Background paper

Iron and Steel Scrap
1. Introduction

According to Article 6 (1) and (2) of the new Waste Framework Directive 2008/98/EC certain specified waste shall cease to be waste when it has undergone a recovery operation and complies with specific criteria to be developed in line with certain legal conditions, in particular when there is an existing market or demand for the material and the use is lawful and will not lead to overall environmental or human health impacts. Such criteria should be set for specific materials by Commission decision. This mechanism was introduced in order to support recycling markets by creating legal certainty and an equal level playing field and removing unnecessary administrative burden.

A methodology guideline to develop end-of-waste criteria has been elaborated by the Joint Research Centre (JRC) and is documented in Chapter 1 of the JRC "End-of-Waste Criteria" report¹. The European Commission is now working to prepare proposals for end-of-waste criteria for specific waste streams according to the legal conditions and following the JRC methodology guidelines. As part of this work, the JRC-IPTS (Institute for Prospective Technological Studies) is conducting a study with the aim to prepare technical proposals for ferrous scrap. The study should include all the necessary information and as far as possible make technical proposals of end-of-waste for ferrous scrap in conformity with Article 6 of the WFD.

The technical proposals will be developed based on the contributions of technical experts from Member States and the stakeholders by means of a technical expert group. Individual experts may be asked to assist on a case by case basis. The technical experts are requested to make their contribution in the form of written inputs and through participation in an expert workshop organised by the JRC-IPTS. The JRC-IPTS submits background papers to the technical expert group in order to prepare the work of the experts group, to collect the necessary information from the experts and to have previously collected information peer-reviewed within the expert group. A final study report will be prepared by the JRC-IPTS based on the inputs and comments from the expert group.

1.1 Aim and Objective

The purpose of this first background paper on ferrous scrap, prepared by JRC-IPTS, is to present the key issues to be addressed by the technical expert group, and to identify the information that is needed in order to make technical proposals on end-of-waste criteria for ferrous scrap.

This paper has been written using and elaborating the results of the metal scrap case study which was carried out as part of the JRC work to develop the end-of-waste criteria methodology guidelines. The case study is included as Chapter 4 in the JRC "End-of-Waste Criteria" report.

The members of the expert group are requested to respond to this background paper by:

submitting their comments on all relevant aspects of the text (the information, analysis and conclusion it provides and the proposals it makes), and,

• answering when possible to the questions highlighted in boxes in the text, if not possible indicating to the JRC-IPTS as soon as possible who can supply the requested information, estimating by when it would be possible to obtain it.

Whenever possible, experts are asked to submit the required information in advance of the workshop on 3 July 2009. Additionally, any information received by the JRC-IPTS by 8 June 2009 will be used to prepare a further elaborated version of the background paper for the discussions at the 3 July workshop.

1. 2 Structure of the paper

The first part provides a comprehensive overview of ferrous scrap recycling. It analyses scrap sources, describes the scrap metal recycling processes depending on the source of the material, and identifies the main health and environmental issues. It includes also a description of the economic and market aspects, the industry structure, scrap type specifications used by industry, and related legislation and regulation.

The second part deals with the end-of-waste criteria as such. It identifies the reasons for developing the end-of-waste criteria for ferrous scrap, i.e. the advantages they offer compared to the current situation. It then analyses if and how the basic general conditions for the end-of-waste criteria can be fulfilled and finally proposes outlines of possible end-of-waste criteria.

Questions to the expert group are formulated at the end of various sections throughout the document. A summary of all the questions is provided in the Annex.
2. Analysis

The development of end-of-waste criteria has to consider the characteristics of waste streams, the structure of the industry, the economics, market situation and trade flows, the existing regulations and standards/specifications. The following sections look at these issues throughout the entire recycling chain of ferrous scrap.

2.1 Characteristics of ferrous scrap

The main ferrous scrap sources are those products for which metal is a main constituent namely, vehicles (including ships and aeroplanes), metal products for construction, machinery, electrical and electronic equipment, packaging. It was not possible, from the point of view of data and information as well as practical resources for this case study, to cover all the possible sources of ferrous metal scrap, and therefore, only the above mentioned main sources of scrap are discussed hereafter.

There is a different between carbon steel and stainless steel; the carbon steel differs from stainless steel by composition and treatment. Ferrous scrap (carbon scrap) is used for secondary production of steel in EAF and partly as well in BOF. Stainless steel scrap is used in order to produce new stainless steel in EAF.

2.1.1 Scrap sources

Scrap is first distinguished as new scrap or old scrap depending on when it becomes scrap in its life cycle. Scrap metal is further distinguished according its specific source.

2.1.2 New scrap

New scrap is generated during initial manufacturing processes. It is recycled onsite or sent directly to a steel works. The composition of new scrap is well known and in principle new scrap does not need any pre-treatment process before it is remelted, although cutting to size might be necessary.

In the Communication from the Commission "Interpretative Communication on waste and by-products" (COM (2007) 59 final), an example of a by-product is given as being "off-cuts and other similar materials". There it is stated:

‘... Use is certain, as part of an integral production process and without further processing other than being adapted to the appropriate size for being integrated into the final product. In more general terms, excess material from a primary production process, or material that is deficient only in a cosmetic way but that is materially similar to the primary product, such as rubber compound and vulcanisation mix, cork shavings and pieces, plastic scrap and similar material may be seen as by-products. For this to be the case they must be able to be reused directly either back in the primary production process or in other integrated productions where reuse is also certain. Materials of this type can also be considered to fall outside of the definition of waste.’

Following this theme, new scrap could be considered as by-product and not waste. Even new scrap with paint or coating (with the exception of cable which does need treatment prior to input into a furnace) does generally not need any waste related pre-treatment before sending
to the furnaces, since many furnaces can melt such new scrap directly and if required, decoating can be performed in a thermal process immediately prior to feeding to the melting furnace.

2. 1. 3 Old scrap

Old scrap is collected after a consumer cycle, either separately or mixed, and it is often contaminated to a certain degree, depending highly on its origin and collection systems. Since the life time of many metal products can be more than ten years and sometimes more than 50 years, for instance products for building and construction, there is an accumulation of metal in use since the beginning of the industry.

Since 2004, the EU25 has consumed in total around 100 million tonnes of iron and steel scrap each year, which equates to about 54% of the steel produced. Taking into account that exports of scrap total around 9-10 Mt and imports 7-8 Mt, the average net exports have been around 2 Mt per year. The main sources of iron and steel scrap are the construction and transportation sector, which together accounted for 42% of the total steel consumption in 2006. Mechanical engineering, tube and metal ware account for another 40% of the total and are also the main sources of old scrap. No detailed information and data are available regarding the sources of steel scrap in the Member States. Information collected in a study by Okopol shows that, construction, mechanical engineering and vehicles generated 34%, 27% and 21% respectively of the total scrap in 1997.

Stainless steel scrap as part of ferrous scrap should be included in this study; however, little data and information were gathered on stainless steel scrap and it is therefore not assessed here in detail. The stainless steel consumption according to the end use sector is shown in Figure 1. The stainless steel scrap data regarding production, consumption, export and import should be researched.

![Stainless Steel Consumption by End Use Sector](image)

**Figure 1. Stainless steel consumption by End Use Sector.**

Vehicles and transportation

Based on a study from International Copper Study Group (ICSG) in 2004, information on a stakeholder consultation carried out in 2005 and a study by Wuppertal Institute, around 8
million cars are being recycled annually in the EU. Using the 2000 average material composition of the European car fleet, it is estimated that if all steel is recycled, around 6 Mt of steel scrap are generated from cars, i.e. 6% of the 2005 steel scrap consumption. From all the ELVs, Veolia reported that total recovered ferrous scrap was 11 Mt in Europe, representing 11% of all scrap sources. (Note: this figure in comparison to that in 1997 Okopol study seems different, even taking into account other type of vehicles.)

Construction and building
Steel has been used as beams, reinforcement bars, and other structural parts in building and construction since its industrial production. Large amounts of steel scrap could be generated during the demolition of a building however the amount varies greatly from the type of building and its geographical location. On average, steel accounts for slightly less than 1% of the mass of a residential building. Almost all steel parts are recovered, with good quality beams for direct reuse and the rest for recycling in a steelworks. An estimate in the UK shows that some 90 000 tonnes of iron and steel were recovered from construction and demolition waste in 1998 in the UK.

