Landesanstalt für Umweltschutz Baden-Württemberg

Ökologische Umweltbeobachtung 2e

Ecotoxicological characterization of waste – Method development for determining the „ecotoxicological (H14)“ risk criterion

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Dr. K. Deventer, Dr. J. Zipperle

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Within the scope of this feasibility study, the following references were considered:

R. Kostka-Rick: Ökotoxikologische Charakterisierung von Abfällen – Literaturstudie, 2002.

Fa. ÖkoTox: Durchführung von Pflanzentests mit Abfallproben, 2003.

Fa. TÜV-Süddeutschland: Feststoff-Analytik von Abfällen, 2003.

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1 Summary

The Directive on hazardous waste 91/689/EEC names 14 criteria for the characterization of hazardous wastes. For the definition of the criterion H14, relevant for waste (ecotoxic), there are, so far, no measuring procedures and/or corresponding indications adapted to the substrate „waste". However in the future particular importance will be attributed to the criterion H14 for the estimation of the environmental hazards originating from certain types of waste.

In order to cover the time period between the enforcement of the European Waste List on 1.1.2002 and the availability of usable methods for waste probing through biotests, the Ministry for Environment and Transport Baden-Württemberg has published a Preliminary Implementation Manual (October 2002) with wich, mainly supported by chemical analysis, the ecotoxicity should be illustrated. With this the enforcement of the European Waste List should be made possible.

With this project accomplished on behalf of the Ministry for the Environment and Transport Baden-Württemberg (MET) the content of the Preliminary Implementation Manual were examined for plausibility. A literature study conducted in this context (Kostka-Rick 2002) documents the current state of research and the developments in the area of ecotoxicological waste characterization in view of the suitability for the enforcement, in particular, within the course of the European standard development.

Standardised biotest procedures and those already successfully used in other domains were employed for the ecotoxicological characterization of hazardous wastes. Besides the ecotoxicological examination of the original sample and the waste eluate, an extensive chemical analysis was also conducted.

The procedures were examined for their reproducibility, suitability as a routine test and information content, and recommendations regarding the execution of the Directive 91/689/EEC, criterion H14, concerning hazardous wastes, were derived.

The examined waste samples, predominantly determined as hazardous, demonstrated a very wide range of toxicity, from non-toxic up to very toxic. Some samples were also genotoxic. The involved procedures originating from the aquatic field proved to be suitable as well and are recommended for the ecotoxicological examination of waste eluates. Regarding the procedures for sediment examination, the fundamental suitability of the methods was shown; however the methodology must still be adapted to the testing of wastes. For the evaluation, the biotest results were classified into three classes. By means of the toxicity ranges 1-3 the wastes were divided in hazardous and/or non hazardous wastes. The classification, based on the toxicity ranges hazardous or non hazardous, did not coincide for all samples with the classification according to the Preliminary Implementation Manual of the state. The criterion H14 - ecotoxic – is only depicted by the ecotoxicological test procedures since complex samples usually contain more than one pollutant.

Based on the available investigation of 24 waste types originating from different industrial sectors with 6 different biotest procedures, it is suggested to use a minimum test battery consisting of an aquatic test procedure, the algae test, and two procedures for solid phase examination, the plant test and the bacteria contact test.

The introduction of a limit test, instead of the more complex G-value determination by means of dilution series, reduced the test extent further and, thus, the analysis costs. With the approaches described in this study the criterion H14 of the EEC Directive 91/689/EC concerning hazardous wastes is manifestly and economically defined, and a comprehensible waste classification into the category hazardous and/or (only) non-hazardous, depending on their ecotoxicological effect, is made possible.

2 Introduction

The Directive 91/689/EEC on hazardous waste names 14 criteria - H1 to H14 – for the description of hazardous waste products. For the determination of criterion H14 (ecotoxic) there is so far no measuring method adapted to the substrate “waste” and no allowed limit value. In the appendix of the Standards of the European Committee for Standardisation (CEN 2002) ecotoxicological testing procedures are described that seem adequate for the assessment of hazardous wastes.

The ecotoxicological risk potential of waste is best described using biological test methods. Also in the wastewater directive, the ecotoxicological test methods have become more significant for the evaluation of certain wastewater types. There clear limit values are set for the assessment of toxicity of wastewater produced by the chemical industry (Appendix 22 to the wastewater ordinance based on Article 7a of the Federal Water Act).

On the national and/or international level, there are standardised test protocols for a series of biological test methods that assure reproducible results. At the present moment, other bioassays are being considered in national and /or international standardisation procedures.

The biological test method used for regulating purposes must respond to requirements such as standardisation (DIN, CEN and ISO), routine suitability, economy and reproducibility. A substantial battery of ecotoxicological tests should consist of test organisms coming from different food chain levels (destruents, producers, consumers) and capture the end points acute and chronic toxicity.

The literature study conducted within the scope of this project summarizes the current state of the research and the use of ecotoxicological test methods for the evaluation of waste toxicity (Kostka-Rick 2002). While in few cases a direct, solid-waste-oriented ecotoxicological characterization was first realized with terrestrial biotests, aquatic bioassay methods are widely used for the evaluation of waste eluates or landfill leachate. In view of the large variety of methods, a standardised procedure for the collection of waste eluates is a fundamental condition for a uniform ecotoxicological evaluation of wastes based as well on chemical analysis as on biological methods.

Besides a clear emphasis on aquatic rather than on terrestrial bioassay methods, significant differences in the handling of e.g. waste eluates used in biotests were noticed. Hereby, as well as for the optimization and determination of adequate, i.e. ecotoxicologically substantial test batteries that are also economical, a clarification is still necessary before a norm can be defined.

Numerous current developments, on the one hand in the domain of terrestrial bioassay methods which originate principally from polluted soils and sediments, and on the other hand in the miniaturisation and the rationalisation of various standard test systems - while maintaining the validation criteria - promise a rational and thus economical use for routine operation in the future.

As little experience with ecotoxicological methods for the evaluation of risk potentials of wastes exists, in this project standardised bioassay methods and those already proven in other fields (e.g. wastewater) were tested on selected waste types. In addition, two terrestrial test systems, which up to now were barely or not at all employed for the determination of waste ecotoxicity, were used. All of the samples, sediments as well as eluates, underwent a chemical analysis. The waste samples were collected thanks to the kind support of the Factory inspectorates and of the waste producers. The classification into hazardous wastes through ecotoxicological characterization is compared with the classification based on Preliminary Implementation Manual by the State of Baden-Württemberg. A methodological proposition for the realization of the criterion H14 is presented.

3 Principle of bioassays

The toxicity of waste samples and /or of waste eluates is assessed according to several dilution steps in the respective test system (Table 1). Thereby the sample is repeatedly diluted until no further toxicity can be detected.

Effect threshold

For each biological test system a test-specific effect threshold level beyond which an effect is considered toxic is fixed. It means, for example, in the luminescent bacteria test, that the light emission intensity must have decreased by at least 20 % before this effect is considered toxic. If the reduction of the light emission intensity is below 20 %, then this effect is not called a toxic effect. For the daphnia test the effect threshold is at 10 %. For the algae, luminescent bacteria, bacteria contact and plant tests the effect threshold is at 20 %.

Dilution steps

The waste eluates are diluted with dilution water, in the solid phase test the solid matter samples are diluted with the appropriate control medium (e.g. sand or standard soil).

Table 1: Dilution steps in the bioassay and G-values.

Dilution	Dilution step G-value	Mix ratio sample + diluant	sample proportion in test formulation [%]	Diluant proportion in test formulation [%]
1:1	1	1+0	100	0
1:2	2	1+1	50	50
1:3	3	1+2	33.3	66.7
1:4	4	1+3	25	75
1:6	6	1+5	16.7	83.3
1:8	8	1+7	12.5	87.50
1:12	12	1+11	8.3	91.7

The dilution step of the sample (G-value) is determined, which causes no further toxix effect in the test system (Figure 1). In the daphnia test, a G-value of 6 means that the sample is diluted in a 1:6 ratio, representing a sample proportion of 16.7 % (dilutant, water proportion of 83.3 %), and indicates no toxicity above the effect threshold of 10 %.

