

**Evaluation and Validation Workshop on Technical and Economic Study with regard to the Development of Specific Tools and/or Guidelines for Assessment of Construction and Demolition Waste Streams prior to Demolition or Renovation of Buildings and Infrastructures**

**Specific Contract**

**30-CE-0751644/00-00 –**

**SI2.720069**

**BACKGROUND DOCUMENT FOR THE  
EVALUATION AND VALIDATION WORKSHOP**

**9<sup>th</sup> December 2016**



# ***Evaluation and Validation Workshop***

***on Technical and Economic Study with regard to the Development of Specific Tools and/or Guidelines for Assessment of Construction and Demolition Waste Streams prior to Demolition or Renovation of Buildings and Infrastructures***

- **WHEN AND WHERE**

The workshop will be held on the **9th December 2016 from 10.00 till 14.30** at the **European Commission, DG GROW**, Avenue d'Auderghem 45, Belgium- 1040 Brussels.

- **TO WHOM IS ADDRESSED**

The target audience of the workshop is construction and demolition industry in general as well as property owners and authorities.

- **BACKGROUND**

Communication (COM (2014) 445 final) "on Resource Efficiency Opportunities in the Building Sector" stated the Commission's intention to encourage a more efficient use of the resources consumed by new or refurbished buildings. The Waste Framework Directive 2008/98/EC establishes a target of 70% of CDW to be recycled by 2020. In December 2015 The European Commission adopted the "Circular Economy Package", which includes revised legislative proposals on waste to encourage Europe's transition towards a circular economy. In this Circular Economy Package, Construction and Demolition Waste is identified as a key aspect. The present study is one of the 3 actions identified in the Circular Economy Package for the construction and demolition sector.

The main objectives of the study, that will be evaluated and validated during the workshop, are:

1. The assessment of the current regulatory, technical and economic conditions within the Member States,
2. Identification of key-factors which could drive the implementation of pre-demolition/renovation audits and assessment and definition of the conditions – upstream and downstream – for successful implementation of pre-demolition/renovation audits
3. To provide comprehensive and operational information and to draft methodological, technical and best-practice guidelines to be implemented by contractors and project sponsors in order to support national authorities for the actual achievement of the EU 2020 target for CDW recycling

## • KEY FINDINGS

The strategies adopted by European Countries to reduce non-recovered waste are uneven and success rates are unequal. For instance, when considering countries or regions with reported high recycling rates such as the Netherlands or the region of Flanders in Belgium, Denmark or Czech Republic, it seems that strategies around regulation are diverse; Flanders has a landfill ban for recyclable waste materials, whereas the Czech Republic is planning to introduce it by 2023. Onsite sorting based on the European classification (or similar), and a waste audit depending on size and type of building are compulsory in Flanders and Czech Republic, while in Denmark they are conducted as part of PCBs screening. In The Netherlands, however, these practices are not enforced, and their success may be linked to the scarcity of natural aggregates. On the other end, Italy and Spain can be found as examples of low recycling rates. The regulations and guidelines concerning waste audits were identified in many countries in the Resource Efficient Use of Mixed Wastes study by Deloitte<sup>1</sup>. While Spain is one of the countries (especially some regions as the Basque Country) with strong regulations for compulsory waste audits, Italy has very little regulation around CDW. In some cases, as in Spain, these practices are hardly implemented. Several reasons have been found in literature and during interviews, including, but not limited to: lack of control and monitoring or lack of management infrastructures.

