

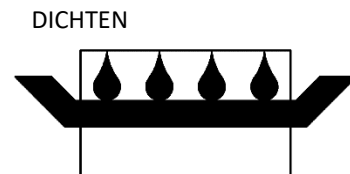
- Geosynthetics and environment -

The horizontal dynamic surface leaching test for the release of dangerous substances from building products

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- Initial situation
- Series of standards – construction products:
Release of dangerous substances
- Dynamic Surface Leaching (DSL)-
Test
- Chemical analysis of the eluates
- Biological analysis of the eluates
- Perspectives for geosynthetics

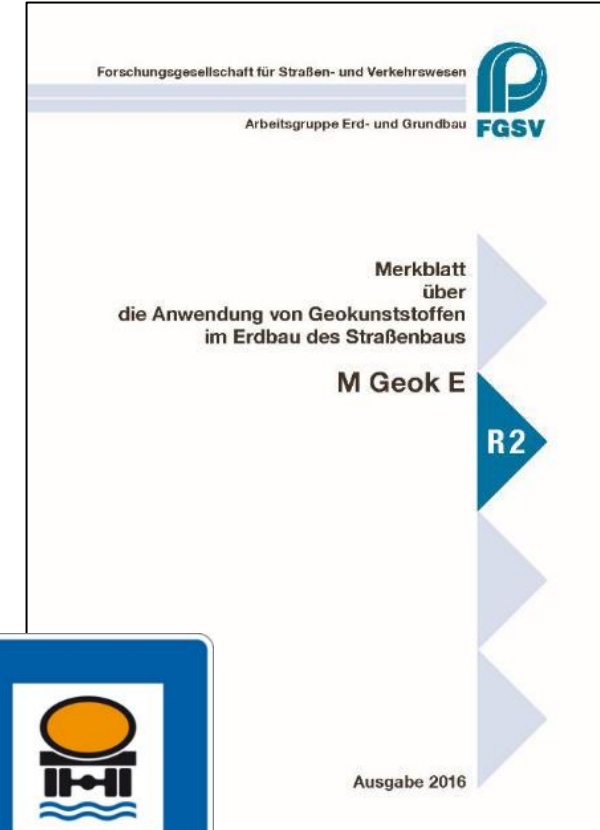


Initial situation

1.4 Environmental safety

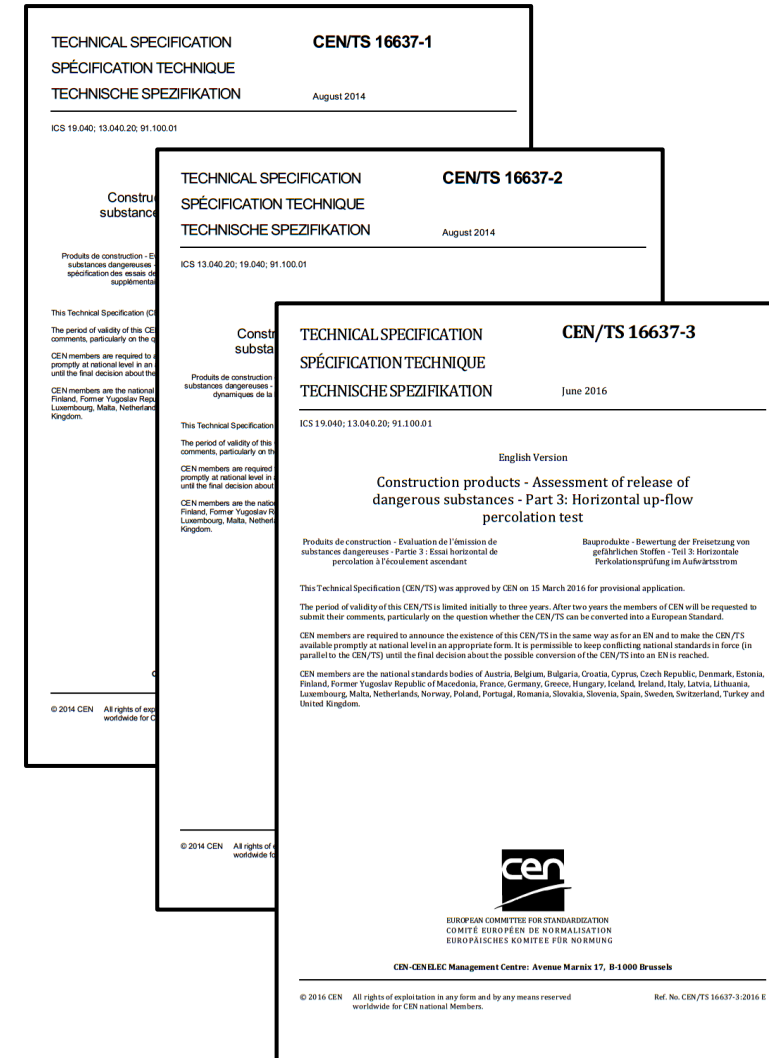
The environment is a valuable asset that must be protected. The Code of Practice is the only document in Germany that explicitly refers to the impact of geosynthetics on the environment and shows a way to assess environmental safety. In order to remain in the terminology of geotechnics and to obtain results comparable with the assessment of soils, the assessment of the environmental safety of geosynthetics is carried out according to the Federal Soil Protection Ordinance (BBodSchV, 2017). By converting the mass per unit volume of geosynthetics in relation to one cubic metre of soil, the liquor ratio of water to soil was modified in such a way that it does justice to the unfavourable case of use of geosynthetics in earthworks in road construction and thus an assessment can be made on the basis of the limit values of the soil-water pathway of the (BBodSchV, 2017). In the meantime, this approach has also become established in railway traffic route construction and hydraulic engineering and can be found in the corresponding regulations and recommendations of the responsible federal authorities and institutions.

