



## **PROPOSAL FOR AN APPROACH TO DERIVE END-OF-WASTE CRITERIA FOR RECYCLED AGGREGATES**

**F.I.R.- International Recycling Federation  
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### **Introduction**

Recycling of C&DW has become regular business in many Member States. One aspect that hinders recycling is the issue of waste definition. The International Recycling Federation (F.I.R.) has called upon the European Commission to render recycled aggregates the status of “product”. The F.I.R. welcomes the fact that in its proposal for a revision of the Waste Framework Directive, the Commission has introduced an article which enables certain substances to cease to be a waste.

Moreover, the F.I.R. welcomes the fact that in its planning of forthcoming actions, the Commission envisages to first clarify the issue of waste definition for recycled aggregates. We consider this a recognition of the importance of the C&DW recycling activities in Europe and recognition of the fact that recycled aggregates are already considered a valuable product with negligible effects on the environment.

The Commission proposes to develop environmental criteria in order to determine the end-of-waste status. As the F.I.R. and its members have been closely involved in development of (environmental) criteria in Member States, we consider it our responsibility to support the Commission in drafting criteria in accordance with the new Waste Framework Directive.

Based on the expertise within the F.I.R., this document contains a proposal for an approach to develop such criteria. Available information within F.I.R. has been used to indicate in which way criteria can be developed. A large set of data has been used to prepare an indicative set of criteria. In our view, criteria as such are not suitable. They need to be applied within the framework of a Quality Assurance scheme. Furthermore, certain requirements must apply to the production process. Below these aspects are explained.

### **Requirements regarding criteria**

The definition of waste is such, that careful interpretation must take place in order to determine if a substance is a waste or not. The European Court of Justice has ruled in several cases where the question has been put if specific materials are to be considered a waste. From these rulings it may also be deduced when a waste ceases to be a waste. The jurisprudence therefore provides for circumstances that play a role upon deciding if a substance ceases to be waste.

The proposal of the European Commission of 21 December 2006 describes the following requirements under which a waste may cease to be a waste:

- *Reclassification will not lead to overall negative environmental impacts*
- *A market exists for the secondary product*
- *Criteria must ensure that the product meets necessary conditions to be placed on the market*
- *Criteria must take into account any environmentally harmful use or shipment and must guarantee a high level of protection for human health and the environment*

Applying environmental criteria in order to distinguish between waste and non-waste is a useful approach that will also be practically feasible. To our opinion the requirements as described reflect many of the relevant aspects which the European Court of Justice has put forward in its rulings on the issue of waste-definition. At least two more “indicators” from the ECJ rulings however should also be taken into consideration:

- the substance has been produced purposely (ARCO ruling)
- the substance will be applied without any further treatment (Palin Granit ruling)

These indicators should be taken into consideration, as they reflect the main consideration of the ECJ, namely the intention of the discarder. This intention is a very important indicator to decide if a substance is a waste. As for recycled aggregates, it is important to distinguish between proper recycling activities which aim at the production of high quality aggregates as opposed to those cases where C&DW is merely used as construction material as such or after simplistic treatment.

Criteria should therefore not only be environmental limit values (for instance maximum leaching) but should also address the quality of processing and process control. The F.I.R. has written down its view on the issue of the waste definition in an official document (1). This document has been supplied to the Commission during the consultation period in 2003 on the Communication COM(2003) final *Towards a Thematic Strategy on the prevention and recycling of waste*. To our opinion, an approach merely based on criteria will not be sufficient to fulfil all requirements from the Waste Framework Directive concerning proper waste management and sound use of secondary materials, nor is this in line with the interpretation given by the ECJ. A minimum requirement should be that a Quality Assurance (QA) scheme is in place. Such a QA system will provide for confidence that criteria have been applied in a proper way and that the quality of recycled aggregates really meets the criteria. QA systems often go with certification of recycled aggregates. Certification is a costly exercise. The fact that a QA system is in place indicates that a mature market exists and that holders of recycled aggregates have the intention to sell products and will benefit from these sales.

As for the “no overall negative impact” criterion the following can be put forward. Environmental impact can be taken very broadly. A whole life-cycle analysis should actually be applied in order to determine the overall effects. However, this will not be feasible in practice. In a separate document to the Commission, the F.I.R. already has elaborated on the overall environmental impacts of the recycling of C&DW. It was concluded that, overall, this impact is positive. The “no overall negative impact” should then address the direct impact of the use of recycled aggregates. Possible environmental impact from secondary materials in construction is mainly related to leaching behaviour.