### Legal and Regulatory aspects

- Within current legal framework throughout Europe, waste audits (if they exist) are generally developed together with (or as part of) the technical documentation of the corresponding demolition/renovation works.
- Due to differences in national regulations throughout Europe, the types of works for which an audit or inventory is prepared and the level of detail are varying. This depends on several factors as the volume of waste to be generated, building size, building type, age of the building, contract type or expected hazardous waste.
- Audits or inspections may be performed multiple times in some countries. One is usually organized by the owner in order to obtain the demolition permit and the following one may be performed by the contractor immediately before the demolition for instance to set the price. These assessments are rarely regulated and generally based on their internal rules and experience. The level of regulation of those audits is different in each country. For instance the so-called “Study of CDW management” in Spain is further developed in the “plan of CDW management” by the contractor that will execute the works once commissioned.
- Waste audits can serve as contractual documents, especially if they are part of the demolition/renovation project. For example the “second” audit in Spain can be considered contractual, as it is part of the contract between the owner and the demolition company.

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<sup>1</sup> Resource Efficient Use of Mixed Wastes  
[http://ec.europa.eu/environment/waste/studies/mixed\\_waste.htm](http://ec.europa.eu/environment/waste/studies/mixed_waste.htm)

- In some countries, waste audits for infrastructures follow the same regulations as for buildings (Czech Republic), but the recommended methodology (e.g. material sampling) may differ.
- Audits for refurbishment activities are a voluntary condition in some countries. However, if refurbishment works require a technical project and/or it involves demolition of building structures, it may be required to include a waste audit (Spain, Czech Republic).
- In the case of asbestos and other hazardous wastes, most European countries follow similar practices and legally force the drawing up of an asbestos inventory, including demolition and refurbishment works. (Italy represents an exception to this requirement).
- According to the interviews held, even asbestos inventories are not always available.

It has been observed that In many countries where waste audits are mandatory as France, Spain or Portugal the real implementation is very low. Main reasons identified for this seem to be:

- Lack of surveillance and monitoring from authorities.
- Not sufficient awareness of the owners (responsible to perform the waste audit set in regulations)

Even in the cases where audits are available, the contractor still prefers to perform their own internal audits (often due to lack of quality and no supervision on the quality)

**Which additional issues would you see as problematic for the implementation of waste audits? And why?**

#### Technical and methodological aspects

According to EDA's Industry Report 2015, 63% of waste assessment is done by the demolition contractor, as opposed to a 5% where no one does it. Several interviews claim that audits do not provide enough detail. Sometimes doubts arise regarding the training of the people performing the audits and in some cases on the reliability of the audits. Regarding dangerous substances, the main focus is on asbestos. However, legislation concerning PCBs and other hazardous wastes has been recently implemented in several countries. These aspects are by far the ones with higher consideration and control, but still there is the opinion in the sector that asbestos inventories should be more professional, regardless the estimated amount.

#### General remarks

- Most countries allow visual inspections complemented with either desk studies or computer applications.
- The testing and sampling requirements are mostly not defined in the legislation, however, methods to identify hazardous materials and contamination are usually recommended in guidelines (e.g. Czech Republic).

- It should be noted that the number of materials separated due to their dangerous nature is growing and the methods for the identification of contamination are better, which can result in a slight decrease of recyclable materials, but in a higher safety of the materials that are recovered.
- Inventories of hazardous substances (especially asbestos) indicate the presence of asbestos, but not always its location and amount. Also, there is an added obstacle in the hidden dangerous substances that usually lead to extra costs and in some cases to stop the works.
- The minimum content of these assessments generally include, identification (usually according to the classification based European List of Waste or European Waste Catalogue) and quantification (in weight and volume). This minimum content can be complemented with other aspects such as:
  - o Indications about the planned management.
  - o Information about the location in the building of the waste materials (for example in Flanders)
  - o Description of the way in which the waste materials will be separated (Spain, France, Czech Republic), collected, stored and/or transported
  - o A separate budget chapter associated to waste management (for example in Spain and France)

#### **Market Issues and economic dimension**

The European Commission is aware of divergences between statistical data and has established that “the existing measurement method to assess what is actually recycled should be clarified. Some Member States currently report waste collected as waste recycled despite the significant material loss between these phases” (EC Towards a circular economy. A zero waste programme for Europe., 2014). Therefore, the proposal for a new Waste Directive (WDF-proposal for a new WDF, COM/2015/0595 final – 2015/0275(COD)), establishes the formula to be used by the MS to calculate the rate of recycling and preparation for re-use. CDW reporting should be improved by this measure in the future.