Large equipment and machinery
This category covers the industrial and agricultural machinery and structure, such as earth-moving and quarrying equipment, cranes, farm vehicles and machinery, storage tanks, tools, etc. No detailed data are available.

Electronics and electrical equipment
As discussed previously, on average steel accounts for almost half of the content on a weight basis in electrical equipment and this would potentially generate some 4 Mt of steel scrap each year in Europe. However, without information on collection rates, it is difficult to estimate the actual amount of steel scrap from WEEE.

Packaging material
Steel packaging includes food cans, beverage cans, aerosols, etc. According to APEAL, over 2.3 Mt of steel packaging was recycled in 2005, which is about 2% of the total scrap recycled in the EU.

2.2 Management alternatives

Due to the value of metal scrap, it is recycled or reused whenever possible. The figure for iron and steel scrap is reported to be 29 Mt according to a study by the European Topic Centre on Waste and Material Flows (in this report it is estimated that out of nearly 112 Mt of scrap in 2000, 86.5 Mt was old scrap).

Furthermore, in some countries, when metal containing products can not be easily collected separately, for instance flexible metal packaging, the majority of them will be within mixed waste which may be incinerated for energy recovery, with the incineration slag processed for metal recovery. However, the chain of technologies which can recover metal from incinerated household waste is not installed throughout Europe and this, coupled with the issue of transfrontier shipment of waste, results in some potentially recyclable metal being lost.

2.3 Ferrous scrap metal recycling processes
In general, ferrous scrap recycling consists of collection, sorting, shredding and/or sizing, and final melting at the steel works. This process can be summarised as the following:

- Ferrous scrap metal is collected either separately or mixed and then sorted in the scrap yard and then sold to scrap treatment plants or sent directly to a steel works.
- Arriving at the scrap treatment plant, different types of metals are further separated and prepared for shredding/sizing. Shredding and sizing is often needed for a further stage of separation. While shredding and cutting, magnetic separation would single out the ferrous metal (carbon steel). If shredded scrap metal needs to be dried or to be further cleaned of possible contaminants such as oil, grease, lubricants, lacquers, rubber, and plastic laminates, this could be done at the scrap treatment plant but for thermal treatment, it is more energy efficient to perform this at the remelter and avoid double heating.
- At the steel works, iron and steel scrap are often charged directly to the furnaces.

The following origins of scrap metal are presented here in detail (BIR, EAA, ELDAN recycling, and Novelis are the main references). Although not all the origins of scrap are included here, it is believed that their treatment process resembles those that are described in Figure 2.

**End of life vehicles:**
Today in the EU when a passenger car (as main example for end of life vehicles) reaches its end of life, it is brought to a specific collection point, which in some cases could also be a generic scrap treatment plant. ELVs are treated (depolluted) according to a certain procedure guided by the ELV Directive, as shown in the diagram. ELVs are first decontaminated by removing various fluids and parts. The rest of the car, including the body, the interior, etc. is fed into a shredder. In the shredding process, magnetic separation is used to remove the magnetic ferrous fraction, leaving non-ferrous metals and non metallic materials to pass to further stages, i.e. dense media separation and eddy-current separator, for the segregation of one type from another. The separated ferrous part contains as much as 98% metal.

**Used beverage cans**
In most countries, used beverage cans (UBCs) are made both from steel and aluminium and they are collected by local authorities as part of the municipal solid waste, although increasingly, industry is involved in the collection of the UBCs. For example, in the UK, there are separate containers for UBCs deposit, as well as special collection points for bringing in UBCs which can be sold on a weight basis. At the collection point, steel cans and aluminium cans are separated for baling and then sent to refineries.

**Electronics and electrical equipment**
This waste stream covers a wide variety of end of life products mainly from households and offices. The WEEE Directive requires the responsibility of producers in recycling and waste prevention; however, users and local authorities play an essential role in waste collection and separation. The WEEE Directive also requires that hazardous components, such as batteries, printed circuit boards, liquid crystal displays, etc., are removed with proper technologies. This is done at different stages of the treatment process depending on the implementation of the Directive in Member States.

After this de-pollution step, WEEE consists chiefly of a mixture of metal, plastics and glass. From here, the treatment of WEEE in general has the following steps, though the process may vary with different combinations of: shredding, granulating (more than once), magnetic
separation, and eddy current separation (more than once), there is also the possibility of density separation on the separation table and/or hand separation (Figure 2).

![Figure 2. An example of WEEE treatment](image)

The stainless steel, Al and Cu fractions are separated from other ferrous metal and other non-ferrous metal during these processes and can be sent directly to the steel works or refineries. The preparation and treatment of different WEEE may have different requirements. For example a fridge needs to be treated in an enclosed environment to avoid the emissions of CFC gases.

**Scrap metal from construction and demolition**

Regulation and standards related to construction and demolition have been developed in the past years mostly in favour of selective demolition, which has been proven to be most effective for recycling various types of waste streams. For cost reasons, metal scrap is separated whenever possible along the dismantling process and is sold for direct reuse or to traders or treatment plants. Since by weight aluminium and steel have different prices, further separation is often performed on site. Steel elements inside concrete may first be sent to recycling centres for crushing and separation with magnets before being returned to the metal industry.

<table>
<thead>
<tr>
<th>Questions:</th>
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<tbody>
<tr>
<td>1.1 To what extent are pre-treatment processes applied in practice to remove the paint/coatings?</td>
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<tr>
<td>1.2 Where does pre-treatment take place (at the steel work site, at the mechanical treatment site, elsewhere)?</td>
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**2.3.1 Environmental and health aspects**

The environmental impact of waste management and the end-of-waste criteria should be evaluated from a life cycle point of view. Throughout the recycling chain, the key environmental impacts of scrap recycling occur at the steelworks. Scrap treatment, sorting, separating and baling, are mainly mechanical processes with dust as the main air emission, and thus have limited environmental impact. While some individual scrap sources should be examined in detail due to their specific characteristics (discussed later in the paper), the potential environmental issues in scrap management are summarised here along the recycling chain.

**Risks related to scrap transportation and storage**
Scrap metal in itself does not pose any risk to the environment, i.e. there are no environmental risks in transportation and storage of metal itself. However, if metals are contaminated with oil or mixed with other waste, this may be considered hazardous in relation to transportation or storage. For example, oil or any other liquid attached to scrap metal, when exposed to rain, may cause contamination to its surrounding environment. If scrap metal is collected together with other type of waste, the shipment of such mixed waste cannot be guaranteed free of risks either.

**Energy use and GHG emissions**

Treatment of ferrous scrap metal, mainly due to the shredding consumes electricity and therefore has indirect GHG emissions. The production of steel from scrap is integrated in the steelworks and thus the use of energy and emissions are not reported separately. However, energy use in the processing of ferrous scrap is much less in comparison to production of metal from ore which explains why scrap is so attractive to the metal industry. One ton of steel scrap saves one ton of CO₂ and 650 kg of iron ore (information source: EFR). In EU 27, 118 million tons of steel scrap saves 118 million tons of CO₂ and 77 million tons of iron ore per year.

**Other air emissions in scrap treatment**

Dust and air emissions from scrap treatment are generally at low level. For example, in 2004 AEA Technology carried out an analysis of shredder waste on behalf of the UK Government. The conclusions were that the levels of polychlorinated biphenyls (PCBs) in shredder waste were very low (1 mg/kg) and therefore the emission of other persistent organic compounds, minimal.

However, several hazardous air pollutants are possibly associated with the secondary metal production in a furnace, e.g. benzene, styrene, dioxins and furans, hydrogen chloride, hydrogen fluoride, and chlorine, metals, arsenic, lead, and chromium. These substances are usually controlled according to permits under the IPPC directive irrespective of whether the scrap is waste or not.