Inorganic substances	[µg/L]
antimony	10
arsenic	10
lead	25
cadmium	5
chromium, total	50
chromate	8
cobalt	50
copper	50
molybdenum	50
nickel	50
mercury	1
selenium	10
zinc	500
tin	40
cyanide, total	50
cyanide, easily purgeable	10
fluoride	750
Organic substances	[µg/L]
TOC [mg/L]	20
petroleum derived hydrocarbon	200
arenes	20
benzene	1
volatile halog. Hydrocarbon	10
aldrine	0.1
DDT	0.1
phenole	20
PCB, total	0.05
PAH, total	0.2
naphtalene	2



Produkt lfd Nr.	Produkt	Herstellen von Probekörpern für DSLT-Versuche				Herstellung der Eluate				Messwerte für vereinigte Eluate				
		Datum	Vorgehen	Format cm	Fläche cm ²	Datum (Start)	Wasser- volumen Testansatz ml	Testgefäß	V/A-Verhältnis ml/cm ²	TOC mg/l	pH	Leitfähigkeit µS/cm	Kationen	Anionen
HSR-9	PEHDMonofil (Geotextil)	17.6.13	Zuschnitt	8 cm x 12.5 cm	100	17.6.13	200	GS: 1 L	2	3,1	6 - 7	4,5	nicht analysiert	
HSR-10	PET Multifil mit Polymerschicht (Geotextil)	17.6.13	Zuschnitt	8 cm x 12.5 cm	100	17.6.13	200	GS: 1 L	2	7,8	6 - 7	11,6		
HSR-11	HDPE Gitter (Geotextil)	17.6.13	Zuschnitt	8 cm x 12.5 cm	400	17.6.13	200	GS: 1 L	0,5	4,2	5,8	6,1		
HSR-12	Kern: Polyamid Monofilament, Auflagen: PP Vlies / PVC-Bahn (Geotextil)	17.6.13	Zuschnitt	8 cm x 12.5 cm	n.b.	17.6.13	200	GS: 1 L	2	46,9	6,5	15,5		
HSR-13	Kern: HDPE Gitter, Auflagen: PP Vlies, (Geokomposit)	17.6.13	Zuschnitt	8 cm x 12.5 cm	200	17.6.13	200	GS: 1 L	1	5,5	6,7	15,5		
HSR-14	PET Multifil mit Polymerschutzmantelung (PVC) (Geogitter)	17.6.13	Zuschnitt	8 cm x 12.5 cm	80	17.6.13	200	GS: 1 L	2	11,6	6,5	11,3		

- Mandat M366 of CEN/TC 351 with horizontal effect, i.e.
- tests methods apply to all construction products
- methods have to be applied to geosynthetics as well.
- Published so far as Technical specifications
- Draft standards are being prepared, since 2021 as draft version available and will be possibly finalised within the European framework
- The maximum permissible leaching is laid down for all conceivable hazardous substances in Directive EU 2020/2184