In general it is relatively difficult to estimate the cost of the audit process itself, but it is considered to be below 5% of the whole demolition and treatment process activities. The influence of waste audits on the economy cannot be directly assessed, and several doubts have been raised about its economic benefits (especially when the contractor performs additional inspection after the official audit made by the owner or engineering company).

Segregation on site is in most cases economy driven, especially if there is a market demand on the recycled products (as in Belgium) or if lower fees are applied. Waste audits, if performed correctly, allow a quantitative justification for more selective demolitions and becomes a necessary step to

select the most adequate demolition and treatment alternatives from an economical point of view.

It has been observed that:

- Most industrial stakeholders consider that economic aspects should be carefully considered. In some countries (for example due to landfilling low taxes or cheap raw materials), the waste audits and onsite sorting does not pay off. Therefore the claim is to consider the whole CDW management process when considering drivers and barriers.
- It is a common claim that the cost of performing pre-demolition/renovation audits should be considered in the projects.
- There is an important concern on the higher costs associated in many occasions with errors during the preliminary audit, and special budget considerations to mitigate these effects are considered important, and in many countries a % of the budget is estimated for these errors

**Have you faced these situations? Can you identify other relevant issues?**

### **Human and cultural aspects**

In each country and region, there are different information and awareness raising activities organized by public administration or by associations, generally devoted to professionals. Some consulted stakeholders consider that public awareness should also be enhanced, mainly in countries with low recycling rates. Many stakeholders considered that there is an important lack of information regarding waste audits, benefits, best practices,... An important concern was raised about the contractors and owners being almost completely unaware about the possibilities to reduce the waste production by re-selling the salvaged building parts. To some extent, this also applies to the different recycling options. During these interviews, it also came up that there is very little information exchange between the companies. Training of actors along the supply process is considered to be poor in some countries, but very little information regarding these aspects has been collected.

### **General remarks**

- It is a common claim that audits do not provide enough detail and are prepared by non-experts or non-independent professionals. This can lead in some cases to direct economic implications as for instance in the Basque Country (Spain) where the budget in these audits is used to establish a bail for issuing some work-permits.
- CDW inventories and audits are generally requested to be performed by skilled specialists in most countries. In general, there are no related training activities or accreditations to become a skilled specialist, except in some cases. In general authorized professionals (usually an architect) are allowed to prepare the assessments. In spite of their general

technical knowledge, this professional usually lacks specific training on demolition activities and processes, which often lowers the quality of the audit. In general there is an important lack of knowledge, especially between buildings and infrastructures owners of their obligations.

The contractors in general do not trust the results of waste audit performed by the owner or engineering company for the purpose of demolition/renovation permit and would rather prefer their own waste assessment. This is usually due to lack of quality and supervision on the waste audit. In order to avoid this lack of confidence the following measures have been proposed by several stakeholders:

- Training programs and accreditation schemes should be available for skilled specialists.
- Auditors should be independent.
- Law enforcement and monitoring measures should be further enhanced
- Quality assessment of waste audits, and clear responsibilities should be set.
- More homogeneous reporting of data is deemed important not only in the preliminary audit and offer stage, but also on the general CDW management process.

**Can you identify other relevant issues?**

- **NEEDS IDENTIFIED FOR WASTE AUDITS**

The objectives of the EU C&D waste protocol<sup>2</sup> are focused on the increased perceived quality/reliability of C&D waste management process and C&D recycled materials.