**Chemicals and waste in secondary process**

The melting of steel scrap mainly uses electric arc furnaces (EAF), and in this process slag and dust are generated. On average, 100-150 kg/t (liquid steel) of slag and 10-20 kg/t (liquid steel) of dust is generated. The major components of EAF slag are lime, silica, and oxidised metal elements. Dust may contain high levels of zinc, lead and cadmium, and that from stainless steel processes has additional chromium, nickel and molybdenum elements. In recent years, due to waste management regulations, the percentage of dust to landfill has been decreasing with majority of dust treated for recovery of its remaining metal content. Slag is used in steel making, or is assessed for its suitability for being used as aggregates in building and road construction.

**Radioactive metal scrap**

Scrap metal can contain sources of radiation with the associated environmental and health risks. Higher levels of radiation are possible and may stem from losses, accidents or inadvertent disposal of radioactive material. In order to minimize the risks, radioactivity needs to be measured systematically. The United Nations Economic Commission for Europe
UNECE has released recommendations to monitor and reduce the risks involving radioactivity in scrap metal. While these recommendations are not legally binding, they provide guidance based on existing best practice to all interested parties (scrap yards, metal smelters, customs, regulatory authorities and transporters, amongst others).

Questions:

2.1 Is there any evidence of higher or lower environmental and health impacts if certain processes of ferrous scrap recycling (e.g. decoating) are carried out outside the EU?

2.3.2 Economic and market aspects

In 2003, the total scrap metal trade (import + export) of the EU was 59 Mt, which is the largest regional market accounting for nearly 40% of the world total. Due to resource availability and energy savings, scrap metal is desired wherever technology permits.

In last few years, before the financial crisis, the demand for scrap rose worldwide. The collection rate of ferrous metals increased in all sectors in the EU. In the second half of 2008, with the onset of the global financial and economic crisis, falling output among many metal processing companies has resulted in low levels of demand for scrap; many consumers have announced plant closures, production curtailments or reductions of employee working hours. After a peak in summer 2008, the price of ferrous scrap decreased to half of the price in last year (Figure 3). However at the end of 2009 it was still comparable to the ferrous scrap prices in 2003. Prices have recuperated somewhat in early 2009.

![Figure 3. Prices of ferrous scrap from 2003 until 2008.](image)

Similar development occurred also with the stainless steel market. Stainless steel scrap prices decreased rapidly. The overview about stainless steel scrap prices for two kinds of stainless steel scrap are shown in Figure 4.
2. 4. Scrap and secondary material industry

2. 4. 1 Industry Structure

The ferrous scrap recycling industry consists of scrap collection and sorting, distribution, treatment and processing (Figure 5.). Along this recycling chain, scrap is cleaned to become secondary material for final metal products. In the steel industry, scrap processing is an integrated part of the primary steel production.

Figure 4. Stainless steel scrap prices from January 2008 until March 2009 for two kinds of scrap (304 and 316 from Roterdam), source http://www.recyclinginternational.com
Depending on the type of product and the country, the collection system can vary. Large sized and quantity end of life products, such as those from construction and demolition, are usually transported directly to the scrap yard or scrap treatment plants. Both ELVs and WEEE place the responsibility of recycling, hence scrap collection, on the producers. Small products such as packaging materials are collected by the local authorities, which means that in this case, collection is not in the hand of the scrap metal industry, though some industry initiatives are taken in the case of UBCs, e.g. collection centre, scrap terminals, where steel and aluminium cans are separated and baled for transportation to treatment plants or refineries.

Scrap trade within the EU as well as import and export to other countries has been established for decades. Within the EU it is difficult to estimate the total quantity of the scrap being shipped, though an internal steel scrap trade of 28,6 Mt is recorded in 2006, as illustrated in Figure 6. The export and import of steel scrap totalled (export + import) 16-19 Mt in the last few years.
The European steel recycling industry (at the treatment stage) is fairly concentrated, with seven companies providing some 40% of the total steel scrap delivered to the steelworks. According to BIR and EFR, there are around 220 shredders and 40 media separation plants in the EU25. Half of the scrap recycling companies is considered to be large and medium sized handling over at least 30 000 tonnes of scrap per month.

2.4.2 Specifications and standards

Currently, specifications and standard classifications for ferrous metal scrap exist at all levels, international, European, national, as well as between individual parties. It is clear that for the reason of marketing and trading, standards and specifications are needed not only to set the price but also used as reference for classification and controlling of the quality. In many cases based on the production need, ferrous scrap is processed according to the bilateral specifications agreed upon between the scrap processor and smelters.

Traded scrap metal is basically classified according to several properties, most notably:

- Chemical composition of metals
- Level of impurity elements
- Physical size and shape
- Homogeneity, i.e. the variation within the given specification

European Steel Scrap Specification
EFR and EUROFER developed the European Steel Scrap Specification. The Specification covers the requirements from the safety perspective, the excluded elements for all grades from a cleanliness point of view, and the tolerance for residual and other metallic elements. It also provides a detailed description of these specifications by category, which corresponds to the type of scrap.
ISRI specifications
Developed by the Institute of Scrap Recycling Industries (ISRI), this American standard provides the norms for classification of ferrous and non ferrous scrap metal and is used internationally.

National standard classification
Some countries have their own classifications for steel developed by the national industry associations, for example, the UK, Spain, Belgium, France, and Germany.

Bilateral contract/specification
As already mentioned, there are also specifications made as agreements or contracts in trade between two parties. Such a specification is usually based on a standard classification with additional requirements suitable for the desired production process or product. In this case, the specifications are being continuously reviewed and if necessary modified.

European Stainless Steel Scrap Specification
EUROFER is preparing a specification for stainless steel.

2. 4. 3 Legislation and regulation

In the EU the management of waste scrap metal is currently under the waste regulations, e.g. the Waste Framework Directive and EU Waste Shipment Regulation. Scrap treatment plants (shredders, dismantlers, media separation plants) are operated under a permit for waste treatment, although the details of their permits vary among member states.

The production of secondary metal at steel work and the associated treatment of scrap metal on site are subject to the IPPC Directive. The current discussion on the possible extension of the scope of the IPPC Directive in relation to waste treatment activities has suggested the inclusion of separate installations for scrap metal treatment.

The shipment of metal needs to fulfil requirements based on the Waste Shipment Regulation, which was revised and entered into force July 2007. Most types of scrap metal belong to the list B of Annex V, covering wastes which are not covered by Article 1(1)(a) of the Basel Convention, and therefore not covered by the export prohibition, when transportation and shipment (to non-OECD countries) is concerned. The EU has sought responses from non-OECD countries detailing those wastes they would accept and under what conditions. Where there is no reply, the EU imposes additional notification requirements. There is some evidence that this is reducing the willingness of some overseas customers to trade with EU suppliers.

Certain metal containing waste streams are regulated under specific directives, such as the WEEE, ELV and Packaging Directives. In these directives, the following elements regarding the treatment and process of the two types of waste are described and they ensure proper handling of the waste stream:

- separate collection
- permits for waste treatment operations
- compliance with minimum standards for recycling and treatment of WEEE
- minimum technical requirements for the treatment of ELVs
2. 4. 4 REACH

When metal scrap ceases to be waste, it will be subject to REACH. However, recycling of metal scrap is considered as a form of recovery, thus under the three conditions stated here below, it is exempted from registration, according to Guidance on registration, June, 2007, published by European Chemicals Agency (page 33-34):

"(1) The recovered substance must have been registered. This means that if, for some reason, the substance has not been registered at manufacturing or import stage the recovered substance has to be registered following the recovery operation before being put to a new use. On the other hand, the person who performs the recovery should check whether an exemption applies to the recovered substance. If an exemption applies which frees the recovered substance from the registration obligation, then that exemption can of course be invoked.

(2) The substance already registered must be the same, i.e. have the same chemical identity and properties, as the substance being recovered. For example, if the substance itself was modified in the recovery then the recovered substance has to be registered.

(3) The legal entity who did the recovery must ensure that information on the registered substance is available to it, and that information must comply with the rules on information provision in the supply chain. This means that the person who did the recovery must have obtained one of the following: (i) a safety data sheet, as required by Article 31 (1) or (3), on the registered substance, (ii) other information sufficient to enable users to take protection measures, as required by Article 31 (4), for the registered substance, or (iii) an information package comprising the status of the registered substance under the authorisation part of REACH, any applicable restrictions under REACH, other information necessary to allow appropriate risk management measures and the registration number, as required by Article 32 (1)."