#### **Integrated approach to develop criteria**

Upon summarizing the above, the following requirements apply for the development of end-of-waste criteria for recycled aggregates:

1. recycled aggregates must have undergone a finished crushing process. This process must be well controlled and it must be possible to influence the quality of the aggregates
2. a Quality Assurance system must be in place in order to safeguard that these criteria are applied in a reliable way
3. criteria must guarantee the fitness for use. Environmental criteria must reflect leaching of contaminants or either the composition regarding contaminants

When these requirements are met, it will be possible to develop a sound system based on criteria, while meeting the rulings (and their contents) from the ECJ.

#### ***Requirement 1: recycled aggregates must have undergone a finished crushing process***

A proper production process for recycled aggregates requires controlled input, controlled process parameters and quality control of the product. These requirements have already been described by the F.I.R. in a position paper on Quality Assurance regarding recycled aggregates (2). In short, the following must apply:

- Incoming materials are extracted from mineral C&DW and originate from selective demolition
- The products are manufactured by a state-authorized recycling operator
- The product must meet the requirements of European Building Codes. Until these codes become effective, national building codes should apply.
- The product must meet the environmental standards. Until European environmental standards become effective, national environmental standards should apply.
- The product must be subjected to internal and external testing (by accredited institutions) to guarantee the quality

*Requirement 2: a Quality Assurance scheme must be in place*

Application of end-of-waste criteria without using a proper Quality Assurance scheme will lead to situations which are in contradiction to the objectives of the WFD. In all of the F.I.R. countries proper QA schemes have been developed. The F.I.R. will assist any other Member State which considers development of a QA scheme.

*Requirement 3: criteria must guarantee fitness for use*

The F.I.R. document prescribes that recycled aggregates must fulfil the national requirements which are set (technical and environmental) for the use of it. A certified product meeting these requirements should already be regarded a product and not a waste. Upon drafting European criteria, the current criteria which are applied by Member States will have to be taken account for.

**Environmental behaviour of recycled aggregates**

Recycling companies produce a range of products from C&DW. These products have various applications and therefore substitute a certain number of primary products. In those countries where recycled aggregates have been in use for many years, data concerning their environmental behaviour are available. Recycled aggregates are usually tested using a leaching test. As for organic parameters such as mineral oil and PAH concentrations are measured. Both parameters to be tested and their limit values vary between Member States.

One could argue that each individual Member State has defined its limit values in such a way that, upon meeting these values, any negative impact of recycled aggregates is considered negligible. There is sense then in stating that these limit values can be used as guideline for new end-of-waste criteria to be set by the Commission.

Data from several F.I.R. countries on recycled aggregates have been collected and compared to national limit values. As an example, annex 1 gives results for some elements. The results shown here are rather typical. They show that the leaching of contaminants from recycled aggregates usually is lower than most of the national limit values. Remarkably, some limit values in Germany and the Czech Republic are very low compared to other countries.

From the collected data an interesting conclusion can be drawn. The limit values applied in the Netherlands are based (in accordance with the "Bouwstoffenbesluit", Building Material Decree) on the requirement that leaching of contaminants should never result in an additional contamination of the first meter of subsoil of more than 1%. From the graphs in annex 1 and from additional graphs which were drawn based on the available data, it can be concluded that the leaching values of recycled aggregates in general are about 20-30% of the Dutch limit values. This goes for almost all parameters. It must be noted here that most available data concern averages, individual batches of recycled aggregates may of course show a higher leaching value.

Generally speaking then, it seems that the use of recycled aggregates is not expected to lead to additional contamination of subsoil of more than 0.3% in 100 years. One should moreover take into account the fact that primary materials do also show leaching behaviour. In general, leaching from primary material will be lower than leaching from recycled aggregates. There are however not very much data available on primary materials. Annex 2 shows some data. Compared to primary materials, recycled aggregates are therefore not likely to lead to additional contamination of the subsoil of more than 0.3% in 100 years.

**Which parameters should be addressed?**

Upon concluding, this first analysis of data on recycled aggregates indicates that environmental effects from leaching of recycled aggregates are negligible. As other environmental effects are positive (saving of natural resources, saving of landfill space, reduction of CO<sub>2</sub> emissions), the overall environmental impact must be judged as "positive".

This does not mean that recycled aggregates need no control. The above applies to recycling plants which produce according to F.I.R. standards. It is a fact that C&DW and aggregates derived from it which result from inappropriate operation (no selective demolition, poor separation afterwards) will contain harmful components. These components are related to the use of products such as tar containing materials. Experience in F.I.R. countries has shown that certain components in recycled aggregates are critical when compared to the national limit values. Often these parameters can be related to the use of said specific products.

An important study has been carried out by the Austrian Bundesministerium für Land- und Forstwirtschaft in 2003. In this study the leaching behaviour of recycled aggregates has been studied and set out against leaching of primary materials but also against existing regulations on harmful substances. Based on the study from the Bundesministerium the following set of parameters is regarded the most appropriate:

**PAH, mineral oil, Cu, Cr, SO<sub>4</sub>**

Comparison with other countries shows that these parameters are indeed relevant in order to assess the environmental suitability of recycled aggregates. There is also much sense in selecting this set of parameters, when considering the composition of C&DW. The main possible contamination of inert C&DW (after selective demolition) results from for instance remaining tar and oil. The proposed set of parameters for most part reflects these possible contaminants.

