



End-of-Waste Criteria for Waste-Derived Aggregates

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- **What is EoW, and what are the conditions for a waste material to qualify for EoW status?**
- **EoW criteria for aggregates?**
- **Leaching criteria for aggregates, based on free use**
- **Leaching criteria for aggregates, based on restricted or conditional use (examples)**
- **Conclusion**

According to Article 6 (1) of the Waste Framework Directive (2008/98/EC), a waste material (substance or object) may cease to be waste as defined in the WFD* when it has undergone a recovery, including recycling, operation and complies with specific criteria to be developed in accordance with the following conditions:

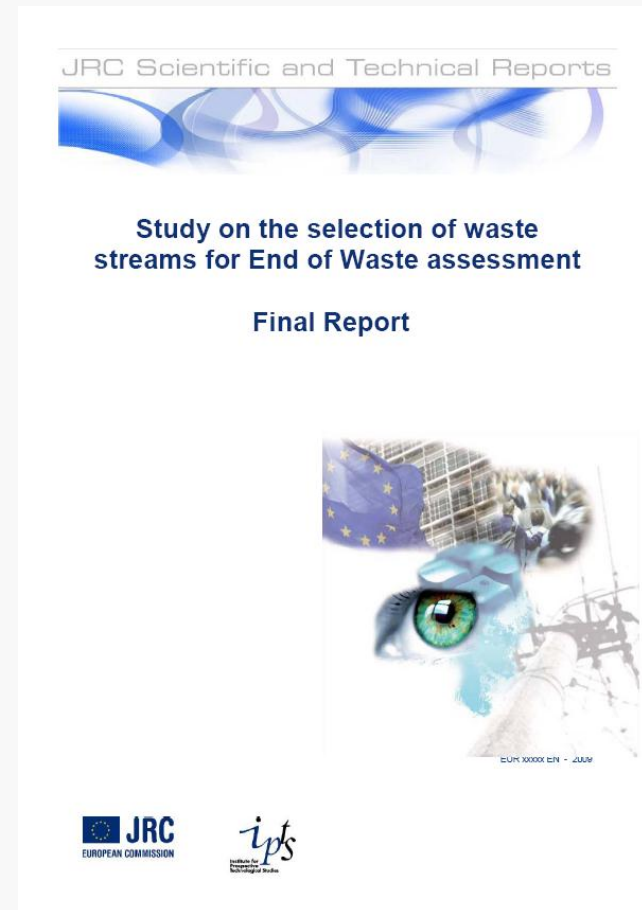
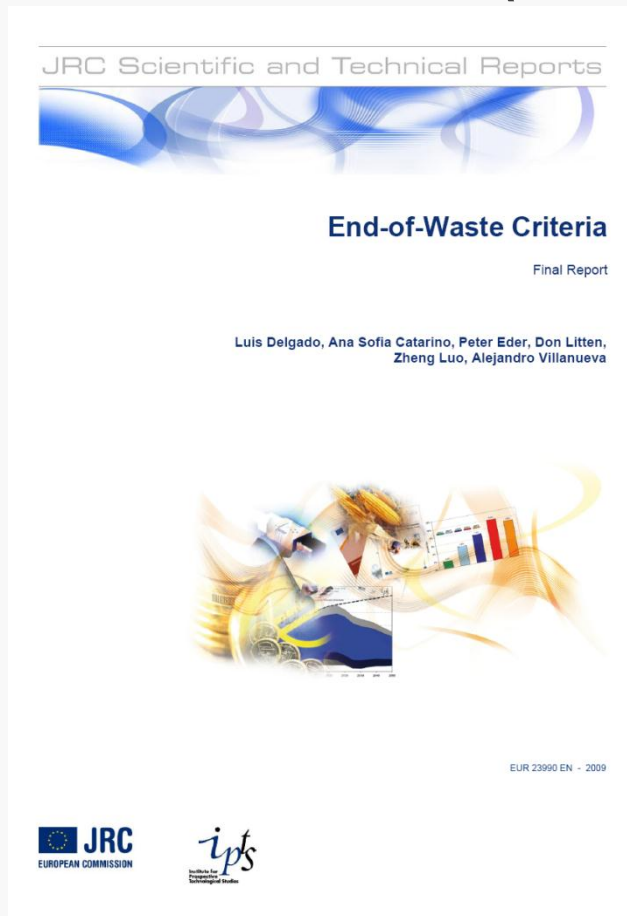
- a) the material is commonly used for specific purposes;
- b) a market or demand exists for such a material;
- c) the material fulfils the technical requirements for the specific purposes and meets the existing legislation and standards applicable to products;
- d) the use of the material will not lead to overall adverse environmental or human health impacts.