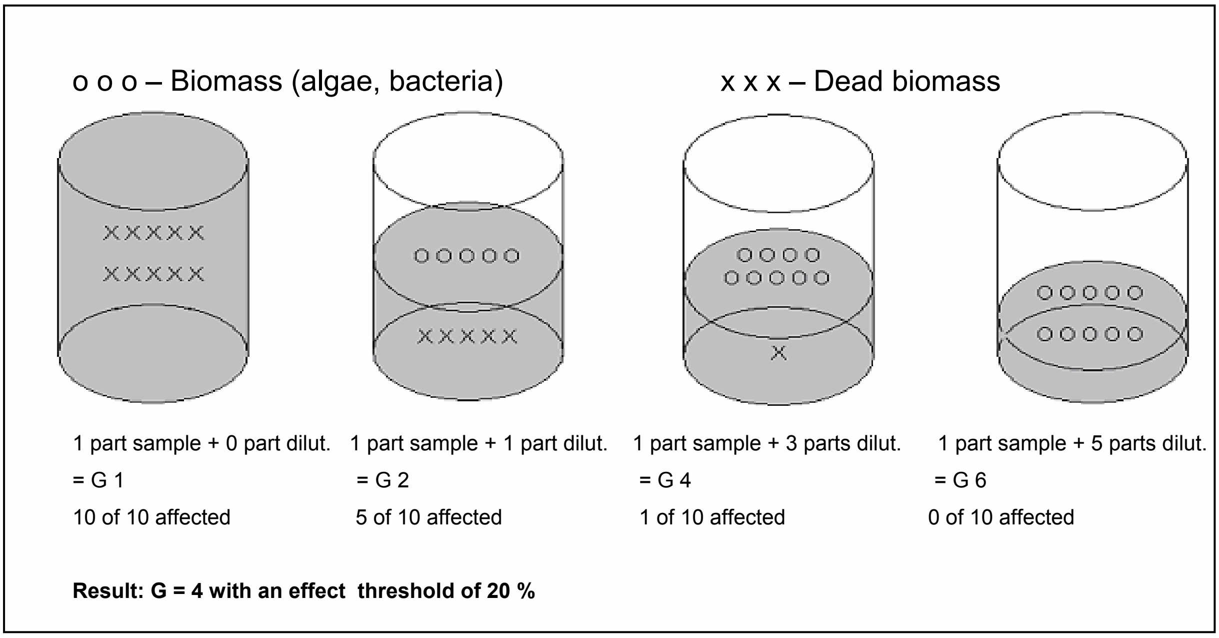

Figure 1: Principle for conducting a biotest.

In addition the EC values are indicated in the data sheets (Appendix). The EC value is, in contrast to the G-value, a calculated value that is determined from the dilution steps and the obtained effect in the biotest (e.g. by Probit analysis). The EC value stands for „effect concentration“, it describes the sample concentration (= sample share in %) which causes a defined effect in the test. Thus, for example, a sample with an EC_{20} = 25 % achieves a 20 % effect with a sample fraction of 25 %.

4 Methodology

4.1 Sample collection and conservation

The waste samples were collected at the waste-producing companies. The waste samples were temporarily stored at -20°C up to the time of testing. Altogether 24 waste samples were examined.

4.2 Sample preparation

The waste samples were homogenized, and appropriate sample fractions were taken for the investigation. The samples were ground and used without any additional sample preparation to carry out the solid phase test (bacteria contact test and plant test). For the solid phase test the samples were investigated starting from dilution step 2. Quartz sand was used as diluting medium for the bacteria contact test whereas standard soil was used for the plant test.

Eluate preparation according to DIN 38414 S4
For preparing an aqueous eluate, 1 part waste, corresponding to 100 g dry matter, was suspended in 1 litre water (de-ionized) in a 2000 ml-glass flask (Schott). The suspension was rotated with 10 rpm in an overhead shaker for 24 h at ambient temperature. Fine particles were separated by centrifugation with 11 000 g at 20°C over 20 min, followed by filtration (0.45 µm). The eluate was stored at 4°C in the dark up to the testing time, however no longer than 14 days.

4.3 Selection of the biological test procedures

The aqueous eluate of all waste samples was investigated by means of the miniaturized algae test, the luminescent bacteria test, the *umu*-test and the daphnia test (DIN 38412-33, EN ISO 11348-34, DIN 38415-3 and DIN 38412-30), all DIN standardised test procedures.

In addition two terrestrial test procedures, the plant test according to OECD 208A and the bacteria contact test to DIN 38412-48, were tested, procedures which until now have hardly been used and/or are not yet used for monitoring waste toxicity. The plant test according to OECD 208A is a standardised method that was employed in the main to characterize soils and contaminated sites.

Good experiences regarding reproducibility and sensitivity were made so far with the bacteria contact test, particularly in sediment investigation (Gratzer and Ahlf 1999).

All test procedures, other than the bacteria contact test, are mentioned also in Appendix B of the European standards by the European Committee for Standardisation (CEN 2002) as possible procedures for the characterization of waste ecotoxicity.
Other test procedures developed for soil and contaminated site investigations are not suitable

for animal protection reasons or because of the long test duration (Nematode test, fish test). The chironomid toxicity test (OECD Draft document 218) was not included in the investigation program, since LFU experiences have shown that it is not yet sufficiently reproducible. Solid phase testing with luminescent bacteria was foregone, since the luminescent bacteria can adsorb onto the solid particles, thus may influence the test result. For this reason the bacteria contact test with *Arthrobacter globiformis* was selected as additional solid phase test, since this test procedure determines the toxicity through a substrate conversion in the medium and, thus the adsorption of test bacteria onto the solid particles has no influence on the test result.

Algae test according to DIN 38412-33

In the algae test the chronically toxic effect of aqueous test material is determined by measuring the biomass production of algae. The index for algae biomass is the chlorophyll fluorescence. The test algae are, in culture usually unicellular, the green alga, *Scenedesmus subspicatus* CHODAT, representative for primary producers in the plankton. The algae test was modified and miniaturized to the point that it can be performed on a micro-plate with 24 wells (test volume 2 ml).

Daphnia test DIN 38412-30

The test organism *Daphnia magna STRAUS*, a member of the Phyllopoda order, is a part of the zooplankton in stagnant waters. As a filter of particulate organic substance, it is classified in its ecological function as a consumer of lower rank between destruents (e. g. bacteria) and primary producers (Algae) on one side and consumers of higher rank (e. g. fish) on the other side. In the daphnia test, the acute toxic effect of aqueous test material is determined on *Daphnia magna STRAUS* after a testing time of 48 h.

Luminescent bacteria test EN ISO 11348-2

In the luminescent bacteria test the inhibition of the light emitted by the bacterium Vibrio fischeri through aqueous test material is measured. This bacterium represents the group of destruents.

***Umu*-test DIN 38415-3**

Using the *umu*-test, the genotoxic potential of an environmental sample is determined. The genetically modified test organism, *Salmonella typhimurium*, TA1535/pSK1002 is exposed under predetermined conditions to various concentrations of the test material. Thereby the genotoxins induce, via DNA-damage, the *umu*C-gene of the test organism which is involved in DNA-repair. The induction of the gene is detected by means of the reporter gene lacZ through the ß galactosidase activity. The induction rate of the *umu*C-gene is the measure for the mutagenic potential of the test material. The effect of substances whose metabolism can be activated was determined through addition of S9 (enzyme preparation from rat liver).

Bacteria contact test DIN 38412-48

The test, originally developed for sediment analysis, allows a direct ecotoxicological assessment of contaminated solid matter by measuring an enzyme activity (dehydrogenase activity) of *Arthrobacter globiformis*. The test allows that the effect of adsorbed pollutants in solid environmental samples may be estimated. The bacteria are directly incubated with the sediments, and the dye resazurine is converted, in the presence of the bacterial enzyme dehydrogenase, into resorufine, the concentration of which is measured by photometry. The results are available within a day. For determining the G-value, the samples are mixed in various quantities with the reference sediment (quartz sand). Testing starts from a sample concentration of 50 %. The G10- and G100 values are measured in order to be able to proceed to a ranking into toxicity classes.

Plant test according to OECD 208A

The effect of solid matter samples on terrestrial plants is examined by measuring the germination rate, the growth of spring length and the dry weight. The exposition time is 14-21 days. Two dicotyledon species *Brassica oleracea* (cauliflower) and *Lycopersicum esculentum* (tomato), and one monocotyledon specie, *Avena sativa* (oat) are tested. For the definition of the G-value the waste samples are mixed in different quantities with a reference soil (standard soil of LUFA Speyer). Testing starts from a sample concentration of 50 %.

4.4 Chemical analysis

The parameters cited below were investigated in all the waste samples according to TA Siedlungsabfall (Technical Instruction on Domestic Waste). The results are listed in the data sheets in the Appendix.

Original substance analysis

Arsenic, lead, cadmium, chromium, cobalt, copper, nickel, mercury, Zinc, AOX, carbohydrate, lipophilic, TOC, benzene, toluene, ethylbenzene, xylene, total BTEX, total PAH (16 EPA - Environmental Protection Agency) and the water soluble portion.

Eluate analysis

The eluates obtained to perform aquatic bioassays were checked for the following pollutant contents:

Arsenic, lead, cadmium, chromium, copper, nickel, mercury, zinc, manganese, AOX, DOC, NH_4-N total, PAH (16 EPA), PCB, BTEX and chlorinated hydrocarbon. In addition, selected samples were measured for chromium-(VI) and long chain hydrocarbons.

Physico-chemical Parameter

In the eluates pH value, oxygen content and electrical conductivity were measured. Before performing the biological test, the pH value and the oxygen content were adjusted, when necessary, to values appropriate for the test procedure. When the eluate underwent changes, for example through precipitation or formation of a two phase system, then they were separated.

4.5 Waste samples

The waste samples were collected directly at the industrial waste producers (Table 2). The samples were stored at -20°C.