### **Conclusion**

The proposed approach for end-of-waste criteria addresses the requirements from the new WFD:

#### *Reclassification will not lead to overall negative environmental impacts*

A first analysis shows that only marginal effects from leaching of recycled aggregates will occur. Overlooking "overall" effects, the conclusion is that the use of recycled aggregates has positive environmental impact. As reclassification is expected to result in more recycling of C&DW, it will lead to overall positive environmental impacts.

#### *- A market exists for the secondary product*

Recycled aggregates are already applied and in many countries there is a market. Recycling companies apply high quality processes and stringent Quality Assurance schemes with the evident aim of selling products.

#### *- Criteria must ensure that the product meets necessary conditions to be placed on the market*

Technical requirements for recycled aggregates are described in CEN/TC154 standards. These standards are adopted through national standardization in the F.I.R. countries. As for environmental criteria these countries have set limit values which are related to testing of products in the framework of a Quality Assurance scheme. End-of-waste criteria must therefore take account of these national limit values. Key parameters to be addressed are PAH, mineral oil, Cu, Cr and sulphate.

#### *- Criteria must take into account any environmentally harmful use or shipment and must guarantee a high level of protection for human health and the environment*

This issue is addressed above.

In order for flexible implementation of end-of-waste criteria, it is recommended that they are in line with national limit values for the application of recycled aggregates. End-of-waste criteria should be such that current QA schemes need not be changed and that certification according to these schemes automatically implies that the certified recycled aggregates cease to be a waste.

### **References**

- (1) "Recycling products from mineral construction and demolition waste and mixed construction and demolition waste". F.I.R. issue, 2003.
- (2) "F.I.R. recommendation guidelines for Quality Assurance of recycled building materials". F.I.R. issue, 2003.