Under REACH, pure metal is considered as a substance and is required to be registered. Metallic alloys are considered as special preparations. It is clearly stated in the REACH legislation that Safety data sheets (SDS) are required for certain special substances and preparations (e.g. metals in massive form, alloys, compressed gases, etc.) listed in chapters 8 and 9 of Annex VI to Directive 67/548/EEC.

It is clear that the chemical and physical characteristics of the metal components (pure or alloyed) do not change during the phases of use and recycle. It can also be expected that all the individual metals are registered when manufactured. However, during the recycling process the following changes occur that are considered relevant to REACH:

First, collection and sorting of metal scrap may separate different metals but could result in mixture of different alloys. Based on the understanding of REACH, mixed metal alloys could be seen as preparations consisting of several different metals, which should be already registered by the primary producers.

Second, mechanical separation of metal containing products results in ferrous and different non-ferrous fractions with high purity, but it is impossible to reach 100% purity free of alien elements. These alien elements often are stone, plastics, pieces of rubber, sand, etc., of which the composition and total amount are difficult to be precise. In this case, it is likely that they...
are considered as impurity under REACH. REACH requires the register to characterise the impurity in term of composition and estimated quantity.

There is still some need for legal clarification of the issues regarding metal scrap under REACH. However, it appears that the cost of complying with REACH when end-of-waste status is obtained will not be excessive. This is possible by meeting the conditions of Article 2(7)(d) so that the recovered substances will be exempted from title II (Registration) and VI (Evaluation) of the REACH Regulation. This would imply that the recyclers do not have to register a recycled substance (because the same substance will have been registered already before). However, to benefit from this exemption, the recyclers must ensure that they have access to safety data sheets for the substances used as inputs to the recovery process. Access to safety data for the input substances will also facilitate the task of preparing and providing safety data sheets for the recovered substances downstream.

2. 4. 5 Waste Shipment Regulation

On 12 July 2007, the new Waste Shipment Regulation EC 1013/2006 came into force. Accordingly, most metal scrap is under the list B of the Part 1 of the Annex V, "which are not covered by Article 1(1) (a) of the Basel Convention, and therefore not covered by the export prohibition", and is also referred to as the "green list" (it should be noted here that many countries have not confirmed the green list).

Export of waste under the "green list" within the OECD countries is not subject to notification and consent procedure and is done under normal commercial transactions; however, the new Waste Regulation does require the completion of an Annex VII form.

For “green list” exports to non OECD countries, the Regulations require the Commission to obtain a new declaration from the receiving country as to whether it will accept each kind of waste; it may also require pre-notification.

The end-of-waste will affect metal scrap that has fulfilled the criteria and become product/secondary material. In the list B, the possibly affected ones are some metal scrap under B1010 (ferrous and aluminium) GC010 (electronic assemblies consisting of only metals or alloys) and GC020 (Electronic Scrap e.g. printed circuit boards, electronic components, wire etc.) and reclaimed electronic components suitable for base and precious metal recovery). Most of the responding countries have B1010 as green list without the need of control. However, so far large number of non-OECD countries failed to respond, and where no reply is received, the Red list is assumed. This has resulted in high number under the Red list in the case of ferrous scrap (Table 1).

Table 1. Summary of countries' response

<table>
<thead>
<tr>
<th>Number of countries in respond</th>
<th>B1010 Iron or steel scrap*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green list</td>
<td>18</td>
</tr>
<tr>
<td>Ban</td>
<td>1</td>
</tr>
<tr>
<td>Red List (incl. no reply)</td>
<td>42</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
</tr>
</tbody>
</table>

*: Only including countries with iron and steel works.
When scrap is traded under Red list, exporters of scrap metals to non-OECD countries are required to pre-notify, which requires administration and payment of a fee; and shipments are delayed whilst this is completed.

Questions:

3.1 Please provide evidence on how the waste status of ferrous scrap affects the exportability of the material in practice. Please provide information for each scrap category included in the European Steel Scrap Specification.

3.2 What could the effect on scrap demand and prices be if the Waste Shipment Regulation did not apply anymore as a consequence of introducing end-of-waste criteria?
3. End-of-waste criteria

3.1 Rationale for end-of-waste criteria

The end-of-waste criteria should be such that the recycled material has waste status if – and only if – regulatory controls under waste legislation are needed to protect the environment and human health; otherwise the material should have end-of-waste status to facilitate recycling and recovery. The criteria must be developed in compliance with the legal conditions, be operational, not lead to new disproportionate burdens and consider that ferrous scrap recycling is a well-functioning industrial practice today.

The following main types of benefits can be expected when EU-wide end-of-waste criteria for ferrous scrap are introduced:

- Improved functioning of the internal market (simplified and harmonised rules across countries)
- Clearer differentiation between high quality scrap and low quality scrap. Only high quality scrap will cease to be waste.
- Reduction of administrative burdens related to shipment and transport

The current ‘waste’ status of fully-processed, furnace-ready metal scrap creates a variety of administrative and economic burdens, especially related to shipment and transport of metal scrap.

The total involved costs related to international shipment are difficult to estimate however the British Metals Recycling Association gave practical examples of possible complications due to the 'waste' status of scrap metal:

- Requirement to obtain certain information from overseas (non-EU) reprocessors to satisfy ‘broad equivalence’ obligations set out in the Packaging Directive, WEEE Directive and Waste Shipments Regulation. With ‘end-of-waste’ status, it would be possible to produce the necessary evidence based on fully processed metal leaving the site, rather than having to track the material through the docks and across the world. 

  According to one large UK metal recycling company the costs in 2007 associated with obtaining this information from around 200 facilities was £100,000. This figure includes administrative and translation (of supporting documents/licences) costs.

- Notification and insurance costs on financial guarantees for waste shipments sent to countries where pre-notification is required (including certain ‘green list’ shipments) under the Waste Shipments Regulations

  For certain countries (including some EU accession states) pre-notification of ‘green list’ recycled metal is required. In the UK, the cost of a single notifiable ship is high plus insurance premiums on a financial guarantee (typically several thousand pounds)

- Administration costs for maintaining Annex VII Waste Shipments Regulation tracking forms and domestic waste movement forms

  In addition to the direct administration costs associated with form filling, there is the requirement for commercially sensitive data - which is inappropriate to a well established trading market in secondary raw material for which there is sustained demand. The British Metals Steel Association received evidence that: Companies have
lost customers due to this requirement. Customers outside the EU jurisdiction are not willing to have their commercial transactions recorded and made available to public authorities. Therefore they turn to non-EU suppliers, such as exporters from the US, Russia or Japan.

There is also at least one example where this Annex VII data was inadvertently released from a public data base, compromising commercial relationships.

- Loss of business where customers fail to provide appropriate information
  
  The Waste Shipment Regulations require that non OECD countries must reply to the Commission’s ‘note verbale’, indicating which ‘wastes’ they are prepared to accept. If they do not reply (and very many do not – or give a false reply for metal scrap, since they do not consider it to be ‘waste’), then notification controls apply. In these circumstances, either:
  
  The business incurs the additional costs of notification or since notification documentation from the receiving country is difficult and time-consuming to obtain, and in the meantime the buyer may turn to a non-EU supplier, the exporter often has to turn away from such markets, losing the trade.

All waste, including scrap metal, is required to use only transport companies which hold waste carrier licences. In some cases, because of the lack of proper law application, the transport is also performed by non licensed companies. The change status of metal scrap from waste to non-waste should help to facilitate the proper interpretation of law and in aim to simplify the system of transport and to avoid illegal activities.

Questions:

4. 1. Please describe which permits, licences and administration paperwork are required in practice for handling metal scrap as waste (e.g. examples per country or company)?

4. 2. Please provide information (if possible quantitative) on the costs associated with the waste status of metal scrap, such as licence fees, cost of paperwork, extra cost of transporting waste, costs of public administration (e.g. examples per country or company)?

4. 3. Are there any other possible benefits or drawbacks of end-of-waste criteria for ferrous scrap, which have not been mentioned in this paper?