The criteria shall include limit values for pollutants where necessary and shall take into account any possible environmental effects of the material.

*at EU or national level

EoW initiatives within the EU

The EU Commission (JRC i Sevilla, Institute for Prospective Technological Studies) is responsible for the development of EoW criteria within the EU and has produced two reports on the implementation of EoW (2009)



The JRC-IPTS reports



Define the EoW concept, develops an overall methodology for classification of candidates for EoW status, and identify the most suitable candidates for non-waste classification. Three different types of waste streams are identified:

- I Streams that are in line with the basic principles of EoW and suited for further *EoW criteria assessment*;
- II Streams that may be in line with the principles;
- III Streams that are not considered appropriate for EoW classification.

EoW initiatives at EU level

The first category of waste streams has been further divided into two sub-categories, namely:

- I.1): Streams used as feedstock in industrial processes, a pathway that controls the risks of health and environmental damage. These streams include **metal scrap of iron and steel, aluminium,*** copper, plastics, paper, textiles, glass, metal scrap of zinc, lead and tin, other metals;
- I.2) Streams used in applications that imply direct exposure to the environment. In these cases, the EoW criteria to be developed in the further assessment shall include where necessary limit values for leaching pollutants, taking into account any possible adverse environmental and health effects. The streams in this subcategory include: Waste **aggregates** (e.g. C&D waste, steel slags, phosphorous slag, CFA, MSWI BA, granulated tyres), biowaste materials stabilised for recycling.

***Council Regulation (EU) No 333/2011 of 31 March 2011**

Some of the consequences of EoW



A waste material (such as, for example, a waste-derived aggregate) which is declassified by achieving EoW status is no longer subject to waste legislation.

It becomes a product, and subject to product legislation, i.e. the Construction Products Directive (CPD) and its successor, the Construction Products Regulation (CPR) – and the associated harmonised European Product Standards. Existing national legislation on the use of construction products also applies.

Environmental test methods associated with CPD are currently being produced by CEN/TC 351 (implementing ER3). Whereas the test methods are/will be harmonised at EU level, the environmental criteria to be met by construction products are national (and with few exceptions non-existent).

The relationship of waste-derived aggregates with EoW status with REACH is partly unclarified.

Condition d) - Protection of the environment and human health: EoW criteria for aggregates (limit values for leaching)