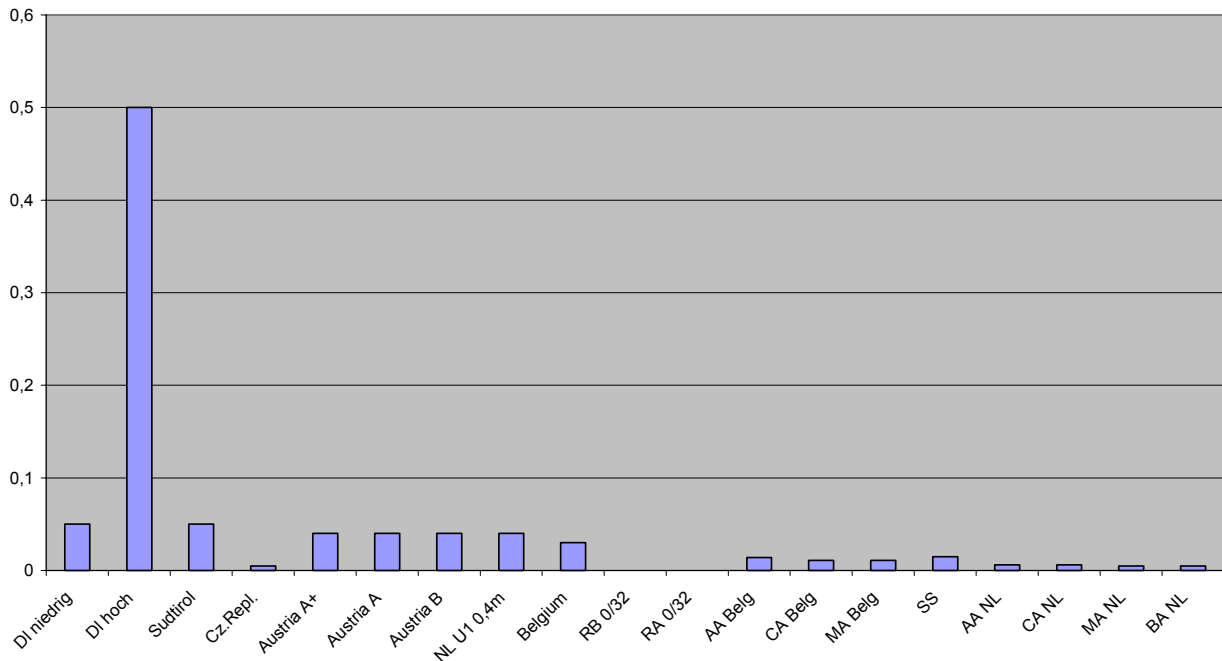
## Annex I

### Comparison of leaching behaviour of recycled materials with national limit values

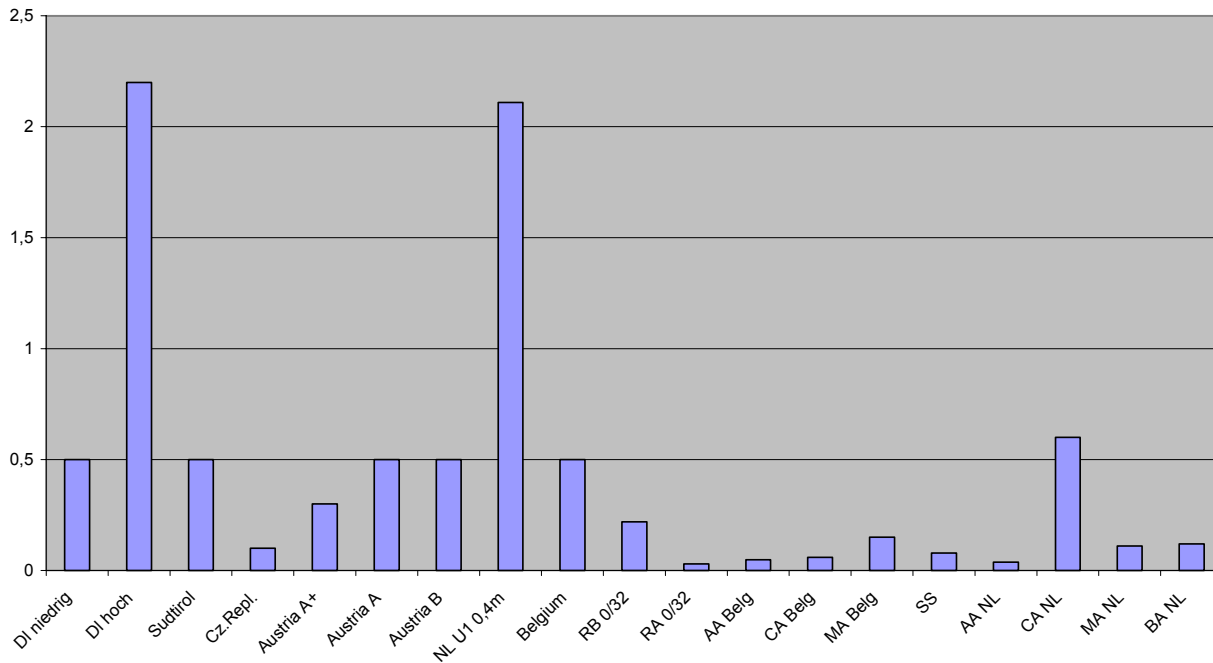
**Explanation to the graphs**

RA	recycled Aggregates
DL Niedrig	Lowest limit value from German Bundesländer
DL hoch	Highest limit value from German Bundesländer
Sudtirol	Limit value South Tyrol
Cz. Republ.	Limit value Czech Republic
Austria A, A+, B	Limit values Austria for different applications
NL U1 0,4 m	Dutch limit value category 1 materials at an application height of 0.4 m
Belgium	limit value Belgium
RB 0/32	Recycled concrete 0/32 Austria
RA 0/32	Recycled asphalt 0/32 Austria
AA Belg	Recycled asphalt aggregates Belgium
CA Belg	Recycled concrete aggregates Belgium
MA Belg	Recycled mixed aggregates Belgium
SS	Recycled sieve sand Belgium
AA NL	Recycled asphalt aggregates Netherlands
CA NL	Recycled concrete aggregates Netherlands
MA NL	Recycled mixed aggregates Netherlands
BA NL	Recycled masonry aggregates Netherlands