Waste code	**Sample number**	**Waste type**	**Sampling**
		06 05 Sludge from on-site effluent treatment	
060503	**26**	Sludge from on-site effluent treatment other than those..	27.06.2002
		08 01 Waste from MFSU and removal of paint and varnish	
080111*	**27**	Waste Paint and varnish containing organic solvents or other dangerous substances	27.06.2002
080113*	**8**	Sludges from paint or varnish containing organic solvents or other dangerous substances	27.06.2002
080113*	**4**	Sludges from paint or varnish containing organic solvents or other dangerous substances	21.06.2002
080115*	**12**	Aqueous sludges containing paint or varnish containing organic solvents or other dangerous substances	12.09.2002
080115*	**19**	Aqueous sludges containing paint or varnish containing organic solvents or other dangerous substances	21.10.2002
080115*	**1**	Aqueous sludges containing paint or varnish containing organic solvents or other dangerous substances	27.06.2002
080116	**3**	Aqueous sludge containing paints and varnishes other than those ..	21.06.2002
080116	**13**	Aqueous sludges containing paint or varnishes other than those ..	12.09.2002
		10 10 Wastes from casting of non-ferrous species	
101008	**6**	Casting cores and moulds after metal pouring other than those mentioned.., moulding sand	11.07.2002
101008	**9**	Casting cores and moulds after metal pouring other than those mentioned.., core sand	11.07.2002

Table 2: tested waste types, * - mark: hazardous waste according to Directive 91/689/EC.

11 01 Wastes from chemical surface treatment and coating of metals and other materials (for ex. galvanic processes, zinc coating processes, pickling processes, etching, phosphating, alkaline degreasing and anodizing)			
110109*	**2**	Sludges and filter cakes containing dangerous substances, galvani-zation	16.05.2002
110109*	**30**	Sludges and filter cakes containing dangerous substances	27.01.2003
110110	**28**	Sludges and filter cakes other than those ..	16.10.2002
110110	**17**	Sludges and filter cakes other than those ..	16.10.2002
12 01 Wastes from shaping and physical and mechanical surface treatment of metals and plastics			
120114*	**14**	Machining sludges containing dangerous substances	12.09.2002
120114*	**7**	Machining sludges containing dangerous substances	27.06.2002
120116*	**16**	Waste blasting material containing dangerous substances	10.10.2002
120116* and 120117	**21**	Waste blasting material containing dangerous substances and waste blasting material, other than..	16.10.2002
19 01 Wastes from incineration and pyrolysis of waste			
190107*	**23**	Solid wastes from flue-gas treatment	15.10.2002
190112	**22**	Bottom ash and slag other than those..	17.10.2002
190113	**24**	Fly ash containing dangerous substances	17.10.2002
19 08 Wastes from waste water treatment plants not otherwise specified			
190813*	**18**	Sludge containing dangerous substances from other treatment of industrial waste water	17.10.2002
19 10 Wastes from shredding of metal containing wastes			
191004	**11**	Fluff-light fraction and dust, other than those..	21.05.2002

Table 2: tested waste types, * - Mark: hazardous waste according to Directive 91/689/EC – Follows.

5 Results

5.1 Sampling

The samples were taken directly from the waste collection containers of the varous locations. With heterogeneous waste both liquid and solid materials were sampled in order to obtain as representative a sample as possible. Eight of the twenty-four waste samples were paint and varnish residues from the automobile industry, four samples originated from metal surface treatment, two waste samples were moulds and/or sands from an aluminium foundry, three waste samples were flue gas treatment residues and/or cinders from an incineration plant, two waste samples each were treatment sludge, blasting material wastes and sludge from a wastewater treatment and a shredder light fraction. The latter originated from a shredder plant for mechanical processing of old cars and from scrap-iron of consumer goods (stove, refrigerator). All samples were photographically documented (see Appendix II).

5.2 Sample preparation

Generally the investigated waste samples were easy to process, their consistency was mostly from paste to firm and they could be broken up well. Only a few samples presented difficulties during the sample preparation. A few paint and varnish sludge and some treatment sludge had, in some cases high solvent concentrations.

Particularly the paint and varnish sludge exhibited a two phase system (solid and liquid) in some cases, which was counteracted by renewed homogenization. Before testing, particles > 2 cm were removed out of sample 11 (shredder light fraction - polystyrene, plastic) and of sample 22 (rust and bottom-ash - metal parts).

The pH value of samples 24, 22, and 23 (wastes from the incineration plant) was highly alkaline, the pH value of sample 30 (sample containing lead-chromate from surface treatment) was highly acid and had to be adjusted before testing.

While diluting sample 23 (waste from the flue-gas treatment) with water, the former warmed up (approx. 40°C).

Sample 1, a paint and varnish sludge sample, was liquid. This one was handled as an eluate and tested directly.

5.3 Eluate preparation

A sample (number 26, sludge from an on-site wastewater treatment) was hard to filter through a membrane filter due to the proportion of fine particles so that the filtration took several hours.

With a sample (number 27, residues of paint and varnish waste) the membrane filter dissolved due to the high solvent content in the eluated sample. Here the membrane filtration of the sample was foregone and solely a glass fiber was used. This sample formed afterwards a two phase system with an aqueous and a solvent phase. The solvent phase was decanted, as water-insoluble phases can not be examined in the biotest.

While adjusting the pH value of the eluate - for the biotests the pH value must be in the neutral range - partly a precipitation, supposedly of heavy metal salts, occurred. These were again filtered after pH adjustment (sample 30, sludge containing lead-chromate from surface treatment, sample 24, filter dust from the incineration plant).

5.4 Biotest results

The biotest results obtained showed the large toxicity range of the samples, from non-toxic to highly toxic with a G-value of up to 80 000. The biotest results are summarized in Table 3, and are shown in comparison in Figure 2 (aquatic test systems) and Figure 3 (solid phase test). The G-values marked with a > symbol in Figure 3 indicate test results that are above the indicated G-value, but which were not determined more precisely. The individual results of the biotesting and the chemical analysis are attached in the data sheets in the Appendix.

5.4.1 Eluate

Algae test

Four of the 24 waste eluates were determined as non-toxic by means of the algae test. Sample 1 (liquid paint and varnish waste, directly tested) showed the highest toxicity with a G-value of 80 000, and sample 30 (sludge containing lead-chromate from the surface treatment) with a G-value of 24 000.

Daphnia test

Three of the 24 waste eluates were determined as non-toxic by means of the daphnia test. Also in the Daphnia test the highest toxicity was detected in sample 1 with a G-value of 20 000 and in sample 30 with a G-value of 50 000.

Luminescent bacteria test

Five of the 24 waste eluates were determined as non-toxic by means of luminescent bacteria testing, the highest toxicity was also measured in sample 1 with a G-value of 6 400 and sample 30 with a G-value of 2 500.

***Umu*-Test**

With the *umu*-test, a genotoxicity potential was determined in the eluate of sample 27 (paint and varnish waste), sample 1 (liquid paint and varnish waste) and sample 30 (treatment sludge containing lead-chromate). All other samples did not show genotoxicity.

5.4.2 Solid phase

Bacteria contact test

In the bacteria contact test, all samples, except sample 9 (core sand), were toxic. A statement regarding the greatest toxicity shown cannot be met, as only dilution steps 2, 10 and 100 were examined. Samples 1 (liquid paint and varnish sludge), 8, 13, 19, 4 and 12 (paint and varnish sludge), sample 6 (moulding sand), sample 16 (blasting material waste) and sample 24 (filter dust from the incineration plant) caused, in the 1:2 dilution, a de-coloration of the dye resazurine, possibly for chemical reasons, that can lead to test inaccuracy. During test preparation, sample 26 (sludge from an on-site wastewater treatment) became lumpy and flocculated.

Plant test

Sample 7 (treatment sludge) did not give a clear result in the plant test so that no G-value can be indicated. A plant toxicity was shown in all samples, except in sample 6 (moulding sand). The highest G-values were determined in sample 27 (paint and varnish waste) with a G-value of 16 384, sample 30 (sludge containing lead-chromate from the surface treatment) with a G-value of 65 536 and sample 23 (waste from the flue-gas treatment of an incineration plant) with a G-value of 2 048.