The needs for waste audits identified in the stock taking task are summarized in the following list:

**(1) Environmental and health protection**

- Prevention of hazardous materials circulation
- Health & safety improvements, on-site and during the future use (in the case of renovation)
- Reduction of noise and dust originating from the demolition or renovation process

**(2) Progress towards C&D waste targets**

- Decreased disposal of recyclable waste
- Improved source separation, collection and processing
- Increased prevention and recycling

**(3) Generation of reliable waste statistics**

- Improved waste identification
- Traceability of the waste streams

**(4) Increased environmental performance**

- Decreased raw materials and energy consumption
- Decreased embodied carbon and energy in materials and buildings
- Improved life cycle impact of the buildings

**(5) Demand for C&D recycled materials**

**(6) Increase of cooperation along the waste value chain**

- Appropriate waste transport
- Off-site sorting practices
- Organisation and transparency of waste operations

**(7) Economic performance**

- Setting up the levels of performance of the contractor
- Allocation of space and resources for on-site management
- Estimation of the value of the separated materials

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<sup>2</sup> EU Construction & Demolition Waste Management Protocol, Version 2, 30 November 2015



- **WASTE AUDIT GUIDELINE**

Waste audit of buildings and infrastructures before demolition or renovation forms a specific task within the project planning. It is needed to understand the types and amounts of objects and substances that will be deconstructed/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 off-site and the associated cost savings and energy recovery).

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 such needs to be managed in accordance with a specialized waste legislation. It should be performed before (and in order to secure) the demolition or renovation permit. Its findings support the decisions of the authorities to approve the planned work and should be revised in the light of final results of the construction, demolition or refurbishment process.

#### **Participants of the waste audit**

A general scheme of the waste management process showing actors involved and relations between stages and responsibilities is depicted in Figure 1 and the following list:

- **Property owner** is responsible of the identification and classification of waste as well as preliminary planning of handling of it;
- **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 and their recommendations followed;
- **Auditor** is an expert or the team of experts (auditors team) responsible to perform the waste audit. The auditor needs to be a qualified expert with appropriate knowledge about building materials (including hazardous materials), building techniques and building history. A qualified should also know about demolition techniques, waste treatment and processing as well as with (local) markets;
- **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;
- **Waste manager** is responsible that the waste received from the waste holder or producer will be managed and/or disposed adequately. The waste manager should also contribute to the traceability aspects of waste;
- **Products manufacturer** may contribute to the waste audit providing solutions and/or requirements for the reused/recycled materials and components.