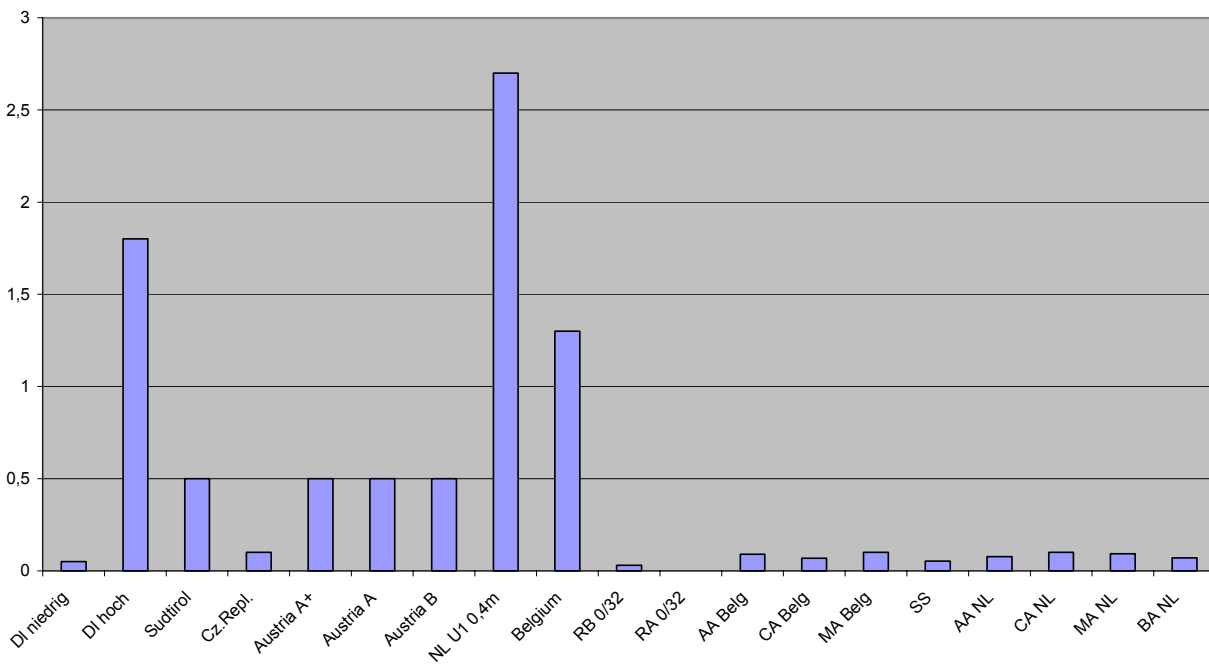
**Cd limit values vs. values RA**



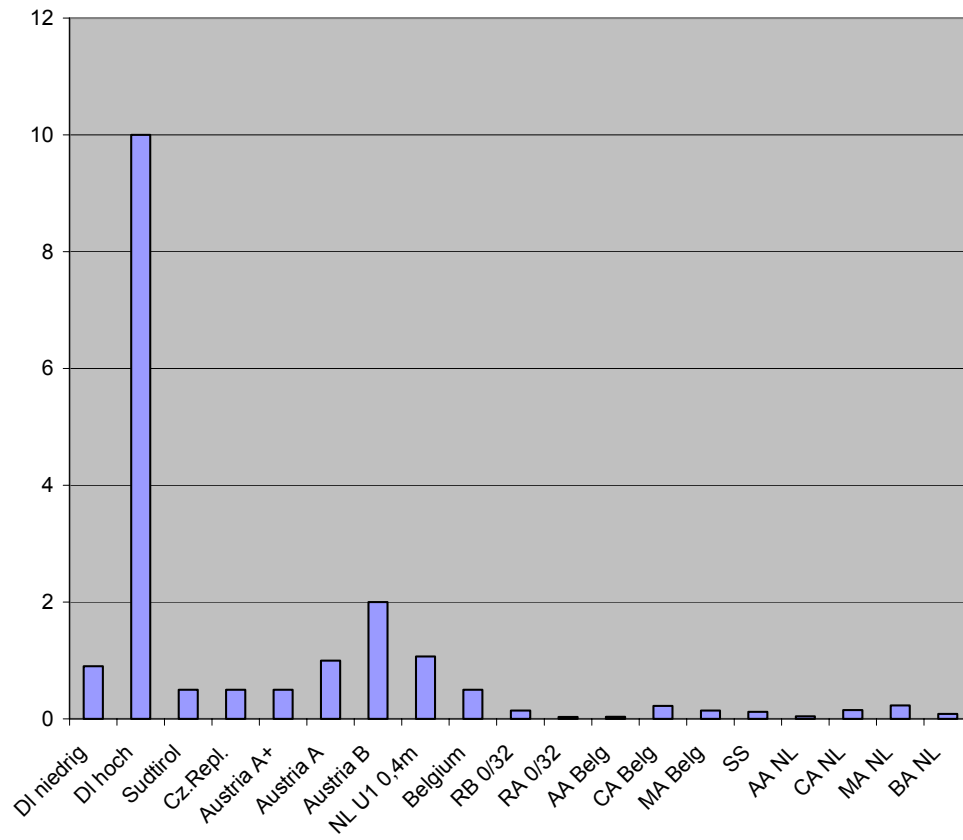
Cr limit values vs. values RA



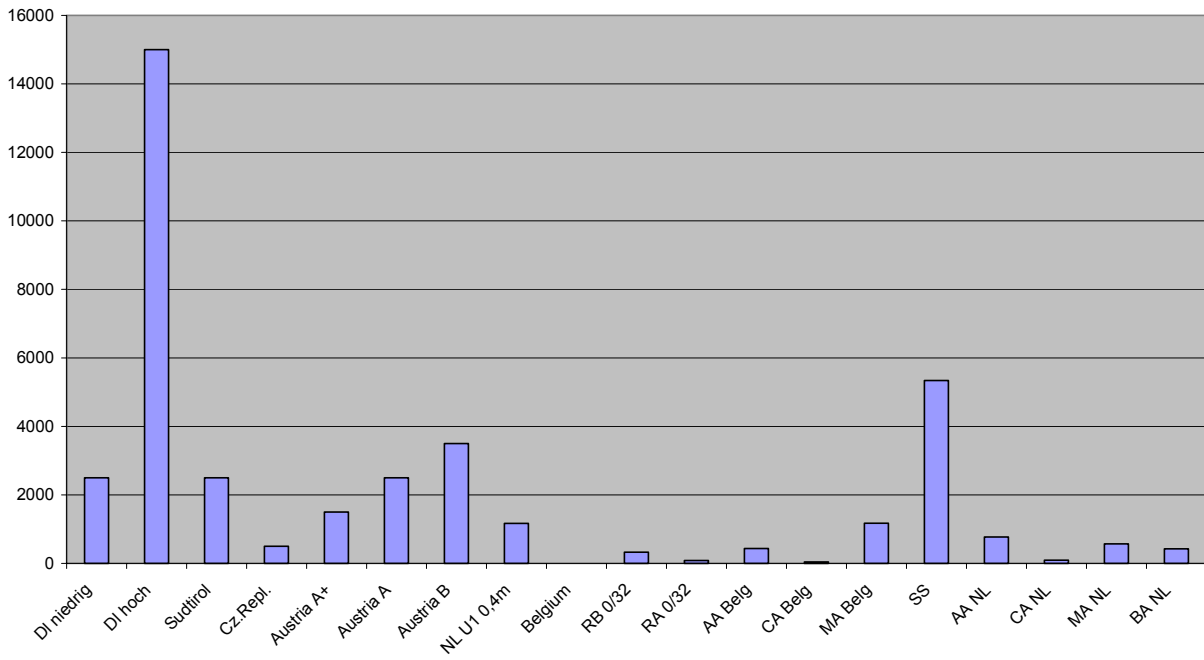
Pb limit values vs. values RA



**Cu limit values vs. values RA**



**SO4 limit values vs. values RA**



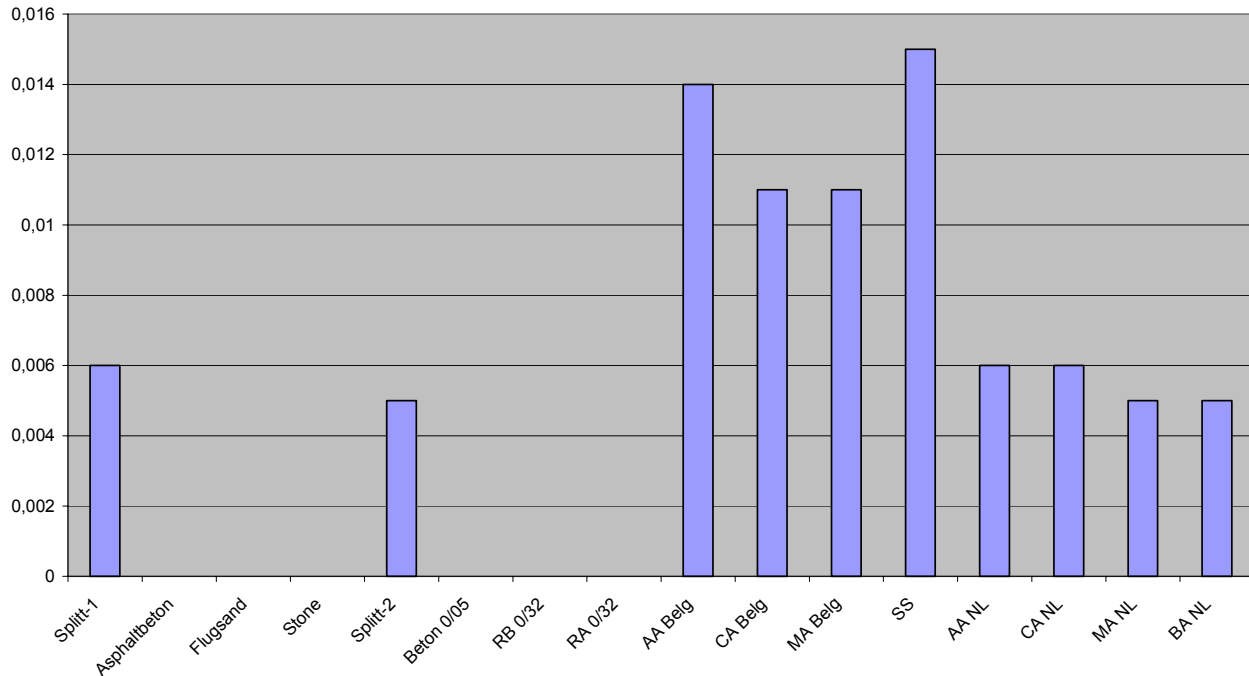