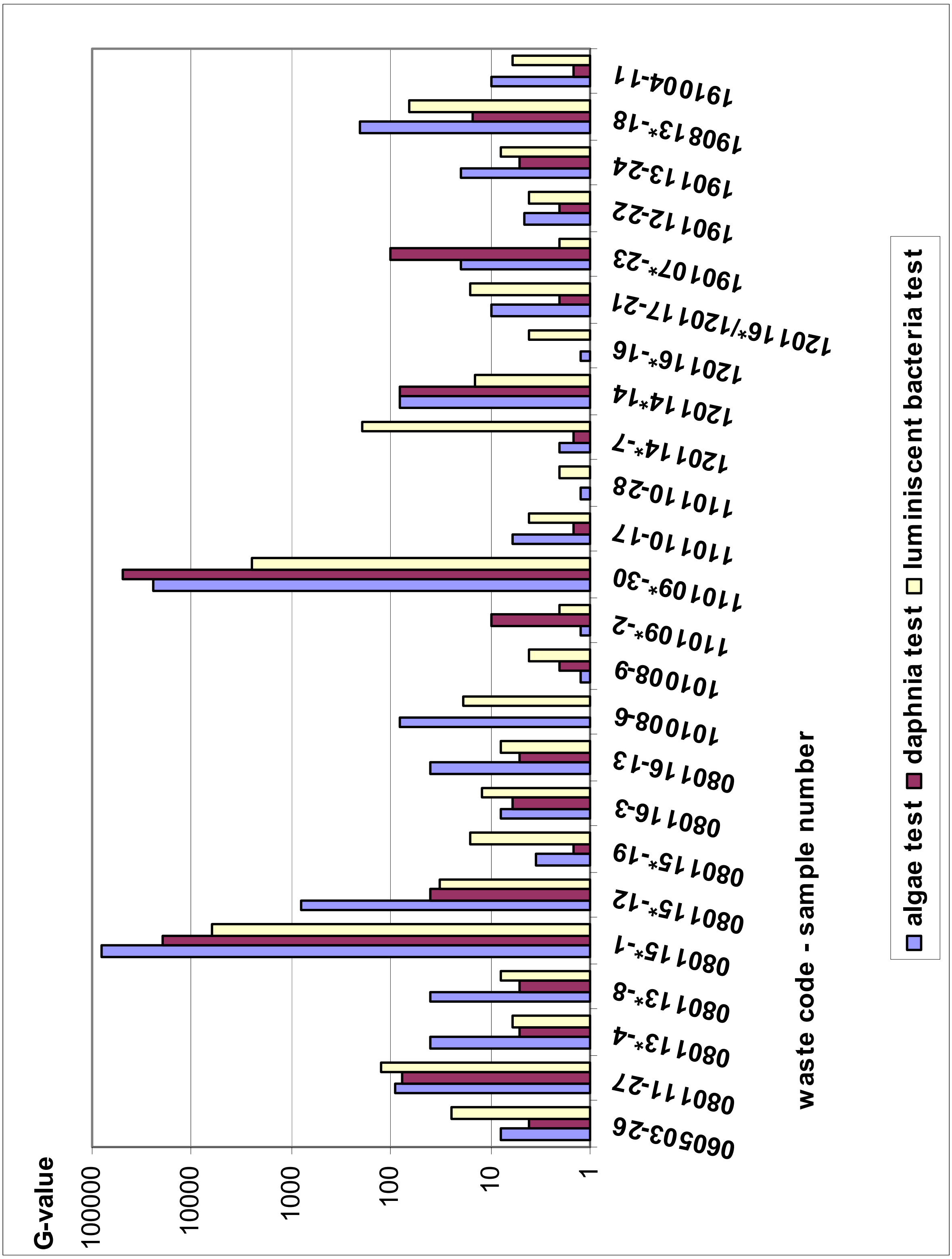

Figure 2: Comparison of the toxicity of waste sample eluates in aquatic test systems.

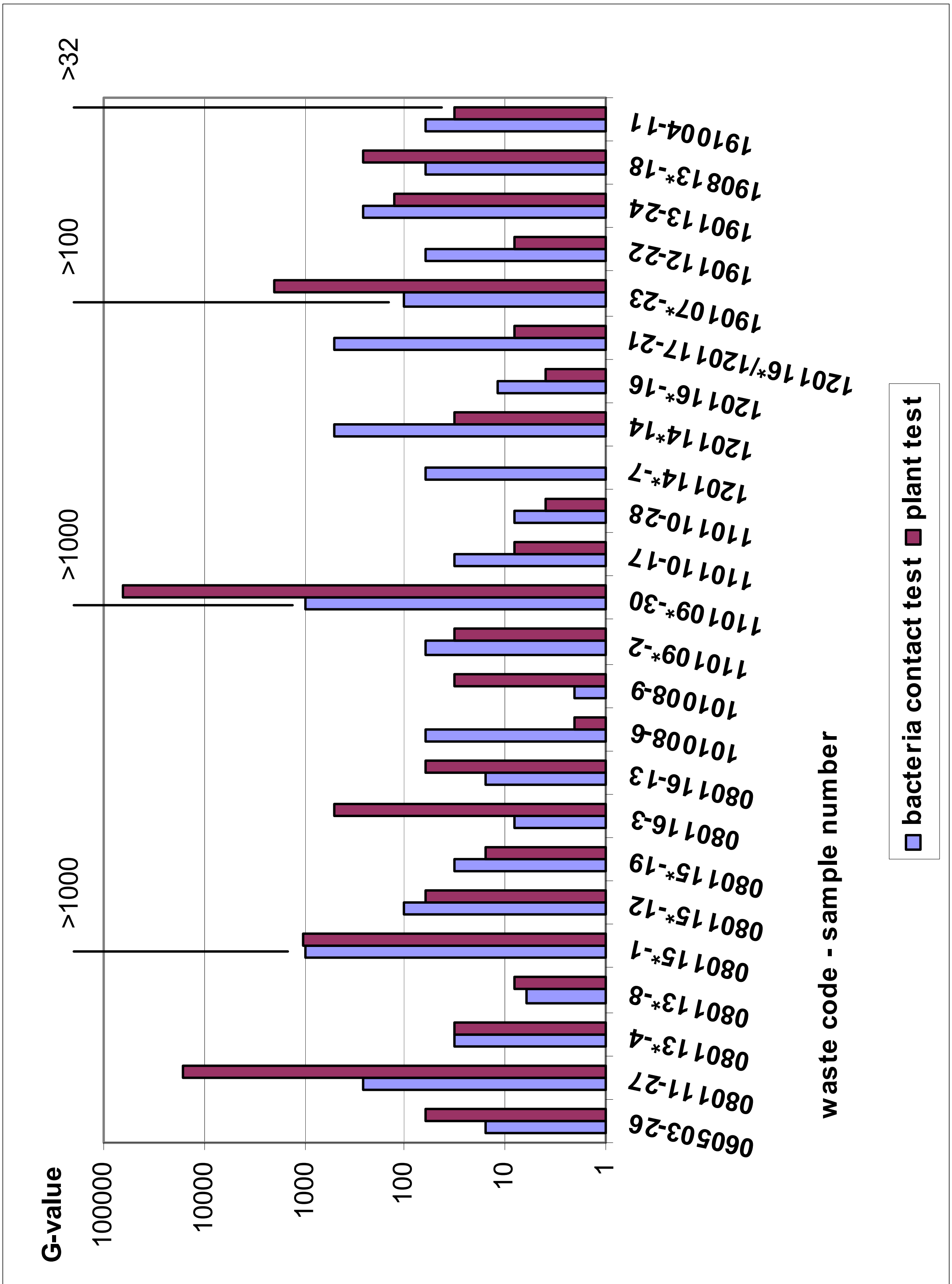

Figure 3: Comparison of toxicity of waste samples in terrestrial test systems;

>32, >1 000, >10 000 – G-value is above the indicated G-value.

5.5 Reproducibility and routine suitability of the biotest procedures

5.5.1 Investigation of the eluate – aquatic test procedure

Algae test, daphnia test,
luminescent bacteria test, *umu*- test

The four applied aquatic biotest procedures showed good reproducibility within 2 weeks (sample preparation and test repeating included). Usually the G-value was confirmed or deviated by rarely more than a maximum 2 dilution steps. The four test procedures, algae test, daphnia test, luminescent bacteria test and *umu*-test, are standardised tests, according to DIN, and were well suited to the testing of the waste eluates. Only sample 7 (treatment sludge from surface treatment, waste reference 120114 *) turned out to be a sample difficult to test by the algae and plant tests due to non-reproducible results.

5.5.2 Investigation of the original sample – tests on solid phase

Plant test
In the plant test the wastes were examined in two independent batches with 3 different plant types for the three effect criteria, germinating rate, sprig length and dry weight, and G-values were determined for each sample. The test lasts 14-21 days, depending on the germinating time. Out of the three effect criteria the germinating rate is the least suitable parameter, since it is not only affected by the sample composition materials but also by the sample structure and the water flow capacity. Sprig length and dry weight are better suitable criteria than the germination rate and are equivalent in their informative capability.

The plant test detected toxicity in concentration ranges comparable to those obtained with the aquatic test, however the former showed a larger deviarion in the test results. Since only two test runs were possible, the G-value determination could not be repeated in each case. The three different plant types showed in some cases varying levels of high toxicity, demonstrating the necessity for parallel testing with different plant types. Among the defined G-values of a waste sample the most representative G-value was determined over all three plant types and the two effect criteria, sprig length growth and dry weight, respectively. The most representative value is the most frequently measured one. In the evaluation the results were weighted differently since the water supply of the used standard soil improved clearly, starting from the second test series. In the last test series the experimental plants were probably damaged due to a brief experiment temperature increase (see Chapter 7).

Bacteria contact test
The bacteria contact test proved to be fast to implement and a method well suited to determining waste toxicity. Waste sample compounds can interact with the dye Resazurine which leads to a small initial concentration of the dye and thus a reduction of the test accu-

racy. However this effect is corrected over a blank value (sample and dye, without inoculum). A sample pH value below 6 can also lead to a resazurine reduction and this was considered in the test result evaluation. The obtained results demonstrate the reproducibility of the test. The bacteria contact test showed a higher sensitivity of the test system than the aquatic and plant tests (see Chapter 7).