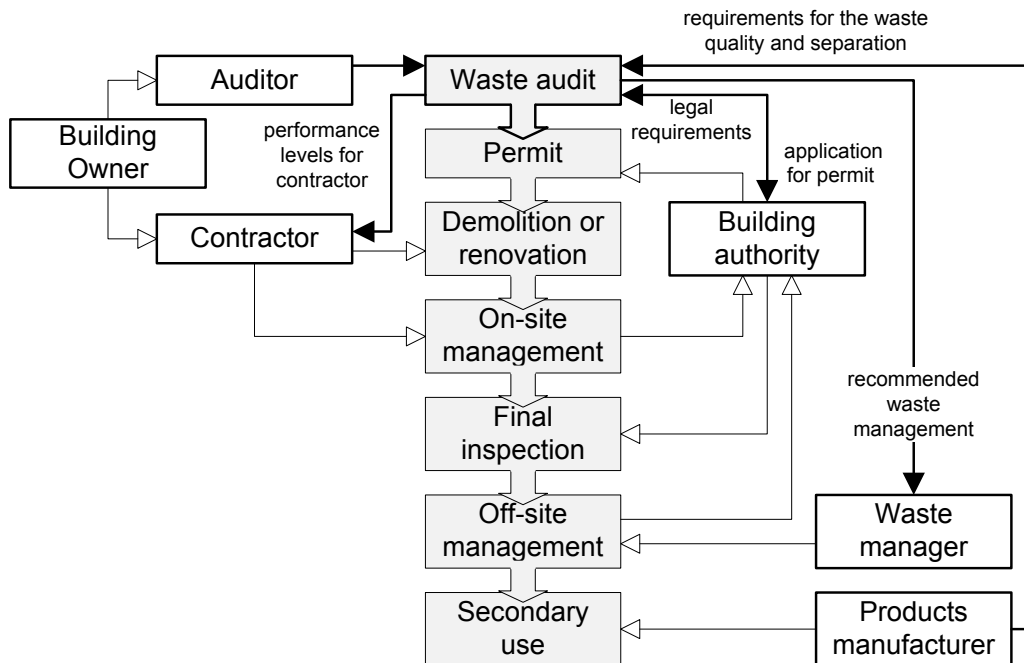


Figure 1 The role of waste audit participants in the waste management process

### Waste audit

The auditing process aims to deliver such documents that the owner can submit a demolition or renovation permit application and open a call for tenders. Furthermore, the outcome of the audit should also provide reliable estimates to contrast with the results from waste management report. An effective process for carrying out a waste audit should follow the steps depicted in Figure 2.

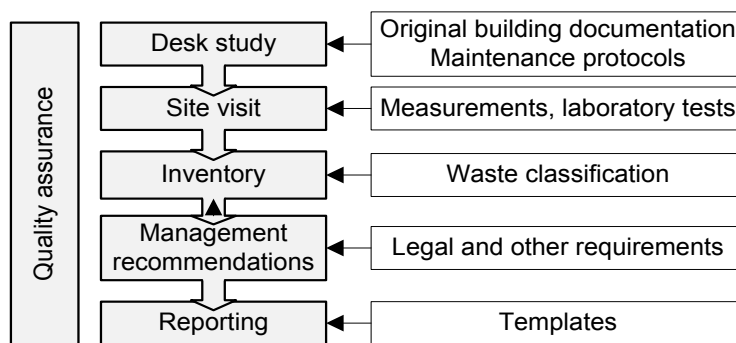


Figure 2 Example of the waste audit process

Inventory and waste management recommendations are typically generated from the desk study and site visit.

### Inventory of materials and elements

It is the duty of the waste holder to have knowledge about the objects and substances he intends to discard and about their hazardous nature and contamination. The inventory of the materials

and building elements is therefore the basic output of the waste audit organized 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 site visit.

Materials assessment aims to present reliable data about types and amounts of the demolition waste. It is based on desk study, site visit and any additional activities aiming to ensure the quality of data. The demolition waste is produced through deconstruction and demolition activities and it may include also 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. Concerning buildings, it is advisable to perform the materials assessment for each floor.

Materials assessment should be including at least:

- **Type of material** to be classified as inert waste, non-inert, non-hazardous waste or hazardous waste. The material should be then classified according to the European list of wastes;
- **Quantification** in tonnes and/or in cubic meters.

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

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

### **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:

- **Recommended waste diversion** of each of the waste streams identified (reuse, recycling, backfilling, energy recovery and elimination) and estimation of the diversion rates . Different alternatives can be provided if there are some that represent similar advantages;
- **Recommended on-site sorting activities** that may include the description of the installation requirements for storage, handling, separation and for any other operation to manage the different sources of materials;
- **Valorisation** of the materials and deconstructed building elements assessed in the previous phase;
- **Estimated cost of waste management process** can be extracted from previous information after consulting different waste management facilities.

- **Recommendations regarding possible precautions** to take during the deconstruction phase or the waste management phase must also be done.

### **Reporting**

The final report of the audit should be prepared by the auditor. It is advisable that a third party revises the report as stated in the quality assessment section. The report needs to include the information relative to the project itself, all the information collected in the previous sections and any information that can be useful for the owner, the contractor or any other stakeholder involved in the value chain of the project.

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

#### **Scope of the report** (mandatory)

Presentation of the project, 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 property
- Location of the site, including information about neighbourhood when relevant.
- History of major renovations and previous use(s)

#### **Summary of the waste audit** (mandatory)

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

- Waste fractions arising (in tonnes)
- Total waste arising (absolute in tonnes)
- Estimated waste recovery (in %)
- 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 when 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.

