owner.	
Identification of the year of design / construction / refurbishment.	
Identification of the main refurbishment interventions, if any.	
Identification of the uses and activities carried on.	
Elements inventory, including types, quantities, location, text descriptions, drawings and photographs.	

Waste inventory

Present reliable data about types (inert; non-inert or hazardous) and quantities of waste (t, *m^3 or other units).*	
Exhaustive identification and quantification of hazardous materials and dangerous substances.	
Identification and quantification of contaminated materials.	
Use the European List of Waste to assure comparability of data across the EU.	
Include also materials due to operation and use of the property.	
Provide a clear and readable report, summarising quantities by waste type and stream.	

Demolition site boundary conditions

Identify sensitive areas around the demolition site (schools, hospitals, pedestrian areas, etc.).	
Identify accesses, surroundings and free spaces to plan the best strategy for waste management.	
Identify also near waste transfer stations, sorting and recycling services and waste management plants	

Auditor requisites

Educative background on building materials, constructive systems, demolition and hazardous substances.	
Providing specific training and experience.	
Professional liability is considered by means of specific insurances.	
Ethic issues (environmental and health and safety issues) are taken into account.	
Independent from building owner, contractors and demolition companies.	

Traceability and control

Add description of material, origin and quality to the European List of Waste codes.	
Guarantee efficient supervision by local authorities or by an independent third party.	
Certify that demolition waste is selectively collected and subsequently gone through a tracing system, thereby assuring the processing company of the quality of the recycled demolition waste	
Control traceability and deviations with the following 3 key documents: *(Pre-demolition) waste audit - On-site waste management report - Waste management final report*	

Implementation

Illegal landfilling is banned and violators are prosecuted.	
Administration includes the waste audits as mandatory requirement for the permits.	
Demolition works and documentation are periodically supervised by the administration.	
Green Public Procurement is regularly applied by the administration contracts.	
Administration promotes Waste Audits and disseminates Best and Worst Practices.	

European Commission
Directorate-General for Internal market, Industry,
Entrepreneurship and SMEs