waste reference	sample number	Algae test		Daphnia test		Luminescent bacteria test		*umu* - test	Bacteria contact test		Plant test	
		G-value	toxic	G-value	toxic	G-value	toxic	genotoxic without S9/with S9	G-value	toxic	G-value	toxic
060503	26	8	yes	4	yes	24	yes	no	10-100	yes	64	yes
080111*	27	90	yes	75	yes	128	yes	yes/no	>100	yes	16 384	yes
080113*	4	40	yes	5	yes	6	yes	no	10-100	yes	32	yes
080113*	8	40	yes	5	yes	64	yes	no	2-10	yes	8	yes
080115*	1	80 000	yes	20 000	yes	6 400	yes	yes/no	>1 000	yes	1 024	yes
080115*	12	800	yes	30	yes	32	yes	no	10-100	yes	64	yes
080115*	19	4	yes	2	yes	8	yes	no	2-10	yes	16	yes
080116	3	8	yes	6	yes	12	yes	no	2-10	yes	512	yes
080116	13	40	yes	5	yes	8	yes	no	10-100	yes	64	yes
101008	6	80	yes	1	no	16	yes	no	10-100	yes	2	no
101008	9	1.25	no	2	yes	4	yes	no	2	no	8	yes
110109*	2	1.25	no	10	yes	2	no	no	10-100	yes	32	yes
110109*	30	24 000	yes	50 000	yes	2 500	yes	yes/no	>100	yes	65 536	yes
110110	17	6	yes	2	yes	2	no	no	10-100	yes	8	yes
110110	28	1.25	no	1	no	2	no	no	2-10	yes	4	yes
120114*	7	2	yes	2	yes	96	yes	no	10-100	yes	n. d.	yes
120114*	14	80	yes	>80	yes	8	yes	no	>100	yes	32	yes
120116*	16	1.25	no	1	no	2	no	no	2-10	yes	4	yes
120116*/ 120117	21	15	yes	2	yes	16	yes	no	>100	yes	8	yes
190107*	23	15	yes	50	yes	2	no	no	>100	yes	2 048	yes
190112	22	5	yes	2	yes	4	yes	no	10-100	yes	8	yes
190113	24	50	yes	5	yes	6	yes	no	>100	yes	128	yes
190813*	18	200	yes	15	yes	48	yes	no	10-100	yes	256	yes
191004	11	10	yes	2	yes	16	yes	no	10-100	yes	>32	yes

Table 3: Biotest results (n. d. - not detectable).

5.6 Classification

To be able to evaluate the data, the biotest results were classified and divided into three toxicity classes: non to moderately toxic - Class 1, toxic - Class 2 and very toxic - Class 3 (Table 4). For the classification by toxicity classes the biotest showing the largest G-value was quoted, for example, in the algae test sample 1 showed the highest G-value with 80 000, thereby class 3, very toxic, is to be assigned to this waste sample. If genotoxic effects are detected, then the waste sample is always to be classified in class 3.

Toxicity class	**Evaluation**	**Algae test, daphnia test, luminescent bacteria test, plant test, bacteria contact test**	***umu*-test**
		G-value	**Effect**
1	non to moderately toxic	1-10	non-genotoxic
2	toxic	>10-100	-
3	very toxic	>100	genotoxic

Table 4: Scheme of the classification (Explanation in the text).

Among the 24 waste samples, three samples, sample 9 (core sand), 28 (sludge and filter cake from surface treatment of metals) and 16 (waste blasting material) were classified in toxicity class 1 - non to moderately toxic. 11 waste samples were assigned the toxicity class 2 - toxic -, 10 waste samples the toxicity class 3 - very toxic (Table 5).

Most waste samples were toxic in several test systems. Sample 19 (paint and varnish waste) was toxic only in the plant test, samples 17 (sludge from surface treatment) and 22 (rust and bottom-ash from an incineration plant) were toxic only in the bacteria contact test.

Three samples were asigned the toxicity class 3 due to genotoxic effects. However, samples 1 (liquid paint and varnish sludge), 27 (paint and varnish waste), and 30 (sludge containing lead-chromate from surface treatment) were also classified in toxicity class 3, due to highly toxic effects in all three aquatic tests and in both terrestrial tests.

The daphnia test showed the smallest test sensitivity. 16 of the 24 waste samples were classified as toxicity class 1 - non to moderately toxic, six samples as toxicity class 2 – toxic, and two samp-les as toxicity class 3 - very toxic. The bacteria contact test exhibited the largest test sensitivity, only six of the 24 waste samples were classified as toxicity class 1 (Table 5).

EAV	Sample number	Toxicity class					*umu*-test	Maximal toxicity class
		Algae test	**Daphnia test**	**Luminescent bacteria test**	**Bacteria contact test**	**Plant test**	**Geno-toxic without/ with S9**	
060503	26	1	1	2	2	2	no	**2**
080111*	27	2	2	3	3	3	yes/no	**3**
080113*	4	2	1	1	2	2	no	**2**
080113*	8	2	1	2	1	1	no	**2**
080115*	1	3	3	3	3	3	no/yes	**3**
080115*	12	3	2	2	2	2	no	**3**
080115*	19	1	1	1	1	2	no	**2**
080116	3	1	1	2	1	3	no	**3**
080116	13	2	1	1	2	2	no	**2**
101008	6	2	1	2	2	1	no	**2**
101008	9	1	1	1	1	1	no	**1**
110109*	2	1	2	1	2	2	no	**2**
110109*	30	3	3	3	3	3	yes/yes	**3**
110110	17	1	1	1	2	1	no	**2**
110110	28	1	1	1	1	1	no	**1**
120114*	7	1	1	2	2	n. a.	no	**2**
120114*	14	2	2	1	3	2	no	**3**
120116*	16	1	1	1	1	1	no	**1**
120116* 120117	21	2	1	2	3	1	no	**3**
190107*	23	2	2	1	3	3	no	**3**
190112	22	1	1	1	2	1	no	**2**
190113	24	2	1	1	3	3	no	**3**
190813*	18	3	2	2	2	3	no	**3**
191004	11	1	1	2	2	2	no	**2**
Number in toxicity class 1		11	16	12	6	8	21	**3**
Number in toxicity class 2		9	6	9	11	8	-	**11**
Number in toxicity class 3		4	2	3	7	7	3	**10**

Table 5: Classification of the test results.

5.7 Distinguishing between hazardous and non-hazardous waste depending on the biotest result classification

Based on the biotest result classification it is possible to decide upon a classification as hazardous or non-hazardous.

Class 1 - non to moderately toxic

If the waste, based on its obtained biotest results, is classified as class 1 - non to moderately toxic -, then it is non-hazardous.

Class 2 - toxic

It is debateable as to whether the toxicity class two is to be assigned to the category non-hazardous or already into the category hazardous (see Section 5.8).

Class 3 - very toxic

If the waste is classified as class 3 - very toxic – then it is hazardous.

5.8 Comparison of the classification based on the toxicity classes to the ranking based on the Preliminary Implementation Manual

In Table 6 the classification of wastes based on their biotest results is compared with the Preliminary Implementation Manual (PIM, Ministry for the Environment and Transport Baden-Württemberg, 2002). In Table 4 of the PIM, orientation values, derived for solids, are indicated for distinguishing between hazardous and non-hazardous wastes. These values are based on chemical analysis parameters. Besides concentration data for various materials there are also sum values in which different heavy metal contents are summed up to an aggregated orientation value (sum a, sum b, sum c). Derived orientation values for eluate are likewise set (Appendix I).

5.8.1 Hazardous wastes based on classification as toxicity class 2

When waste is classified as hazardous starting from toxicity class 2, thus starting from Ghw-value 10 (**h**azardous **w**aste), then it follows:

Based on the Preliminary Implementation Manual 10 of the 24 wastes are rated as hazardous waste. Based on classification starting from toxicity class 2, 21 wastes are rated as hazardous waste. The classification, starting from toxicity class 2, in hazardous or not, corresponds for 11 of the 24 waste samples (45.8 %) to the ranking based on the Preliminary Implementation Manual (Figure 4).

12 waste samples are classified starting from toxicity class 2 as hazardous, however they are non-hazardous based on the Preliminary Implementation Manual. This applies to six of the eight checked paint and varnish sludges, to both treatment sludges, to the moulding sand from the aluminium foundry, the bottom-ash from the incineration plant, a waste with the designation

„sludge and filter cake", and a sludge from the wastewater treatment.

The biotest procedures detected no toxicity in waste sample 16 (waste blasting material from stainless steel), however it is classified as hazardous based on the Preliminary Implementation Manual due to increased heavy metal contents in the solid matter. The high heavy metal contents are probably not bio-available and cause no toxicity in the biotests.

5.8.2 Hazardous wastes based on classification as toxicity class 3

When waste is classified as hazardous starting from toxicity class 3, thus starting from Ghw-value 100, then it follows:

Based on the Preliminary Implementation Manual, 10 of the 24 wastes are rated as hazardous waste. Based on classification, starting from toxicity class 3, 10 wastes are rated as hazardous waste. The classification based on toxicity class 1-3, in hazardous or not, corresponds for 18 of the 24 waste samples (75 %) to the classification based on the Preliminary Implementation Manual (Figure 4).

The waste samples 2 (galvanic sludge, tox. class 2), sample 16 (waste blasting material, tox. class 1) and sample 11 (shredder light fraction, tox. class 2) are rated as hazardous, based on the Preliminary Implementation Manual, however they do not reach the toxicity class 3.