- CEN/Technical Committee (TC) 351 - Construction Products – Assessment of release of dangerous substances
 - Working Group (WG) 1 - Release from construction products into soil, ground water and surface water
 - WG 2 - Emissions from construction products into indoor air
 - WG 3 - Radiation from construction products
 - WG 4 - Terminology
 - WG 5 - Content and eluate analysis in construction products
- CEN/TC 189 - Geosynthetics
 - WG 1 - Geotextiles and geotextile-related products - General and specific requirements, Project Group (PG) – Dangerous substances

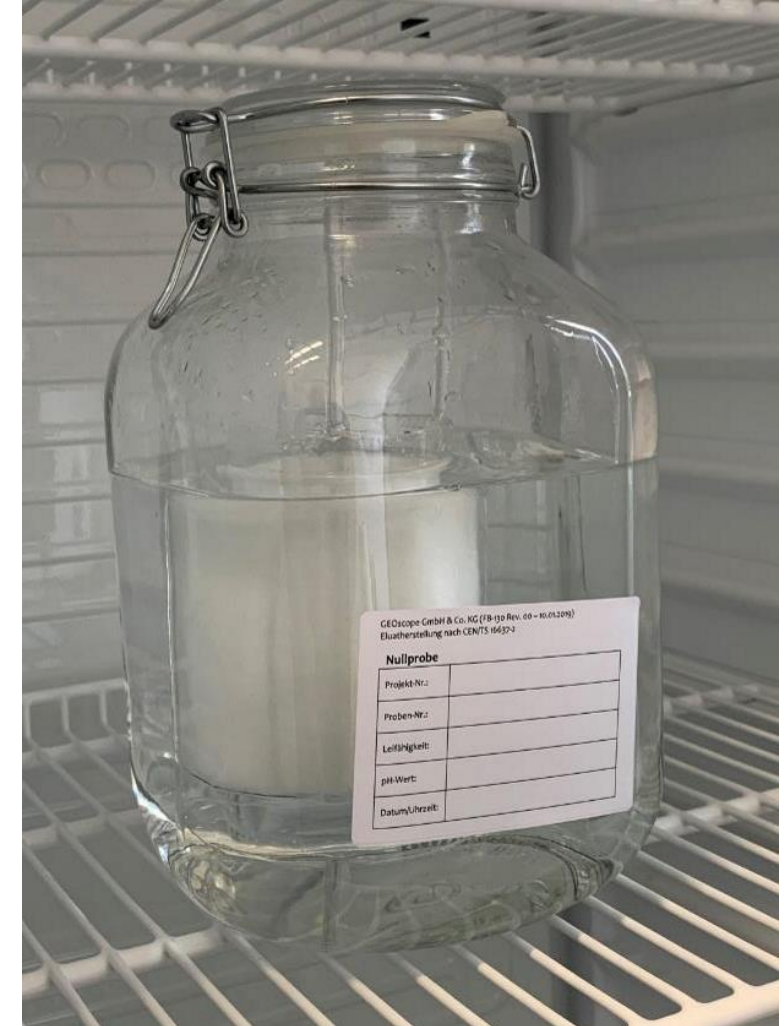
- prEN 16637-1:2021 Construction products - Assessment of release of dangerous substances - Part 1: Guidance for the determination of leaching tests and additional testing steps
- prEN 16637-2:21 Construction products - Assessment of release of dangerous substances - Part 2: Horizontal dynamic surface leaching test
- prEN 16637-3:2014-12 Construction products - Assessment of release of dangerous substances - Part 3: Horizontal up-flow percolation test

Include in the Initial Type Testing et cetera in CEN application standards. The final evaluation is left to the nation states, while the examination is regulated at European level



- Determination of the actual surface, i.e. in the case of nonwovens (GTX-N) the fibre surface determined by fibre titre or computer tomography (especially in the case of thermally bonded nonwovens) Geosynthetic Barriers -Polymeric (GBR-P), Waterproofing membranes) => surface of the panel
- Geogrids (GGR) => measuring the surface or scanning
- Volume-to-surface ratio in litres/m²
- Monolithic materials 80 (±10) L/m²
- Plated materials > 20 L/m²
- However, smaller values can also be used, as the results are then on the safe side
- Surface area at least 100 cm² (platy building products)
- Distance of 20 mm to the wall of the container