3. 2 Conditions for end-of-waste criteria

According to the Waste Framework Directive, Article 6, ‘certain specified waste shall cease to be waste within the meaning of point (1) of Article 3 when it has undergone a recovery operation and complies with specific criteria to be developed in accordance with the following conditions:

a) The substance or object is commonly used for a specific purpose;

b) A market or demand exists for such a substance or object;

c) The substance or object fulfils the technical requirements for the specific purpose referred to in (a) and meets the existing legislation and standards applicable to products; and
The use of the substance or object will not lead to overall adverse environmental or human health impacts.

Regarding the first two conditions is evident in the case of ferrous scrap that a structured market exists (e.g. there are classifications of scrap metal used for trading). Ferrous scrap is commonly used as a feedstock to a melting furnace in the production of mass metal. The value of ferrous scrap complying with specification such as 'European Steel Scrap Specification' is such that there is generally a demand by the secondary steel industry and any other use than for the production of new steel is highly unlikely. This is also true in the case of exports outside the EU, including to non-OECD countries.

The third condition implies that end-of-waste criteria need to ensure that, at the point of ceasing to be waste, any technical requirement related to the use are fulfilled and the recycled material should comply with applicable legislation and standards as product. In the case of ferrous scrap, this means that at the moment of end-of-waste, the scrap should fulfil specifications. As discussed, ferrous scrap is traded based on specifications which are often included as part of the business contract, therefore, in principle whenever scrap is transported from scrap treatment plants to steel work, it meets a specifications. It should be noted however, that in the case of dimensional requirements for pieces of scrap, minor deviation from any of the dimensional specifications may not be a barrier to its direct use as otherwise intended.

From a life cycle point of view, ferrous scrap metal recycling as such has overall environment benefits. The use of scrap metal in the furnace is regulated as far as emissions are concerned by the IPPC Directive regardless of whether the scrap is a waste or not. There is therefore no adverse environmental or human health impact due to the use of scrap as non-waste. Also outside the EU, process emission control of secondary metal production does not depend on the waste status of the scrap.

The main areas where the waste status of ferrous scrap can potentially make a difference for the environmental and health impacts is transport and trade (waste shipment). If scrap has end-of-waste status it can in principle be transported by any transport undertaking and not only those that are permitted to transport waste. It is therefore important that only scrap without waste-specific hazardous properties ceases to be waste. This includes that oil should not be present in problematic amounts and that the scrap has to be free of radioactive material.

Regarding waste shipment it is important that only scrap for which it is highly likely that it will actually be used for secondary metal production can be exported and imported outside waste regulatory controls (especially those under the waste shipment regulation). It is therefore important also regarding the forth condition that the scrap must comply with the standards and specifications of the scrap using industry so that a demand by the metal industry effectively exists.

3. 3 Outline of end-of-waste criteria for ferrous scrap metal

Following these considerations of the rationale and the conditions for end-of-waste criteria it can be summarised that ferrous scrap should cease to be waste when

- the scrap complies with industry specifications for a scrap type for which there is a market and demand by the metal producing industry,
• the scrap should include information about metal yield or metal content which is important in order to guarantee the proper quality of the scrap metal, and

• the scrap does not have any hazardous properties (including radioactivity) and is free of oil

Furthermore the end-of-waste criteria for ferrous scrap should not disrupt the existing recycling system. They should simply identify where scrap has attained a quality that is sufficient to ensure no environmental risks occur when scrap is transported, further processed or traded without being controlled as waste.

According to the JRC methodology guidelines, the ultimate aim of end of waste criteria is product quality and end-of-waste criteria will therefore usually include direct product quality requirements. In addition, a set of end-of-waste criteria may include elements that check product quality indirectly, in particular requirements on input material and requirements on processes and techniques. Usually, there will also be supportive requirements on quality assurance and regarding the provision of information (e.g. on product properties).

In the case of ferrous scrap the approach of combining different types of requirements in a set of end-of-waste criteria corresponds well to current good industrial practice of ensuring the product quality of ferrous scrap. Accordingly, it appears a sound approach to develop end-of-waste criteria so that ferrous scrap ceases to be waste when it is placed on the market and if it fulfils certain product quality requirements, has clearly identified origins and has been processed according to the required treatment processes. Compliance with all these requirements has to be ensured by applying industrial practice of quality control. The different elements of the end-of-waste criteria are discussed in detail in the following sections.

3.3.1 Product quality requirements

Compliance with European Steel Scrap Specification

The most straightforward way to specify product quality requirements is to rely as far as possible on European Steel Scrap Specification, which is used in Europe for the trade of steel scrap. This specification proposes general requirements and guidelines for the delivery and classification of the different categories of ferrous scrap, including quality requirement. For each of the scrap categories the specification is usually referring to the source and/or treatment processes applied, and sets of quantitative requirements on the chemical composition, size, steriles and density.

By demanding compliance with the requirements for certain scrap categories included in the European Steel Scrap Specification, end-of-waste criteria can ensure that there will be a market and demand for ferrous scrap that cease to be waste. The requirements of the specification (in particular regarding composition) as well as requirements on metal yield or metal content should define how effective any pre-treatment should be and should limit the possibilities of diluting the scrap with other waste material. The compliance with these requirements is a main factor for ensuring that the material has been treated sufficiently so that transporting, handling, trading and using the scrap will not increase the environmental and health impact (or risks) compared to a situation where the waste status is maintained.
In the case of steel scrap, the metal yield is not part of the EU-27 Steel Scrap Specification. The metal yield can be measured according to American standard ASTM E 701-80 from 2005 called Standard test methods for municipal ferrous scrap. Compliance with the requirements that the specification including metal yield defines for the different categories would have to be assured by the seller according to good industrial practice, including systematic feedback of the product quality achieved from the customers.

Sellers of metal scrap usually do not test the chemical composition and the metal yield cannot be determined before melting the scrap in the furnace. Instead sellers are able to judge on the compliance with category requirements based on the control of the input materials and the applied separation and treatment processes. However, they need then feedback from their clients to confirm over time that their judgements are correct. It is good industrial practice to include such feedback systematically in the quality control procedures of undertakings that sell ferrous scrap.

An alternative would be to use metal content as a product quality requirement because, at least theoretically, it can be determined at the processor's site before the scrap is actually used. However, it is not fully clear if systematic testing for metal content would be practicable and what the reference for testing and limit values should be.

No hazardous properties and free of oil

Condition (d) demands that end-of-waste criteria need to ensure that the use (understood here as including also transport, handling, trade) of scrap shall not lead to overall adverse environmental or human health impact. This implies that ferrous scrap should not obtain end-of-waste status if it has any of the hazardous properties included in Annex III of the Directive 2008/98/EC on waste (properties of waste which render it hazardous) or if radioactivity has not been excluded. The scrap should also be free of oil to avoid related environmental for example during transports.

How to define a requirement on oil content as part of end-of-waste criteria is an open question. Oil content is not proposed by European Steel Scrap Specification. A control at the supplier's side would in principle be possible through a combination of visual inspection of the product and process/treatment requirements.

European Steel Scrap Specification proposes only specifications for carbon scrap. However, this specification does not cover specifications for stainless steel. EUROFER is working on a proposal for stainless steel scrap. At this moment, it is not clear what reference to use for end-of-waste criteria of stainless steel scrap.