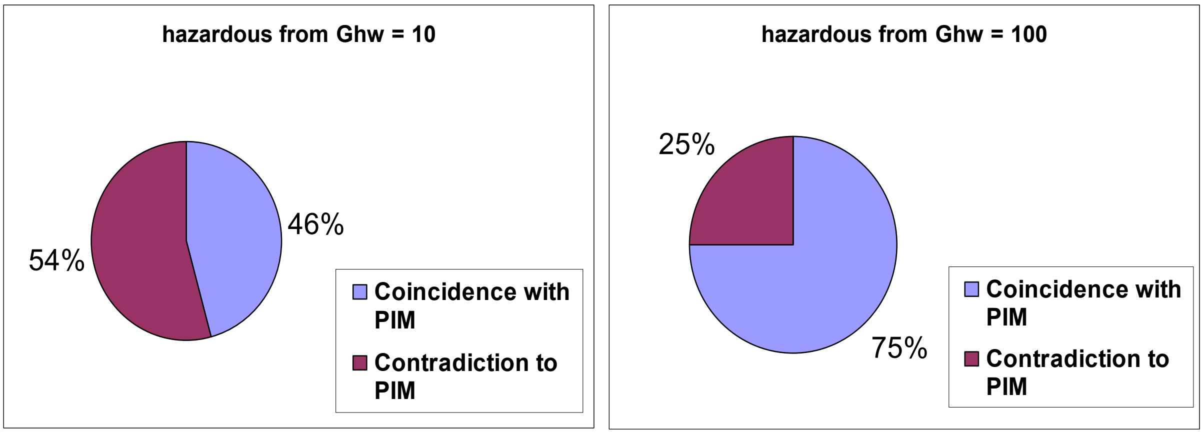

Figure 4: Comparison of the classification, based on toxicity classes, to the ranking, based on the Preliminary Implementation Manual (PIM) – Coincidence or contradiction.

Waste code	Sample number	Waste description	Orientation values Tab. 4 (solid matter) of PIM	Orientation values Tab. 5 (eluate values) of PIM	Classification H14 toxicity class	Contradiction with PIM (hazardous from tox. class 2)	Contradiction with PIM (hazardous from tox. class 3)
060503	26	Sludge from on-site wastewater treatment, other than those under 06 05 02	no OV exceeded	no OV exceeded	**2**	yes	no
080111*	27	Paint and varnish wastes containing organic solvents or other hazardous substances	**Sum BTEX and PAH exceeded**	no OV exceeded	**3**	no	no
080113*	4	Paint and varnish wastes containing organic solvents or other hazardous substances	no OV exceeded	no OV exceeded	**2**	yes	no
080113*	8	Paint and varnish wastes containing organic solvents or other hazardous substances	no OV exceeded	no OV exceeded	**2**	yes	no
080115*	1	Aqueous sludge, containing paint and varnish with organic solvents or other hazardous substances	no OV exceeded	**OV for nickel and AOX in liquid sample exceeded**	**3**	no	no
080115*	12	Aqueous sludge, containing paint and varnish with organic solvents or other hazardous substances	no OV exceeded	no OV exceeded	**3**	yes	yes
080115*	19	Aqueous sludge, containing paint and varnish with organic solvents or other hazardous substances	no OV exceeded	no OV exceeded	**2**	yes	no
080116	3	Aqueous sludge, containing paint and varnish, other than those under 08 01 15	no OV exceeded	no OV exceeded	**3**	yes	yes
080116	13	Aqueous sludge, containing paint and varnish, other than those under 08 01 15	no OV exceeded	no OV exceeded	**2**	yes	no
101008	6	Casting cores and moulds after pouring, other than those under 10 10 07; moulding sand	no OV exceeded	no OV exceeded	**2**	yes	no
101008	9	Casting cores and moulds after pouring, other than those under 10 10 07; core sand	no OV exceeded	no OV exceeded	**1**	no	no

Table 6: Comparison of the ecotoxicological classification to the orientation values (OV) of the Preliminary Implementation Manual (PIM) by MET (2002), yes – no OV exceeded, toxicity class 2 or 3; 1/ yes – OV exceeded, toxicity class = 1; no – no contradiction with PIM.

Waste code	Sample number	Waste description	Orientation values Tab. 4 (solid matter) of PIM	Orientations values Tab.5 (eluate values) of PIM	Classification H14 toxicity class	Contradiction with PIM (hazardous from tox. class 2)	Contradiction with PIM (hazardous from tox. class 3)
110109*	2	Sludge and filter cakes containing hazardous substances	**OV for cooper and Sum c exceeded**	no OV exceeded	**2**	no	1 / yes
110109*	30	Sludge and filter cakes containing hazardous substances	**OV for lead, nickel, chromium (VI), sum b and c exceeded**	**OV for chromium (VI) and nickel exceeded**	**3**	no	no
110110	17	Sludge and filter cakes, except those under 11 01 09	no OV exceeded	no OV exceeded	**2**	yes	no
110110	28	Sludge and filter cakes, other than those under 11 01 09	no OV exceeded	no OV exceeded	**1**	no	no
120114*	7	Treatment sludge containing hazardous substances	no OV exceeded	no OV exceeded	**2**	yes	no
120114*	14	Treatment sludge containing hazardous substances	no OV exceeded	no OV exceeded	**3**	yes	yes
120116*	16	Blasting material wastes containing hazardous substances	**OV for cooper, nickel and sum C exceeded**	no OV exceeded	**1**	1 / yes	1 / yes
120116* and 120117	21	Blasting material wastes containing hazardous substances	**OV for nickel and sum C exceeded**	no OV exceeded	**3**	no	no
190107*	23	Solid waste from flue-gas treatment	no OV exceeded	**OV for cadmium and lead exceeded**	**3**	no	no
190112	22	Rust- and bottom-ashes as well as slag, other than those under 19 01 11	no OV exceeded	no OV exceeded	**2**	yes	no
190113	24	Filter dust from incineration or pyrolysis of wastes	**OV for lead, cadmium sum a and c exceeded**	**OV for lead exceeded**	**3**	no	no
190813*	18	Sludge containing hazardous substances from an other treatment of industrial wastewater	no OV exceeded	**OV for AOX exceeded**	**3**	no	no
191004	11	Shredder light fractions and dust, other than those under 19 10 03	**OV for lead, cooper, mercury, sum a and sum c exceeded**	no OV exceeded	**2**	no	1 / yes

Table 6: Comparison of the ecotoxicological classification to the orientation values (OV) of the Preliminary Implementation Manual (PIM) by MET (2002), yes – no OV exceeded, toxicity class 2 or 3; 1/ yes – OV exceeded, Toxicity class = 1; no – no contradiction with PIM. Continue.

5.9 Comparison of ecotoxicological and chemical characterization of waste

5.9.1 Waste group specific description

Usually it is difficult to establish a correlation between ecotoxicity and concentration of individual pollutants or groups of pollutants in complex environmental samples. Also in waste samples it is usually not possible to define a relationship between ecotoxicity and concentration of individual pollutants. However, a high correlation between eluate toxicity and AOX concentration could be demonstrated (see Chapter 5.9.2). Investigations of complex samples with biological test procedures show effects as a sum effect, therefore bio test results are usually not comparable to analysis results of individual chemical parameters. The chemical analysis values, used in the Preliminary Implementation Manual of the State Baden-Württemberg as orientation values for the evaluation of waste hazard potential, give an idea of the pollutant concentrations of the complex waste sample. Estimates of the prospective risk derived thereby can however be deficient, since, on the one hand, not all pollutant concentrations are known and, on the other hand, no statement on the pollutant interaction can be met.

06 05 Sludge from an on-site wastewater treatment plant

In this group one sample (number 26) with the waste code 060503 was investigated. It consists of sludge of an on-site waste water treatment plant of the automobile industry with a phosphate sedimentation unit. The sample indicated a light toxicity in the algae test and daphnia test, and an increased toxicity in the luminescent bacteria test and in both solid phase tests. Based on the ecotoxicological classification, the waste was ranked in class 2, however, it is categorized as non- hazardous, according to the Preliminary Implementation Manual, since no orientation values were exceeded (Table 6). In the eluate an increased DOC concentration (250 mg/l) and an increased ammonium concentration (77 mg/l) were measured, therefore, a toxic effect of ammonia formed at increased pH value cannot be excluded (see Section 5.9.2). The orientation value for nickel in the eluate (1 000 µg/l) was not exceeded (802 µg/l), also small quantities of volatile hydrocarbons were detected in the eluate (31 µg/l). The current classification of the Preliminary Implementation Manual in non-hazardous is confirmed, according to the bio test results, if wastes are first considered hazardous, starting at toxicity class 3.

08 01 Wastes from MFSU and removal of paint and varnish

In this waste group eight wastes of different waste codes were examined. All wastes of group 0801 were classified in toxicity classes 2 - 3, six of the eight samples are however non-hazardous, according to the orientation values of the Preliminary Implementation Manual.

Waste sample 27 was toxic and genotoxic in all test systems and is classed as toxicity class 3. The eluate showed a high DOC value with 11

000 mg/l. This value exceeds the orientation values of BTEX and PAH in solid matter, according to the Preliminary Implementation Manual and thereby the waste is considered as hazardous. The former ranking in hazardous was confirmed by the biotest results.

Waste sample 4 showed in the algae test, in the bacteria contact test and in the plant test toxic effects that led to the classification as toxicity class 2. However, the orientation values of the Preliminary Implementation Manual were not exceeded. In the eluate, volatile hydrocarbons (ethylbenzene and xylene) were detected in the mg/l range (for chemical-analytical reasons not more precisely measurable), whereas the BTEX concentration in the solid of 277 mg/kg is below the orientation value for solids of 1 000 mg/kg. In addition, the paint and varnish sludge contains bactericidal substances. The current classification in non-hazardous of the Preliminary Implementation Manual is confirmed, according to the biotest results, if wastes starting from toxicity class 3, are ranked as hazardous.