- Basically, container made of glass or plastic can be used
- However, since both inorganic and organic compounds are analysed here, the use of glass containers is indicated
- In order to reduce the CO₂ – absorption from the air, the containers should be closable
- Storage temperature between 19 °C and 25 °C
- Additionally: cooling down the eluate to 6 °C after completion of the leaching process until chemical analysis and biological testing (eventually freezing it)





- Requirements for the water to be used
- Water class 3 according to ISO 3696 with a conductivity < 0.5 mS/m
- For the analysis of organic compounds the water can be stabilised with e.g. sodium azide to prevent respectively to delay biodegradation
- The analysis of substances that are dissolved out of geosynthetics is very sensitive, so that they can be overlaid by impurities of the leaching agent, so that investigations should be carried out with water of class 2 according to ISO 3696 and a reference measurement should ensure a conductivity < 0.1 mS/m

Determination of the characteristic dischargeable substances per surface unit [mg/m²]

Table A.1 — Renewal times of the leachant

Step/fraction	Duration of the specific step	Duration from the start of the test (t_0)
1 ^a	6 h ± 15 min	6 h
2	18 h ± 15 min	1 day
3	1 day and 6 h ± 45 min	2 d and 6 h
4	1 day and 18 h ± 75 min	4 d
5	5 d ± 75 min	9 d
6	7 d ± 75 min	16 d
7	20 d ± 7 h	36 d
8	28 d ± 12 h	64 d

^a Step 1 is described in A.6.2.

TECHNICAL SPECIFICATION **CEN/TS 16637-2**
 SPÉCIFICATION TECHNIQUE
 TECHNISCHE SPEZIFIKATION August 2014

ICS 13.040.20; 19.040; 91.100.01

English Version

Construction products - Assessment of release of dangerous substances - Part 2: Horizontal dynamic surface leaching test

Produits de construction - Évaluation de l'émission de substances dangereuses - Partie 2: Essais horizontaux et dynamiques de la lixiviation des surfaces
 Bauprodukte - Bewertung der Freisetzung von gefährlichen Stoffen - Teil 2: Horizontale dynamische Oberflächenausprüfung

This Technical Specification (CEN/TS) was approved by CEN on 25 February 2014 for provisional application.

The period of validity of this CEN/TS is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the CEN/TS can be converted into a European Standard.

CEN members are required to announce the existence of this CEN/TS in the same way as for an EN and to make the CEN/TS available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force (in parallel to the CEN/TS) until the final decision about the possible conversion of the CEN/TS into an EN is reached.