Ferrous scrap categories according to European Steel Scrap Specification are:
<table>
<thead>
<tr>
<th>Category</th>
<th>Specification</th>
<th>Dimensions</th>
<th>Density</th>
<th>Steriles</th>
<th>Aimed analytical contents (residuals) in %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>CU</td>
</tr>
<tr>
<td>Old scrap</td>
<td>E3</td>
<td>Thickness ≥6mm&lt;1.5 x 0.5 x 0.5 m</td>
<td>≥0.6</td>
<td>≤1%</td>
<td>≤0.250</td>
</tr>
<tr>
<td></td>
<td>E1</td>
<td>Thickness &lt;6mm&lt;1.5 x 0.5 x 0.5 m</td>
<td>≥0.5</td>
<td>≤1.5%</td>
<td>≤0.400</td>
</tr>
<tr>
<td>New scrap (low residual, uncoated)</td>
<td>E2</td>
<td>Thickness ≥3mm&lt;1.5 x 0.5 x 0.5 m</td>
<td>≥0.6</td>
<td>≤0.3%</td>
<td>Σ≤0.300</td>
</tr>
<tr>
<td></td>
<td>E6</td>
<td>Thickness &lt;3mm&lt;1.5 x 0.5 x 0.5 m (except bound ribbons)</td>
<td>≥0.4</td>
<td>≤0.3%</td>
<td>Σ≤0.300</td>
</tr>
<tr>
<td></td>
<td>E8</td>
<td></td>
<td>≥0.4</td>
<td>≤0.3%</td>
<td>Σ≤0.300</td>
</tr>
<tr>
<td></td>
<td>E6</td>
<td></td>
<td>≥1</td>
<td>&lt;0.3%</td>
<td>Σ≤0.300</td>
</tr>
<tr>
<td>Shredded</td>
<td>E40</td>
<td></td>
<td>&gt;0.9</td>
<td>&lt;0.4%</td>
<td>≤0.250</td>
</tr>
<tr>
<td>Steel turnings</td>
<td>E5H</td>
<td></td>
<td></td>
<td>(*)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E5M</td>
<td></td>
<td></td>
<td>(*)</td>
<td>&lt;0.400</td>
</tr>
<tr>
<td></td>
<td>E5M</td>
<td></td>
<td></td>
<td>(*)</td>
<td>&lt;0.400</td>
</tr>
<tr>
<td>High residual scrap</td>
<td>EHRB</td>
<td>Max.1.5 x 0.5 x 0.5m</td>
<td>≥0.5</td>
<td>&lt;1.5%</td>
<td>≤0.450</td>
</tr>
<tr>
<td></td>
<td>EHRM</td>
<td>Max.1.5 x 0.5 x 0.5m</td>
<td>≥0.6</td>
<td>&lt;0.7%</td>
<td>≤0.400</td>
</tr>
<tr>
<td>Fragmentized scrap from incineration</td>
<td>E46</td>
<td></td>
<td>≥0.8</td>
<td>Fe content ≥92%</td>
<td>≤0.500</td>
</tr>
</tbody>
</table>

(*) no clear method to determine these values.
**Questions:**

5.1 For which of the scrap categories included in European Steel Scrap Specification exists a sustained market and demand? Please provide evidence.

5.2 For each of the scrap categories included in European Steel Scrap Specification: Are the requirements on content (Cu, Sn, Ni, etc.) and steriles strict enough? Are there scrap categories for which these requirements are stricter than necessary? Please propose alternative values, if needed, including supporting argumentation.

5.3 Should other types of categories be allowed for end-of-waste (i.e. other categories than those defined by European Steel Scrap Specification)? If yes, please specify them (including limit values) and provide the supporting argumentation.

5.4 Should all or only selected contents (Cu, Sn, Ni, etc.) be part of the end-of-waste criteria for ferrous scrap?

5.5 Is the parameter of metal yield preferable to metal content? What should be the proposed metal yield/metal content for each category mentioned by European Steel Scrap Specification? Please provide the supporting argumentation.

5.6 What should be the limits of oil/grease content for each scrap category mentioned by European Steel Scrap Specification? Would it be better to propose only one limit for all categories? Would all mention categories required limit for oil/grease content?

5.7 Please describe in operational terms that are suitable for a legal text on end-of-waste criteria the good industrial practices by the suppliers of checking compliance with the different requirements of the scrap categories that qualify for end-of-waste.

5.8 Are further product quality requirements needed as part of end-of-waste criteria? Are any of the proposed requirements not needed?
3. 3. 2 Requirements on input materials

The end-of-waste criteria should allow as input only selected waste types for which it is practical to obtain ferrous scrap in compliance with the product quality requirements. This implies that a waste can only be allowed if it is commonly used for the production of steel and, after appropriate treatment, can be used without overall adverse environmental or human health impacts.

Apart from metal which is reused directly, such as old construction beams removed during demolition, metal scrap is collected in varying quantities, processed and eventually recycled into products. From metal scrap to products, the contaminants are removed step by step, for making the scrap suitable for the steel work, whilst satisfying the required quality for metal applications. The recycling process, the logistics and choice of machinery and equipment, depends on the type of the contaminants to be removed, which is determined by, most of all, the source of the metal scrap, as well as the means of collection.

Proposed grouping according to sources

Based on the above description of the characteristics of different sources of ferrous scrap, it is possible to group those that are suitable for end-of-waste into two Groups. The system of groups partly differs from the previous report (‘end of waste criteria’). Group I stays the same and Group II and Group III have been combined together. The combination is due to the fact that ferrous scrap from Group II and ferrous scrap from Group III will require a very similar concept of treatment such as shredding, sorting and magnetic separation.

The purpose of the grouping is not only to clarify the stage of separation of metal scrap along the recycling process, but also to identify the further treatment processes required.

In principle, the same reference system (EWC) for carbon steel could also be used for stainless steel. As the first element of the EoW criteria, the source of scrap metal should be identified based on the EWC.

These two Groups are:

Group I

Those that are separated at source or while collecting and remain separate: the ferrous scrap may need only normal industrial processing such as sizing, sorting by type of alloy, or thermal treatment for de-coating, prior to the remelting process. This group includes wastes from shaping and physical and mechanical surface treatment of non ferrous metals (EWC 12 01 01, 12 01 02) some of the old scrap from construction and demolition waste as defined under EWC 17 04 05. However, turnings and borings could only be included in this Group if they are treated at source (normally centrifuged) to remove cutting fluids so that special measures against pollution are unnecessary for transportation and shipment.

Group II

Those that are separated at a collection centre by sorting to reach a status comparable to Group I and those that can be separated at a pre-treatment plant after more than one process. Most post consumer metal scrap is in a mixture with one or more non-metal waste or other metals. This group covers packaging waste, EWC 15 01 04, municipal waste, EWC 20 01 40 mixed packaging (EWC 15 01 06 and 15 01 11), several categories under the end-of-life vehicles
(EWC 16 01) and WEEE (EWC 16 02), construction and demolition waste (EWC 17 04 07, 17 04 10, and 17 04 11), bottom ash from waste incineration facilities (EWC 19 01 02), and some of the separate collected metal containing municipal waste (EWC 20 01 23, 20 01 35, 20 01 36).

In some case, the set up of the collection system makes further sorting less necessary, however due to the uncertainty of the origin of the metal scrap, the quality management system should take place. The quality management system should provide for documentation which can be inspected by waste management authorities.

Questions:

6. 1 Would certain waste types included in the list of allowed input materials not be suitable for the production of scrap that consistently complies with the product quality criteria? Please, explain.

6. 2 Are the allowed waste input materials sufficiently specified, also regarding the grouping? (For example, should different waste sub-types, such as wheels, be distinguished for ELV?) If needed, please suggest further specifications of the categories.

6. 3 Would additional waste types qualify as input materials?

3. 3. 3 Requirements on treatment processes and techniques

The legal conditions demand that end-of-waste criteria shall ensure that there is a demand for the substance or object that ceases to be waste and that its use will not lead to overall adverse environmental or human health impacts.

This implies that the material must have gone through all necessary treatment processes that make it directly useful and allow transporting, handling, trading and using the scrap without increased environmental and health impact (or risks) compared to a situation where the waste status is maintained.

The required treatment processes to achieve this differ depending on the waste types from which the scrap has originally been obtained. The metal scrap case study in the JRC "End-of-Waste Criteria" report suggested process requirements according to the three groups of scrap sources. The proposed groups partly differ from the previous report. Group I stays the same and Group II and Group III have been combined together. The combination is due to the fact that ferrous scrap from Group II and ferrous scrap from Group III will require a very similar concept of treatment such as shredding, sorting and magnetic separation. It is assumed that the ferrous scrap will obtain the required product quality for complying with the legal conditions if it has undergone all required treatments.

Group I
The only necessary requirement for ferrous metal scrap in this group is that they should remain separated at the collection centre and when transported. For efficiency in transportation, small pieces of scrap should be compacted as much as possible in the form of bales or pellets.
For clean new scrap, according to the *Interpretative Communication COM (2007)59* some may be treated as by-products, which is therefore out of the scope for end-of-waste.