- Inventory of materials (mandatory) is recommended to compile according to the reporting levels outlined in the Construction Waste Measurement Protocol<sup>3</sup> with the following options:

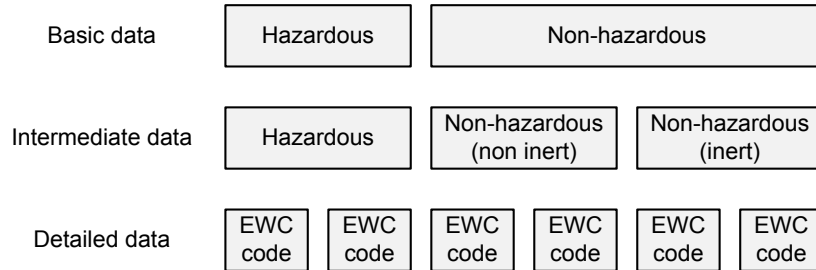


Figure 3 Levels of reporting of waste fractions

- Inventory of elements (optional) can follow the 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”)

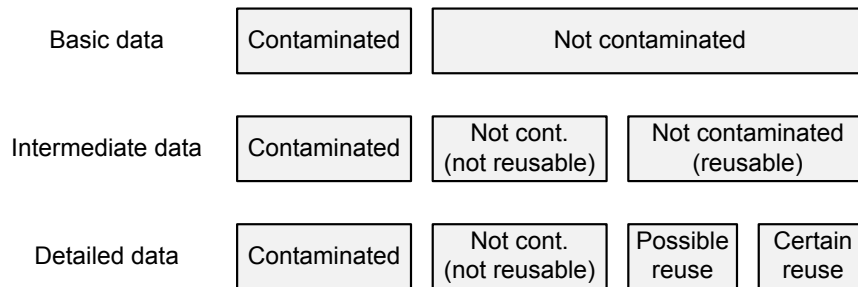


Figure 4 Levels of reporting of waste elements

If a more detailed assessment has been performed, a summary by level should also 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.
- Detailed description of the waste management planning, including any supporting material as allocated spaces marked in a site-plan.
- Assessment of the reachable recovery targets and disposal rates that can be filled using recommended template.
- List of local waste management facilities (if possible) specifying their services.
- Waste traceability process and when possible person(s) or organization(s) responsible to perform waste traceability until the final outlet.

<sup>3</sup> Chapter 2.0 of Construction Waste Measurement Protocol, ENCORD 2013

- 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

### **Quality Assessment of waste audits**

The quality assessment of the waste audit should be based in two main aspects

- **Auditor skills and certifications.** auditors should fulfil a minimum set of requirements:
  - Skilled personnel. Auditors should show combine knowledge and experience. Experience provides an important background that can complement educative background and specific training.
  - Adequate educative background and specific training. Auditors should have knowledge on construction, constructive systems, standardization, materials and hazardous substances.
  - Independence. Auditors and waste audits should be an independent process, so that the results obtained can be used by all the stakeholders involved in the process.
- **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 combining an initial verification with further verifications in several stages.
  - Initial assessment during the waste audit.
  - Verification after sorting. The quantities assessed during the waste audit should be checked against materials obtained after sorting. Discrepancies found in the figures should be notified and justified.
  - Verification with the management process. After reception at waste management facilities, the final figures of materials received should be confronted with the data predicted on the waste audit. Any discrepancy found should be notified and justified.