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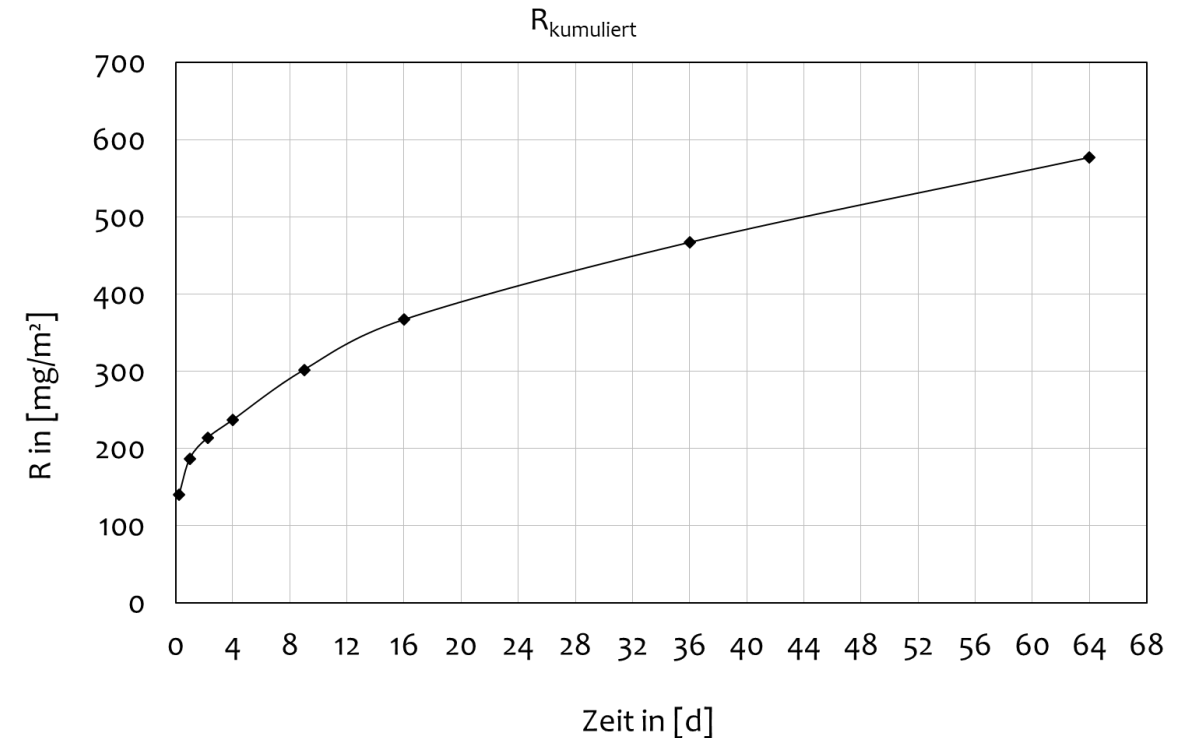
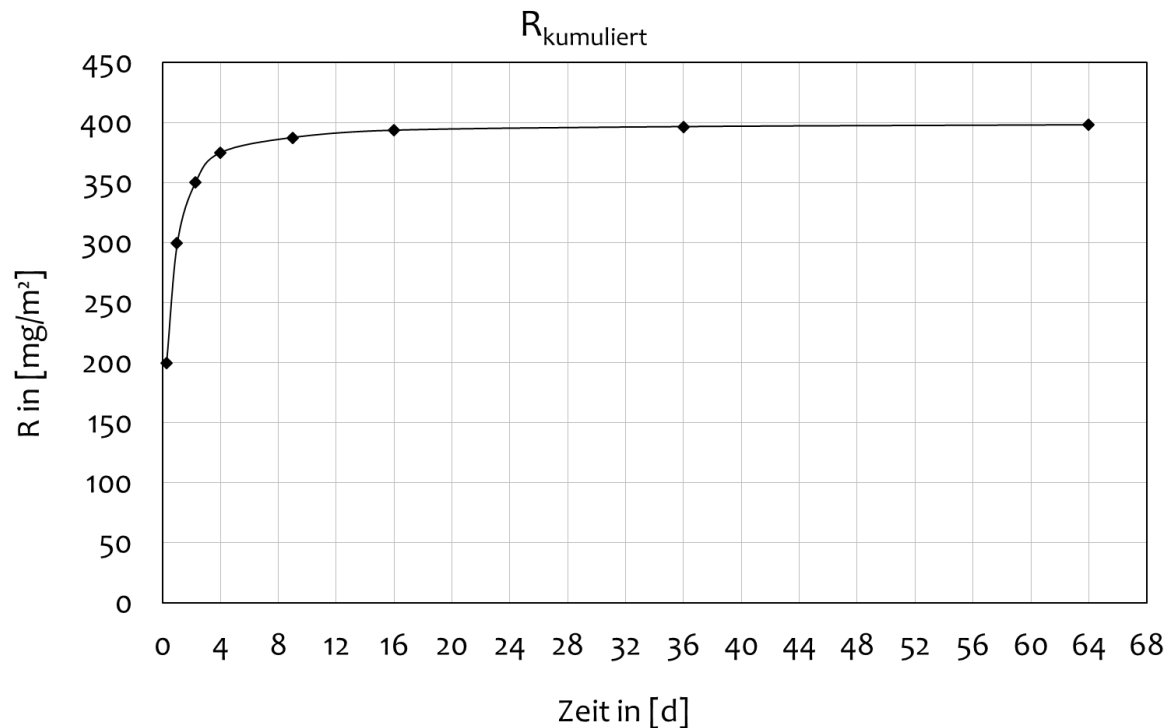