## Annex II

### Comparison of leaching behaviour of recycled materials with leaching of primary materials

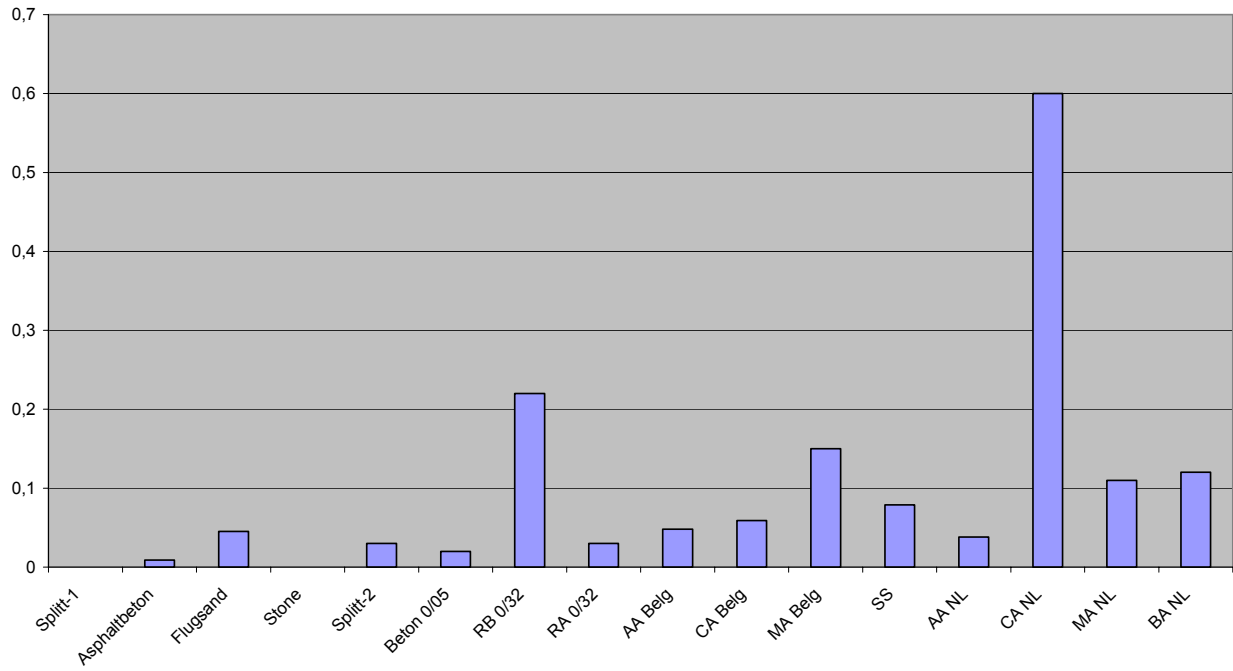
**Explanation to the graphs**

Splitt-1	Primary stone material Netherlands
Asphaltbeton	Primary asphaltbeton Netherlands
Flugsand	Primary sandy material Netherlands
Stone	Primary Stone Netherlands
Beton 0/05	Primary concrete Austria
RB 0/32	Recycled concrete 0/32 Austria
RA 0/32	Recycled asphalt 0/32 Austria
AA Belg	Recycled asphalt aggregates Belgium
CA Belg	Recycled concrete aggregates Belgium
MA Belg	Recycled mixed aggregates Belgium
SS	Recycled sieve sand Belgium
AA NL	Recycled asphalt aggregates Netherlands
CA NL	Recycled concrete aggregates Netherlands
MA NL	Recycled mixed aggregates Netherlands
BA NL	Recycled masonry aggregates Netherlands