Waste sample 8 was toxic in the algae and luminescent bacteria tests, and was classified as toxicity class 2: the eluate exhibited increased zinc values (10.1 mg/l) which possibly caused the toxicity in the algae and luminescent bacteria tests (algae test EC_{50} = 0.25 mg/l, Altlasten-Fachinformation 2003). Increased BTEX values in the eluate (1.9 mg/l) and in the solid (791 mg/kg) were measured, however, the orientation values of the Preliminary Implementation Manual were not exceeded. The current classification in non-hazardous of the Preliminary Implementation Manual is confirmed according to the biotest results, if wastes starting from toxicity class 3, are ranked as hazardous.

Waste sample 1 is liquid and was directly investigated without eluate preparation. It belongs to the three most toxic waste samples and is very toxic in all test procedures and, in addition, it is genotoxic. The sample exceeded the orientation values in the eluate for nickel (1 100 mg/l) and for AOX (3.4 mg/l). The current classification in hazardous of the Preliminary Implementation Manual was confirmed by the biotest results.

Waste sample 12 was toxic in all test procedures, very toxic in the algae test which led to a classification into toxicity class 3. With 1.3 mg/l the orientation value for AOX in eluate (1.5 mg/l) was just not reached, however, it can cause toxicity in the aquatic test systems. The current classification in non-hazardous of the Preliminary Implementation Manual was not confirmed by the biotest results.

Waste sample 19 was classified as toxicity class 2, due to the plant test result. However it did not exceed the orientation values. Increased values for BTEX with 283 mg/kg (OV = 1 000 mg/kg), PAH with 90.3 mg/kg (OV = 200 mg/kg) and AOX (210 mg/kg) in the solid phase were measured. The current classification in non-hazardous of the Preliminary Implementation Manual is confirmed according to the bio test results, if wastes starting from toxicity class 3, are ranked as hazardous.

Waste sample 3 was toxic in the luminescent bacteria test and very toxic in the plant test which led to classification into toxicity class 3. Orientation values of the PIM were not exceeded, however, increased zinc values in the eluate (0.9 mg/l) and in the solid (135 600 mg/kg) were detected and can have caused toxicity (algae test EC_{50} = 0.25 mg/l, Altlasten-Fachinformation 2003). The current classification in non-hazardous of the Preliminary Implementation Manual was not confirmed by the biotest results.

Waste sample 13 was toxic in the algae test and in both solid phase tests, and was classified in toxicity class 2. It exhibited a particularly high AOX concentration in the solid matter (1 260 mg/kg), however not in the aqueous eluate (0.27 mg/l), which could explain the toxic effects in both solid phase tests. Remarkable in the eluate were the high DOC content of 1 100 mg/l and also the ammonia nitrogen content of 78 mg/l. A toxic effect of ammonia cannot be excluded (see Section 5.9.2). During the sample preparation for the chemical analysis a gel formed, so that PCB and PAH could not be determined. However, orientation values of the Preliminary Implementation Manual were not exceeded. The current classification in non-hazardous of the Preliminary Implementation Manual is confirmed according to the biotest results, if wastes starting from toxicity class 3, are ranked as hazardous.

10 10 Wastes from foundry of non-ferrous metals

In this waste group there are two wastes from the aluminium foundry with the same waste code 101008, a moulding sand (sample 6) and a core sand (sample 9). The core sand was classified as non-toxic into class 1, the moulding sand as toxic into class 2 due to the results in the algae, luminescent bacteria and bacteria contact tests. The core sand contained hardener and amines and showed clearly higher heavy metal contents than the moulding sand. The moulding sand contained only bentonite. No orientation values of the Preliminary Implementation Manual are exceeded. The current classification in non-hazardous is confirmed according to the biotest results, if wastes, starting from toxicity class 3, are ranked as hazardous.

11 01 Wastes from the chemical surface treatment and coating of metals an other materials (for ex. galvanization, zinc galvanization, pickling processes, etching, phosphatizing, alkaline degreasing and anodization)

4 waste samples, two out of the waste code 110109 * and two out of the waste code 110109 were investigated.

The waste of sample 2 (galvanization, waste code 110109 *), originating from the coating of printed circuit boards, was ranked as toxicity class 2. The orientation values for copper and sum c were exceeded. The waste is hazardous based on the Preliminary Implementation Manual. The current classification in hazardous is confirmed according to the biotest results, when wastes starting from toxicity class 2, are classified as hazardous.

The waste of sample 30 (sludge containing lead chromate), likewise waste code 110109 *, was classified in toxicity class 3, due to high toxicity in all biotests and proven genotoxicity. The orientation values for lead, nickel, chromium-(VI), sum b and c in the solid as well as chromium-(VI) in the eluate were exceeded. The current classification in hazardous based on the Preliminary Implementation Manual was confirmed by the biotest results.

Waste sample 17 out of the waste code 110110 was toxic only in the bacteria contact test (toxicity class 2). Orientation values of the Preliminary Implementation Manual were not exceeded, and the chemical analysis parameters showed no peculiarity. The current classification of the Preliminary Implementation Manual in non-hazardous is confirmed according to the biotest results, when wastes starting from toxicity class 3, are classified as hazardous.

Waste sample 28 of the waste code 110110 was toxic in no test systems and the orientation values of the Preliminary Implementation Manual were not exceeded; only the nickel content of the sample was increased (1 100 mg/kg, OV = 2 500 mg/kg). The current classification in non-hazardous was confirmed by the biotest results.

12 01 Wastes from processes in mechanical shaping as well as physical and mechanical surface treatment of metals and plastics

Two waste samples of the waste codes 120116 * and/or 120116*/120117 and two of the waste code 120114 * were examined.

The treatment sludge of sample 7 was bacterially toxic in both bacteria test systems, which led to the classification as toxicity class 2. It originated from vehicle-part-cleaning processes and the waste from wet separators. Volatile hydrocarbons were detected (m-/p-xylene 55 µg/l, o-xylene 21 µg/l, ethyl-benzene 14 µg/l). Sample 7 showed an increased DOC value (110 mg/l) in the eluate and an increased portion of lipophilic substances (37 % weight) in the solid matter. Its investigation showed in some cases non-reproducible results in the algae test and, in particular, in the plant test. Orientation values of the Preliminary Implementation Manual were not exceeded. The current classification in non-hazardous of the Preliminary Implementation Manual is confirmed by the bio test results, when wastes starting from toxicity class 3, are classified as hazardous.

The treatment sludge of sample 14 was toxic to very toxic in all test systems, except in the luminescent bacteria test, and is classified as toxicity class 3. It originates from cleaning processes of car bodies, and it contains metal chips and surfactants which could cause toxicity in the eluate investigation and in the solid phase tests. The high zinc contents were remarkable in the solid with 77 000 mg/kg and in the eluate with 26.4 mg/l which, likewise, can lead to toxicity in biological test systems (algae test EC_{50} = 0.25 mg/l, Altlasten-Fachinformation 2003). Orientation values of the Preliminary Implementation Manual were not exceeded. The current classification in non-hazardous based on the Preliminary Implementation Manual was not confirmed by the biotest results.

Waste sample 16 (blasting material waste from stainless steel) indicated no toxicity in the biotests, however, it is ranked as hazardous based on the Preliminary Implementation Manual, owing to increased heavy metal contents in the solid matter. The increased heavy metal contents are probably not bio-available and cause also no toxicity in the solid phase tests. The current classification in hazardous of the Preliminary Implementation Manual was not confirmed by the biotest results.

Waste sample 21 (waste blasting material) exhibited increased toxicity values in the algae test, in the luminescent bacteria test, and in the bacteria contact test, and was classified as toxicity class 3. The orientation values for nickel and sum c were exceeded, reason why the waste is considered as hazardous. The present waste had initially two different waste codes (120116*/120117), however, due to small quantities, they were collected and disposed of together. The current classification in hazardous was confirmed by the biotest results.

19 01 Wastes from incineration and pyrolysis of waste materials

This concerns three different wastes of an incineration plant.

The filter dust of waste sample 24 was classified as toxicity class 3, owing to toxicity in the algae-, bacteria contact- and plant tests, and showed clearly values exceeding the orientation values of the Preliminary Implementation Manual for heavy metals, sum C, cadmium and lead in the solid matter and lead in the eluate (19 mg/l, OV = 1 mg/l). The current classification in hazardous of the Preliminary Implementation Manual was confirmed by the biotest results.

The solid waste from the flue-gas treatment - waste sample 23 - (flue-gas scrubbing) was toxic in all test systems, except in the luminescent bacteria test, and was classified in toxicity class 3. The orientation values for cadmium and lead (eluate) were exceeded, the arsenic concentration of 395 µg/l failed to reach the orientation value (500 µg/l), and the mercury value amounted 6.6 µg/l (OV = 20 µg/l). The current classification in hazardous was confirmed by the biotest results.

Rust and bottom ash of the waste code 190112 showed toxicity only in the bacteria contact test (sample 22, toxicity class 2), and exhibited increased AOX values (120 mg/kg) in the solid matter analysis and increased lead (562 µg/l) and zinc values (740 µg/l) in the eluate analysis which, however, did not exceed the orientation values of the Preliminary Implementation Manual. The current classification of the Preliminary Implementation Manual in non-hazardous is confirmed, according to the biotest results, when wastes starting from toxicity class 3, are classsified as hazardous.

19 08 Wastes from wastewater treatment plants

In this waste group, a waste of the waste code 190813*, sample 8, was investigated. Toxicity was demonstrated in all biotests, in particular, a high algae and plant toxicity which led to classification into toxicity class 3. AOX 820 mg/kg were measured in the solid matter, in the eluate still 2.1 mg/l (OV eluate = 1.5 mg/l), and the orientation value was thereby exceeded. The current classification of the Preliminary Implementation Manual in hazardous was confirmed by the biotest results.