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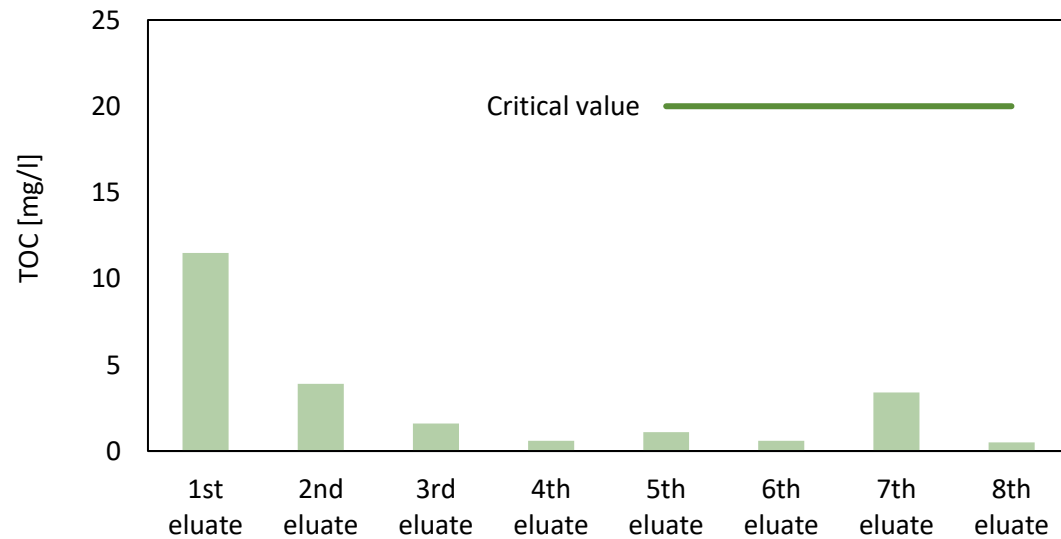
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Exemplary evaluation of the determined concentration of the surface leaching of a substance over the surface of the material in contact with water for the total duration of the investigation of 64 days according to prEN 16637-2

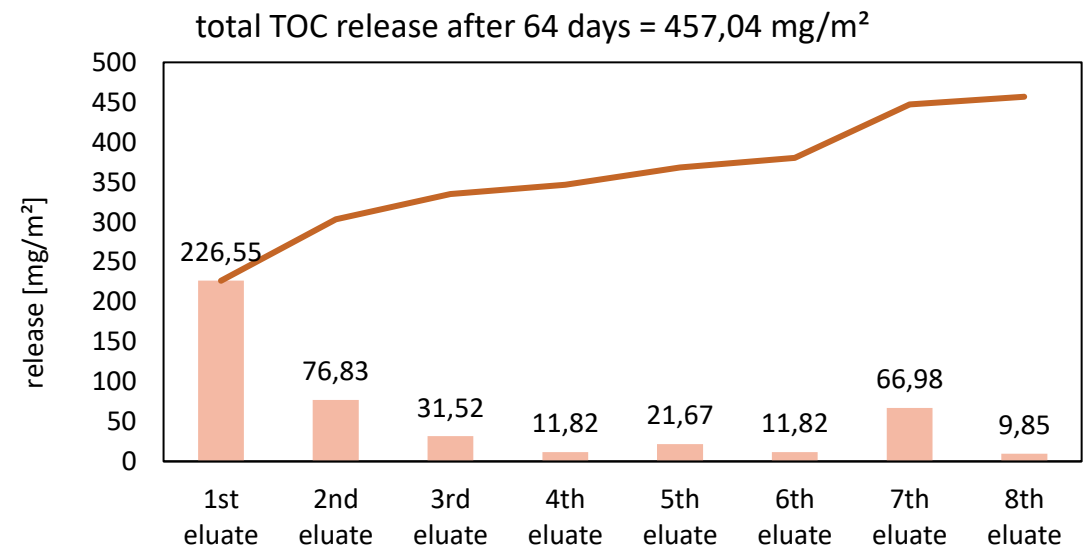


Application of the Total Organic Carbon (TOC)

following M Geok E-StB



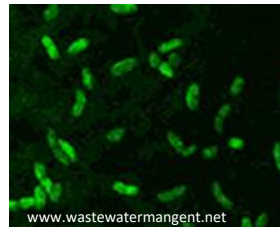
according to prEN 16637-2



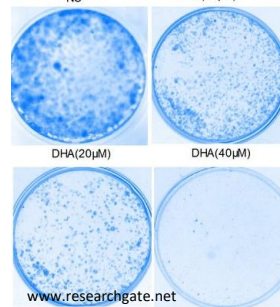
ISO 6341: Determination of the acute toxicity to *Daphnia magna* Straus (Cladocera, Crustacea)