For scrap covered with paint, metallic coating, or lacquer, thermal treatment, when necessary, will take place at the steel work. From the environmental aspect it makes no sense to heat twice and waste energy. In the case of scrap metal processing it is normal industry practice to return off cuts directly to the furnace and any coating or oil on the surface of the off cuts is easily handled by the furnace and actually contributes to the fuel demand. The transportation of these types of scrap does not incur risks to and any adverse impact on environmental and health.

**Group II**

Ferrous scrap in this group comes partly from households, and the typical example here is UBCs. Due to greater risk of mixture at collection, additional minimum requirements are justified for metal scrap in this group compared to Group I. Apart from separation through collection and sorting, the scrap should be clean from visible contaminants. Another criterion is that the scrap, often light and in the form of small containers, should be as compact as possible for transportation. Sometimes, at the recycling site, this scrap may be shredded and baled for proper size or transportation.

In the case of UBCs, depending on the collection system of a region, metal scrap can be collected in separate containers or brought to a collection centre. However, they can also be collected among other municipal waste and further singled out at scrap yard. In both cases, there is first a need to ensure that UBCs are cleaned of other non-metal contaminants and second to separate into steel cans and aluminium cans. The cleaning process could involve manual sorting and separation, magnetic separation, washing and drying.

Metal scraps contained in this group are also an integral part of the end of life products, e.g. ELVs, WEEE, etc. and can not be (easily) removed without the help of equipment or machinery. The minimum requirements vary for each category in the group. For the ferrous fraction, magnetic separation is the minimum process that is required. Often also shredding, sorting or gravity separation are required.

Industrial oil and painted drums are also part of the separated collected metal packaging wastes. They are first pre-treated (de-polluted) at the site of collection or a waste treatment plant and then compacted and transported to steelworks.

For efficient transportation and in order to avoid any unnecessary loss of the scrap during transportation, the cleaned scrap should be baled or compacted with other means. This requirement is more explicit for light metal scrap in this group because old scrap is often moved over longer distance than new scrap (in the Group I), and it may also be traded passing through different entities.

Description of the processes (carried out at recycling plants under waste regulation):

- **Sorting:** This is a chiefly manual process to pick out the scrap metal, according to the type of metal and sources, from the mixed waste.
- **Separating:** When there is the risk of mixed ferrous and non ferrous metal, magnetic separation should be done through a simple magnetic device, such as magnetic conveyor, via mechanical or manual separation.
• Cleaning and de-polluting: If necessary, the sorted scrap should be washed and then dried to have minimal moisture or pre-treated (e.g. thermal treatment) to eliminate residues such as oil, paint.
• Compacting: Baling should be done with baling machine or when sizing is taken place using a shredder such that the resulting material is naturally compacted.

Stainless steel
The treatment process for stainless steel is more complicated because stainless steel is usually not magnetic therefore it usually requires multiple steps separations.

Description of the processes:

• Shredding and magnetic separation: By using standardised mechanical equipment, i.e. a shredder, the scrap metal is shredded into required size for effective magnetic separation.
• Separation (e.g. eddy current or dense media): After separation from the ferrous metal, the non-ferrous metals, stainless steel scrap and non-metal fractions needs to be further separated by using combinations of density and eddy current separations. For example, it may use fluids with different densities to single out, first, the light metal and the heavy fraction and then, to separate the heavy fraction by another density separation system. The final heavy fraction which usually contains mixtures of Cu, Zn, Pb and stainless steel should be manually hand picked.

Note: While baling has clear advantages for transport, it may make subsequent quality control of the material more difficult, which may open the possibility for 'hiding' or 'mixing' lower quality material in the inside.

Questions:

7.1 Should process requirements be defined by group of input materials or are they preferably defined for each type of input material individually? In any case, please make proposals for descriptions of process requirements that can be used in legal text.

7.2 How can compliance with the process requirements be checked in practice (that the process has been carried out in an effective way)?

7.3 Which process requirements could be used to check for the effective removal of oil?

7.4 Should baling be included as a requirement? Please give your explanation.

3.3.4 Requirements on quality assurance

The acceptance of input materials, the required processing and the assessment of compliance with product requirements should all have been carried out according to good industrial practice regarding quality control procedures. Reliable and consistent product quality can be achieved in practice if the different quality control elements work together as a system. Quality control relying on direct product testing alone would be contrary to industrial practice and not be economically feasible.
Regarding direct product quality control at the scrap supplier side, usually only visual control takes place. The customer (steel work) will analyse the metal yield and impurities and refer the results back to the supplier.

It is good practice, however, that the supplier has a quality assurance system in place that includes systematic control based on the feedback from client testing.

In order to demonstrate that all end-of-waste criteria are met, it seems necessary that the producer of the material in question operates a quality assurance system which includes specific provisions designed to ensure compliance with each end-of-waste condition. Whilst an internationally recognised quality assurance system (such as ISO 9000) may be preferable it cannot be a requisite. The system should, however, be designed and operated to use an appropriate combination of knowledge of the relevant waste sources, knowledge and control of key processing steps and where necessary, specific results of analysis, to allow the producer to certify compliance with each and every criterion for end-of-waste. Bearing in mind the potential costs of analysis, the system employed should utilise feedback from receivers and users of the material to optimise the need for specific analysis. The quality management system should provide for documentation which should comply with criteria requirements and which can be inspected by waste management authorities.

![Diagram](image-url)  
*Figure 7. An example of management system for ferrous scrap under EoW criteria.*
Questions:

8. 1. What is good industrial practice to assure the quality of metal scrap? Please elaborate specific requirements on quality control that are adequate to be included in end-of-waste criteria.

3. 3. 5 Summary of possible elements of end-of-waste criteria

Product quality

Ferrous metal scrap shall meet all of the following product quality requirements (a-e):
   a) meet European Steel Scrap Specification (for carbon scrap);
   b) metal yield/metal content ≥ 95% (mass weight); [the exact metal content to be elaborated; 95% is an example]
   c) free of visible oil;
   d) free of radioactivity;
   e) not have any of the properties included in Annex III of the Directive 2008/98/EC on waste (properties of waste which render it hazardous).

Input material

No other types of waste shall have been used as input than those included in the following Groups:

Group I: waste types 12 01 01, 12 01 02, 17 04 05 under the classification of the European Waste Catalogue

Group II: waste types 15 01 04, 20 01 40, 15 01 06, 15 01 11, 16 01, 16 02, 17 04 07, 17 04 10, 17 04 11, 19 01 02, 20 01 23, 20 01 35 and 20 01 36 under the classification of the European Waste Catalogue.

Treatment processes and techniques

The waste input materials shall have undergone at least the following treatment processes.

a) Input materials of waste types from Group I shall have been segregated at source or during collection to pure ferrous scrap. The scrap shall be kept separate from other wastes until it is used.

b) Input material of waste types from Groups II have been sorted or separated into ferrous scrap fraction and other component have effectively been separated. If needed, cleaning or de-polluting processes shall be applied so that the resulting scrap is free of visible contaminants.

Hazardous waste shall not cease to be waste unless it has effectively been treated in a way that eliminates any hazardous properties according to Annex III of the Directive 2008/98/EC on waste. (For example, any liquids or other hazardous components must have been removed from ELVs.)
Input materials that originate from end of life vehicles or waste electronic or electric equipment shall have completed all pre-treatments, such as dismantling, de-pollution, etc., as required by the ELV Directive and the WEEE Directive.

The scrap shall have been compacted in the form of bales or pellets if this is needed to transport the scrap safely or allows reducing substantially the required transport volume.

**Quality assurance**

The acceptance of input materials, the required processing and the assessment of compliance with product requirements shall have been carried out according to good industrial practice regarding quality control procedures.
Annex:

Summary of questions to the members of the technical expert group

Pre-treatment

1.1 To what extent are pre-treatment processes applied in practice to remove the paint/coatings?

1.2 Where does pre-treatment take place (at the steel work site, at the mechanical treatment site, elsewhere)?

International trade

2.1 Is there any evidence of higher or lower environmental and health impacts if certain processes of ferrous scrap recycling (e.g. decoating) are carried out outside the EU?