- **BEST PRACTICES TO ADDRESS CRITICAL PARTS OF WASTE ASSESSMENT AND IMPLEMENTATION PROPOSALS**

The following key points have been identified as greatly affecting the efficiency of the performed waste audits:

- The required skills/knowledge of the auditor and its independency on the contractor (and the owner)
- Comparison of the real outputs from construction and renovation process to the audit
- Definition of responsibilities and compensations in case of strong deviations

The common practices identified to deal with the critical issues are listed below:

**(1) Increasing the quality of waste audits**

- Detailed guidance including templates for the waste reporting
- Certification, authorization and training of the auditors
- Penalty paid by the owner to the contractor for any unidentified dangerous waste defined in the contract
- Independent auditor requirement

**(2) Definition of the responsible waste manager (mostly the contractor)**

- The waste holder is responsible all the time and no transfer of responsibilities is used
- Responsibility is usually defined in the contract
- Contractor's liability is assumed automatically by law
- Transfer notes can be submitted electronically

**(3) Monitoring of the real amounts of wastes and their management**

- Contractors and other waste managers keep the records for possible inspections
- Recorded outputs and waste treatment have to be sent to the authorities
- Recorded outputs and waste treatment have to be sent to the waste holder
- Authorities compare the recorded outputs with the general recovery targets
- Authorities compare the recorded outputs with the audit and the differences must be justified
- Electronic reporting system

**(4) Encouraging the responsible behaviour of the waste managers**

- Certification and training of waste producers, collection and management facilities
- Mandatory reporting
- Deposit of money

**Can you identify other best practices?  
Would you recommend any other issue to enhance waste audit implementation?**

### **Suggestions for supportive actions and recommendations**

The implementation of the Waste Audit Guideline and the European Demolition Protocol should be enhanced considering the different aspects studied in the key finding section.

#### **Legal and regulatory framework**

- It is recommended that Waste Framework Directive is complemented with specific regulation at European level. This regulation should establish at least, clear responsibilities along Europe defining actors, ownership, responsibilities and liability issues, as well as major types of waste fractions to be considered.
- According to European Demolition Protocol *“public authorities should decide upon the threshold for pre-demolition audits (highly variable at the moment along the EU)”*.
- In order to take into account the different realities of Member States, it is considered that recovery targets should be evaluated as improvement ratios instead of absolute figures.
- Establish the framework for surveillance and monitoring procedures to be followed in the whole European Union.

#### **Technical and methodological aspects**

- It is recommended that minimum content of the audit and minimum requirements for the auditor are aligned with European regulations. This minimum set of criteria should be periodically revised to update to EU situation.
- Promote the use of common templates for the reporting to help data interchange and comparison.
- Promote quality control activities of waste audits performance and results.
- Ensure that auditors have proper skills and training.
- Promote electronic document interchange.
- Include waste audits as part of contractual documentation and permit applications.

#### **Market issues and economic dimension**

- Continue the work already in progress to harmonize data reporting of countries.
- Promote higher added value solutions, with different instruments including mechanisms to introduce reused and recycled materials in the market.
- Promote the quality assurance of recycled material. Studies to ascertain performance of these materials, minimum requirements and requisites are recommended to be financed.
- Potentiate the market of recyclable materials. A common market framework is recommended to be established.
- Potentiate the reduction of landfilling, stablishing ways to ascertain that waste value chain is followed. Each member state should also consider the taxes applied and combine it with materials market.
- Potentiate the creation of offsite sorting facilities in the vicinity of highly populated areas with difficult access and lack of space. The cost of these offsite sorting operations could be included in the budget.



### Human and cultural aspects

- Perform information campaigns focused on the different actors in the value chain, so that they know their responsibilities and rights
- Make actors aware of the benefits of waste audits to obtain higher quality materials, even if sorting operations are more complex to obtain the general recycling rate.
- Promote public campaigns, so that society also requires waste audits to be performed.

#### **Should other options be considered?**

**For example:** Builders and firms performing refurbishment activities could have some responsibility in audits.

Could builders or builder associations be involved in the waste management process for example paying for the performance of waste audits or in the training of waste auditors?

Producer's responsibility concept should be established?

Taxes could depend not only on size of the building, amounts of materials, complexity of systems,... but also on the documentation provided, that will in turn reduce the extent of waste audit.