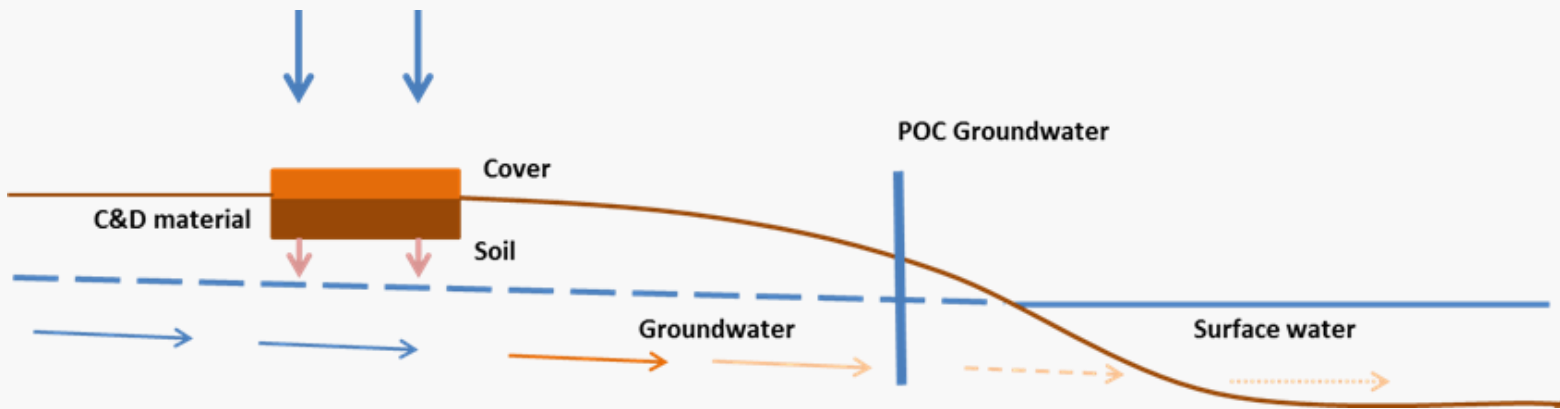
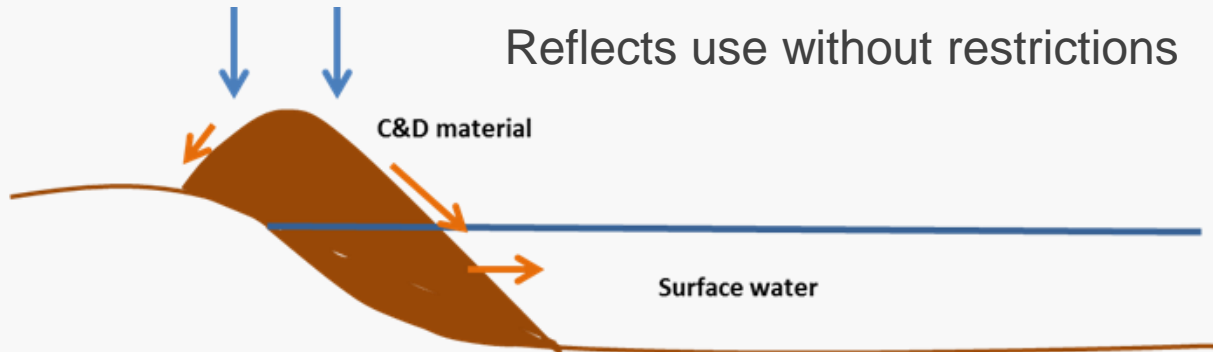
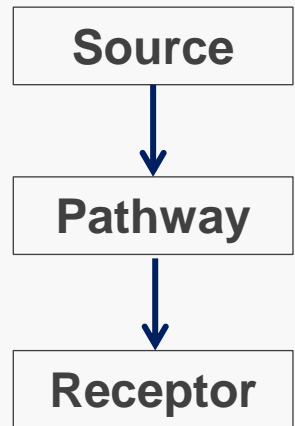
Criteria/limit values should be based on risk/impact assessment:

- Protection of the environment (groundwater, surface water, soil):
Primarily leaching
- Protection of humans (contact, ingestion, etc.): Primarily content

Two very different use situations may be identified for waste-derived aggregates with EoW status :

- Beneficial use **without** restrictions or conditions on the use (free use)
- Beneficial use **with** restrictions/conditions imposed on the use

Utilisation scenarios for assessment of environmental impact (examples)



Reflects use with certain conditions (e.g. limits on height, length, width, distance to surface water or groundwater, infiltration)

Same basic principle as used in setting EU WAC for landfilling

Use without restrictions will require relatively stringent leaching criteria (example based on porewater concentrations)



Substance	WQC	Calculated limit values		EU Inert waste landfill WAC
		L/S=0.2 kg/l	L/S=10 l/kg	L/S = 10 l/kg
	mg/l	mg/kg	mg/kg	mg/kg
Chloride	15	3	28	800
Fluoride	1.5	0.3	6.2	10
Sulphate	30	6.0	90	1000
As	0.0003	0.000060	0.0026	0.5
Ba	0.0093	0.0019	0.049	20
Cd	0.00002	0.000004	0.000042	0.04
Cr	0.0003	0.00006	0.0014	0.5
Cu	0.012	0.0024	0.041	2
Hg	0.000005	0.000001	0.00004	0.01
Mo	0.02	0.004	0.057	0.5
Ni	0.001	0.00020	0.0034	0.4
Pb	0.00034	0.000068	0.0012	0.5
Sb	0.002	0.0004	0.012	0.06
Se	0.01	0.002	0.027	0.1
Zn	0.0031	0.00062	0.011	4
DOC	3	0.6	15	500
Phenol	0.1	0.02	0.33	1