3.1 Please provide evidence on how the waste status of ferrous scrap affects the exportability of the material in practice. Please provide information for each scrap category included in the European Steel Scrap Specification.

3.2 What could the effect on scrap demand and prices be if the Waste Shipment Regulation did not apply anymore as a consequence of introducing end-of-waste criteria?

Costs and benefits

4.1 Please describe which permits, licences and administration paperwork are required in practice for handling metal scrap as waste (e.g. examples per country or company)?

4.2 Please provide information (if possible quantitative) on the costs associated with the waste status of metal scrap, such as licence fees, cost of paperwork, extra cost of transporting waste, costs of public administration (e.g. examples per country or company)?

4.3 Are there any other possible benefits or drawbacks of end-of-waste criteria for ferrous scrap, which have not been mentioned in this paper?

Product quality

5.1 For which of the scrap categories included in European Steel Scrap Specification exists a sustained market and demand? Please provide evidence.

5.2 For each of the scrap categories included in European Steel Scrap Specification: Are the requirements on content (Cu, Sn, Ni, etc.) and steriles strict enough? Are there scrap categories for which these requirements are stricter than necessary? Please propose alternative values, if needed, including supporting argumentation.

5.3 Should other types of categories be allowed for end-of-waste (i.e. other categories than those defined by European Steel Scrap Specification)? If yes, please specify them (including limit values) and provide the supporting argumentation.
5.4 Should all or only selected contents (Cu, Sn, Ni, etc.) be part of the end-of-waste criteria for ferrous scrap?

5.5 Is the parameter of metal yield preferable to metal content? What should be the proposed metal yield/metal content for each category mentioned by European Steel Scrap Specification? Please provide the supporting argumentation.

5.6 What should be the limits of oil/grease content for each scrap category mentioned by European Steel Scrap Specification? Would it be better to propose only one limit for all categories? Would all mention categories required limit for oil/grease content?
Table 3. Preliminary proposal of categories for ferrous scrap.

<table>
<thead>
<tr>
<th>Category</th>
<th>Specification</th>
<th>Metal yield or metal content proposal (%)</th>
<th>Oil content proposal (%)</th>
<th>Steriles (%)</th>
<th>Aimed analytical contents (residuals) in %</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cu</td>
<td>Sn</td>
<td>Cr, Ni, Mo</td>
</tr>
<tr>
<td>Old scrap</td>
<td>E3</td>
<td>≤1%</td>
<td>≤0.250</td>
<td>≤0.010</td>
<td>≤0.250</td>
<td></td>
</tr>
<tr>
<td>E1</td>
<td></td>
<td>&lt;1.5%</td>
<td>≤0.400</td>
<td>≤0.020</td>
<td>≤0.300</td>
<td></td>
</tr>
<tr>
<td>New scrap (low residual, uncoated)</td>
<td>E2</td>
<td>&lt;0.3%</td>
<td>≤0.250</td>
<td>≤0.010</td>
<td>≤0.300</td>
<td></td>
</tr>
<tr>
<td>E8</td>
<td></td>
<td>&lt;0.3%</td>
<td>≤0.400</td>
<td>≤0.020</td>
<td>≤0.300</td>
<td></td>
</tr>
<tr>
<td>E6</td>
<td></td>
<td>&lt;0.3%</td>
<td>≤0.250</td>
<td>≤0.020</td>
<td>≤0.300</td>
<td></td>
</tr>
<tr>
<td>Shredded</td>
<td>E40</td>
<td>&lt;0.4%</td>
<td>≤0.250</td>
<td>≤0.020</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steel turnings</td>
<td>E5H</td>
<td>(*)</td>
<td>Prior chemical analysis could be required</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E5M</td>
<td></td>
<td>(*)</td>
<td>≤0.400</td>
<td>≤0.030</td>
<td>≤1</td>
<td>≤0.100</td>
</tr>
<tr>
<td>High residual scrap</td>
<td>EHRB</td>
<td>&lt;1.5%</td>
<td>≤0.450</td>
<td>≤0.030</td>
<td>≤0.350</td>
<td></td>
</tr>
<tr>
<td>EHRM</td>
<td></td>
<td>&lt;0.7%</td>
<td>≤0.400</td>
<td>≤0.030</td>
<td>≤1.0</td>
<td></td>
</tr>
<tr>
<td>Fragmentized scrap from incineration</td>
<td>E46</td>
<td>Fe content ≥92%</td>
<td>≤0.500</td>
<td>≤0.070</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(*) no clear method to determine these values.
5. 7 Please describe in operational terms that are suitable for a legal text on end-of-waste criteria the good industrial practices by the suppliers of checking compliance with the different requirements of the scrap categories that qualify for end-of-waste.

5. 8 Are further product quality requirements needed as part of end-of-waste criteria? Are any of the proposed requirements not needed?

**Input materials**

6. 1 Would certain waste types included in the list (Table 4) of allowed input materials not be suitable for the production of scrap that consistently complies with the product quality criteria? Please, explain.

6. 2 Are the allowed waste input materials sufficiently specified, also regarding the grouping (Table 4)? (For example, should different waste sub-types, such as wheels, be distinguished for ELV?) If needed, please suggest further specifications of the categories.

### Table 4. Waste types (according to waste list) allowed as input, divided into proposed groups.

<table>
<thead>
<tr>
<th>Group</th>
<th>Category</th>
<th>Comments/Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>12 01 01 (ferrous metal fillings and turnings)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>12 01 02 (ferrous metal dust and particles)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>17 04 05 (construction and demolition waste, iron and steel)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>15 01 04 (metallic packaging)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20 01 40 (industrial and institutional waste, metals)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>15 01 06 (mixed packaging)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>15 01 11 (metallic packaging containing a dangerous solid porous matrix (for example asbestos), including empty pressure containers.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>16 01 (ELV)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>16 02 (WEEE)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>17 04 07 (construction and demolition waste, mixed metals)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>17 04 10 (cables containing oil, coal tar and other dangerous substances)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>17 04 11 (cables other than those mentioned in 17 04 10)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>19 01 02 (ferrous materials removed from bottom ash)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20 01 23 (discarded equipment containing chlorofluorocarbons)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20 01 35 (discarded electrical and electronic equipment other than those mentioned in 20 0</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>21 and 20 01 23 containing hazardous components</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20 01 36 (discarded electrical and electronic equipment other than those mentioned in 20 01 21, 20 01 23 and 20 01 35).</td>
<td></td>
</tr>
</tbody>
</table>

6. 3 Would additional waste types qualify as input materials?
Treatment processes and techniques

7. 1 Should process requirements be defined by group of input materials or are they preferably defined for each type of input material individually (Table 5)? In any case, please make proposals for descriptions of process requirements that can be used in legal text.

Table 5. Process requirements according to waste types.

<table>
<thead>
<tr>
<th>Group</th>
<th>Category</th>
<th>Process proposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>12 01 01 (ferrous metal fillings and turnings)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>12 01 02 (ferrous metal dust and particles)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>17 04 05 (construction and demolition waste, iron and steel)</td>
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<tr>
<td></td>
<td>15 01 04 (metallic packaging)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20 01 40 (industrial and institutional waste, metals)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>15 01 06 (mixed packaging)</td>
<td></td>
</tr>
<tr>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>16 02 (WEEE)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>17 04 07 (construction and demolition waste, mixed metals)</td>
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<td></td>
<td>20 01 35 (discarded electrical and electronic equipment other than those mentioned in 20 0)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>21 and 20 01 23 containing hazardous components</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20 01 36 (discarded electrical and electronic equipment other than those mentioned in 20 01 21, 20 01 23 and 20 01 35)</td>
<td></td>
</tr>
</tbody>
</table>

7. 2 How can compliance with the process requirements be checked in practice (that the process has been carried out in an effective way)?

7. 3 Which process requirements could be used to check for the effective removal of oil?

7. 4 Should baling be included as a requirement? Please give your explanation.

Quality assurance

8. 1 What is good industrial practice to assure the quality of metal scrap? Please elaborate specific requirements on quality control that are adequate to be included in end-of-waste criteria.