ISO 11348-2: Determination of the inhibitory effect of water samples on the light emission of *Vibrio fischeri* (Luminescent bacteria test) — Part 2: Method using liquid-dried bacteria

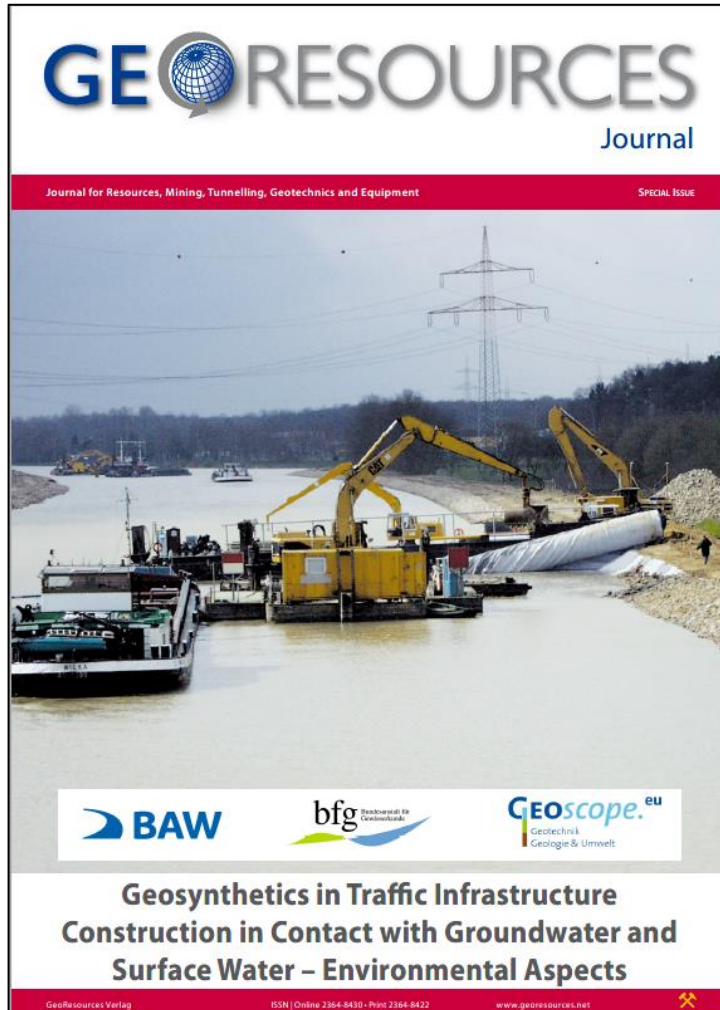


DIN 38412-37: Tests on aquatic organisms (Group L) - Part 37: Determination of the inhibition effect of water on the growth of bacteria (*Photobacterium phosphoreum*; cell multiplication inhibition test) (L 37)



DIN 38412-33: Determination of the non-toxic effect of waste water on green algae (*Scenedesmus* chlorophyll fluorescence test) via dilution steps (L 33)





For road tunnels, the specifications in ZTV-ING Part 5 Section 5 and the associated TL/TP KDB and TL/TP SD [9] apply. The environmental safety must be proven in accordance with the BBodSchV, analogous to [6]. In addition, specifications are made for the resistance to leaching of plastic geomembranes. The EAG-EDT [10] also recommends that DEHP (diethylhexyl phthalate), BBP (benzyl butyl phthalate) and DBP (dibutyl phthalate) should not be used as plasticisers in PVC geomembranes.

Not all plastic-specific substances are included in the checklists available in Europe and overseas – there are also additional or simply other aspects and effects to be considered...



Testing lists for polymeres do not cover alle substances in their receipty

Geosynthetics are different from soil

Weight up consideration on plastic-specific lists of test values and procedures against general applicable approaches

Concentration of substances from geosynthetic lies within the determination limits of generally accessible test equipment and methods

Indicators that justify a shorter test procedure and a reduction in the number of eluates to be tested, e.g. TOC resp. DOC, conductivity, pH-value