Examples of conditions that could be imposed on the use of aggregates with EoW status

No	Imposed condition	Source	Pathway	Receptor
1	The material can only be used for specified purposes	Can be influenced	Can be influenced	May determine which receptors are relevant
2	Take back the material after service life	Reduction in the time span to be considered	Not affected	Not affected
3	Minimum distance to groundwater level	Not affected	Attenuation in the unsaturated zone may be taken into account	Depends on POC
4	Minimum distance to surface water	Not affected	Attenuation in the unsaturated zone and the aquifer may be taken into account	Depends on POC
5	Restrictions on height of application	May reduce source term	Not affected	Not affected
6	Restrictions on the length and width of the application	May reduce the source term	Not affected	Not affected
7	Restrictions on allowed rate of infiltration	Reduction of the flux (the load per time unit)	Not affected	Not affected

A step-wise, scenario-based procedure for development of leaching limit values is proposed (same principle as EU inert landfills but different conditions).

When scenario calculations have been performed, the results should be adjusted to other considerations (existing legislation, corrosion, interaction between substances)

Examples of use scenarios with restrictions and conditions



Scenario conditions	Road scenario	Noise barrier/ramp scenarios	
		A	B
Height (m)	1	10	10
Length (m)	∞	100	12
Width (m)	14	100	12
Infiltration (mm/year)	350	350	350
Thickness unsaturated zone (m)	2	2	2
Distance to POC (m)	30	30	30

Examples of leaching limit values for use of aggregates with conditions (L/S = 10 l/kg)



Substance	Road scenario	Noise barriers/ramps		Un-restricted	EU WAC inert waste landfill
		Scenario A	Scenario B		
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Chloride	580	103	640	28	800
Fluoride	200	26	160	6.2	10
Sulphate	2000	340	2100	90	1000
As	0.096	0.011	0.068	0.0026	0.5
Ba	3.4	0.256	2	0.049	20
Cd	0.011	0.00041	0.0022	0.000042	0.04
Cr	0.17	0.0092	0.052	0.0014	0.5
Cu	29	0.90	4.4	0.041	2
Hg	0.0018	0.00018	0.0011	0.00004	0.01
Mo	8.1	0.41	2.3	0.057	0.5
Ni	0.55	0.025	0.139	0.0034	0.4
Pb	0.83	0.025	0.12	0.0012	0.5
Sb	0.49	0.054	0.33	0.012	0.06
Se	1.7	0.13	0.80	0.027	0.1
Zn	1.7	0.079	0.44	0.011	4
DOC	340	55	350	15	500

Conclusions (1/2)



- The WFD (2008/98/EC) provides an opportunity to declassify waste to become products (End-of-Waste), subject to certain conditions.
- One of the conditions is that the use of the resulting product must not lead to overall adverse environmental or human health impacts, and appropriate limit values shall be developed to ensure this.
- Waste materials obtaining EoW status are no longer subject to waste legislation, as products their use is regulated by the CPD/CPR. Test methods are European but limit values are national. Very few member states have environmental limit values pertaining to construction products.
- The Dutch Soil Quality Decree does not distinguish between products and waste – recommendable!
- Waste aggregates are under consideration by the Commission for possible development of common EoW criteria for the EU.

Conclusions (2/2)

- Protection against environmental impacts should be based on leaching properties, i.e. limit values set by scenario-based impact modelling using the source-pathway-receptor chain principle. Protection against human health effects should be based on limit values on the content of potentially harmful substances.
- Few waste-derived aggregates are likely to comply with the stringent leaching limit values associated with free use.
- It is proposed to include restrictions and conditions on the use of aggregates with EoW status. A step-wise, scenario-based risk assessment procedure for development of leaching limit values that take these conditions into account is proposed (same basic principles as development of EU landfill WAC).