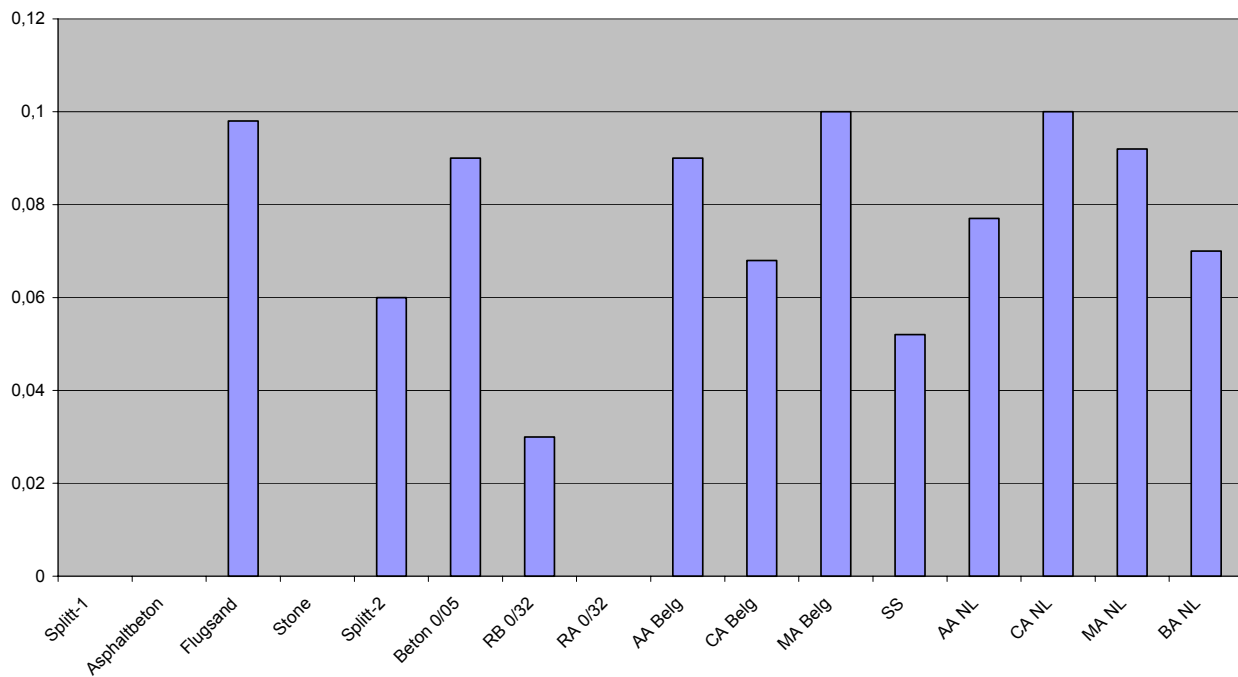
**Cd primary vs. recycled**



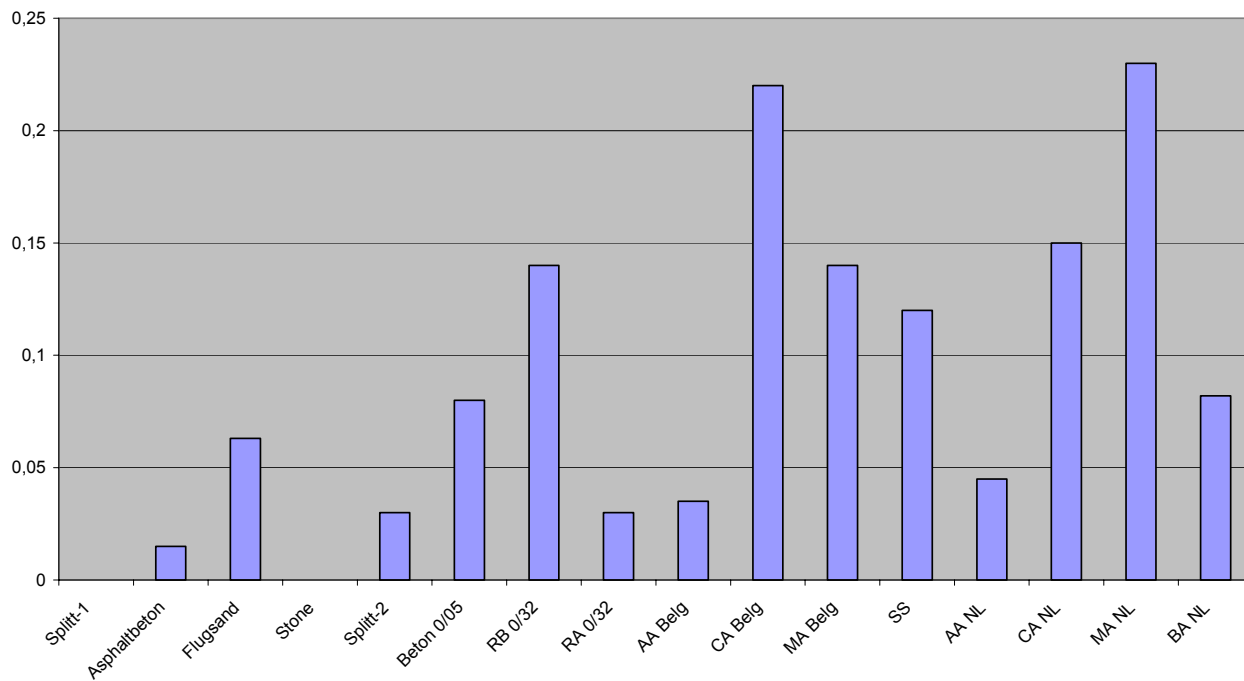
Cr primary vs. recycled



Pb primary vs. recycled



**Cu primary vs. recycled**



**SO4 primary vs. recycled**