19 10 Wastes from shredding of waste containing metals

Sample 11, shredder light fraction, from the group 1910 was examined (191004). The waste sample was characterized by heterogeneous material, and metals, plastics and other materials could be identified in the sample. The sample showed a slight toxicity in the algae and daphnia tests, a moderate toxicity in the luminescent bacteria, bacteria contact and plant tests, leading to a classification as toxicity class 2.

The orientation values for lead, copper, mercury, sum a and c (solid matter) were exceeded. The current classification in hazardous of the Preliminary Implementation Manual is confirmed according to the biotest results, when wastes starting from toxicity class 2, are classified as hazardous.

5.9.2 Relation between toxicity and chemical parameters

In the following selected chemical parameters which can influence the test results of waste investigations and toxicity detection are discussed.

DOC concentration

The DOC concentration of the examined waste sample ranged between 1mg/l and 11 000 mg/l in the eluate. The DOC concentration is a sum parameter which describes the content of organic carbon compounds, but makes no distinction between toxic or non-toxic compounds. Thus, sample 27, exhibiting a DOC concentration of 11 000 mg/l, was toxic and genotoxic in all test systems and was classified into toxicity class 3. According to the Preliminary Implementation Manual of the state Baden-Württemberg, it exceeded the orientation values for BTEX and PAH in the solid phase. The observed relation between DOC concentration in eluate samples of various industrial wastes and their toxicity in different biotest systems is not compelling, but refers only to a possible group of pollutants. Thus it should be individually checked which toxic organic carbon compounds are contained in the sample.

AOX concentration

For the AOX concentration of the waste eluate a close correlation (correlation coefficient r = 0.8) with the biotest results in the eluate (algae test, luminescent bacteria test, daphnia test) was demonstrated, however, no correlation with the plant test results (r = 0.08) for the AOX content in the solid was proven.

Ammonium concentration

In general, the waste samples contained small ammonium concentrations, except two samples (number 13 - 78 mg/l, number 26 - 77 mg/l). To what extent the ammonium contents affected the test results cannot be exactly clarified, since pollutants e.g. AOX were also detected. Gellert (2000) could prove by means of wastewater treatment plant effluents that a rising N total concentration (up to 44.1 mg/l) in wastewater samples did not correlate with the algae test, daphnia test or luminescent bacteria test. The toxic effect of ammonium and/or ammonia depends strongly on the pH and the temperature, since, at increased temperature and pH value, ammonia is formed increasingly, the latter being clearly more toxic than ammonium (Warg 1987). Ammonium can also have a beneficial effect as nutrient in the biotest which can lead to an underestimation of the toxicity of waste samples.

Conductivity

In 5 waste sample eluates the conductivity was partly very high (sample 30, conductivity 97 700 µS/cm). The high conductivity was connected with an increased concentration of heavy metals in the tested waste samples, so that the toxic effect was probably due to increased heavy metal concentrations.

Zinc concentration

In some waste samples a high zinc concentration was measured, up to 119 200 mg/kg in the solid matter and up to 26.4 mg/l in the eluate. Toxic effects of zinc begin with a concentration of 0.25 mg/l in the algae test (Altlasten-Fachinformation 2003) and, thus, cannot be excluded when considering the investigated wastes and/or waste eluates. Orientation values for zinc are not specified in the Preliminary Implementation Manual.

The identification of at least the substance class which is primary responsible for the toxicity determined in biotests, can be done by means of a separation of the complex waste samples and/or eluate with a subsequent biological and chemical investigation of the individual fractions. To this regard, an investigation strategy pertaining to industrial and local wastewater was developed by the US-EPA (Kristensen 1992) and one pertaining to sediments by Brack et al. (1999), as well as Hollert and Braunbeck (2001).

6 Proposed Procedure

In this investigation project the wastes were assessed regarding their toxicity and their genotoxicological effect potential by means of a total of six biological test procedures. The acute toxicity was determined using the luminescent bacteria test, the bacteria contact test and the daphnia test; the chronic toxicity with the algae test and the plant test; and the genotoxicity was captured with the *umu*-test.

Apart from the investigation of eluates on water-soluble pollutants and their effects, the effect of adsorbed pollutants was examined in the solid matter sample based on solid phase tests, by the plant test even on higher ranked phyto-organisms. However, the investigation procedure with six biological tests, used in this project, is too time- and cost intensive for a routine waste examination, so that the issue of the minimum extent of ecotoxicological waste examination, i.e. a minimum test battery, arises.

A test battery is a combination of test procedures performed for examining environmental samples, in order to ensure a risk estimation which is as complete as possible. Thus, for example, four biological test procedures are used for the examination of wastewater (fish egg test, daphnia test, luminescent bacteria test, algae test), in order to protect the water bodies against hazardous discharges with consideration of the different trophic levels.

Should the extent of waste investigation with biological test procedures be meaningfully reduced to a minimum by introduction of a minimum test battery, then the following has to be considered:

- Which test systems are relevant for the classification of the waste toxicity?
- The acute and chronic effect should be examined and different trophic levels (producers, consumers and destruents) determined.
- At least one test with waste eluate should be included in the test battery, in order to define the effect of pollutants that can be mobilized.
- Likewise, a solid phase test should be included in the test battery, in order to determine the toxicity of the unchanged sample.
- How is a further reduction of the test extent and thus of the costs possible?

6.1 Definition of a minimum test battery

By comparing the results of the various test procedures to the classification into the maximum toxicity class using all results of the ecotoxicological examination (Table 7), it is clear that the classification into one of the toxicity classes determined by the daphnia tests agrees only to 25 % with the overall result. The bacteria contact test exhibits the best agreement with 79 % and the plant test with 70 %.

If one combines two test procedures, the best agreement with the overall classification is reached by using the combination of algae test and bacteria contact test (92 %) and the combination of bacteria contact test and plant test (91 %).

If one combines three test procedures, the overall classification into the respective toxicity class is already obtained to 100 % with the combination of algae test, bacteria contact test and plant test. In addition, the combinations of luminescent bacteria test, bacteria contact test, plant test and of algae test, luminescent bacteria test and bacteria contact test, respectively, lead already to a 96 % agreement with the classification in each case.

Test combination	**Concordance with overall classification [quantity]**	**Concordance with overall classification [%]**
Algae test	11 of 24	46
Daphnia test	6 of 24	25
Luminescent bacteria test	11 of 24	46
Bacteria contact test	19 of 24	**79**
Plant test	16 of 23	**70**
Algae test, luminescent bacteria test	15 of 24	63
Algae test, daphnia test	15 of 24	63
Algae test, bacteria contact test	22 of 24	**92**
Algae test, plant test	19 of 23	83
Luminescent bacteria test, plant test	18 of 23	78
Luminescent bacteria test, daphnia test	12 of 24	50
Luminescent bacteria test, bacteria contact test	20 of 24	83
Daphnia test, bacteria contact test	19 of 24	79
Daphnia test, Plant test	16 of 23	70
Bacteria contact test, Plant test	21 of 23	**91**
Algae test, luminescent bacteria test, Plant test	19 of 23	83
Algae test, luminescent bacteria test, bacteria contact test	23 of 24	**96**
Algae test, luminescent bacteria test, daphnia test	16 of 24	67
Algae test, bacteria contact test, plant test	23 of 23	**100**
Algae test, bacteria contact test, daphnia test	22 of 24	92
Algae test, plant test, daphnia test	20 of 23	87
Luminescent bacteria test, bacteria contact test, plant test	22 of 23	**96**
Luminescent bacteria test, bacteria contact test, daphnia test	20 of 24	83
Luminescent bacteria test, plant test, daphnia test	18 of 23	78
Bacteria contact test, plant test, daphnia test	21 of 23	91

Table 7: Comparison of classification in toxicity class of the respective test procedure and /or test combination with the overall classification.

The combination of the three test procedures algae test, bacteria contact test and plant test is sufficient for illustrating the toxicity of the wastes examined here. The test procedures allow the acute and chronic effects to be captured, the different trophic levels to be investigated, and that the toxic effect of both the eluate and the solid phase waste is assessed.

Based on the results compiled here and under the condition that the obtained results are transferable to other wastes, the following minimum test battery is suggested for the ecotoxicological waste investigation:

Minimum test battery:	**Eluate investigation:**	**Algae test**
	Solid phase investigation:	**Plant test, bacteria contact test**

The daphnia test, as representative of the consumers group, is not represented in this test battery, owing to lack of sensitivity, further studies are needed here (see Chapter 7).

In order to further minimize the technical and economic expenditures, it is suggested to introduce a limit test:

6.2 Limit test

The wastes are not examined by means of dilution series up to the G-value (which indicates no more toxicity), but only in the dilution step Ghw (-hazardous waste), still to be defined, located between hazardous and non-hazardous. If the toxicity is below the defined dilution step (e.g. G 10 or G 100), then the waste is considered non-hazardous.

6.3 Eluate investigations for genotoxicity with the *umu*-test

The *umu*-test detected genotoxicity in three samples. If the *umu*-test or other procedure for the genotoxicity determination is already used for the description of criterion H7 carcinogenic and/or H11 mutagenic, than its use can be dispensed with for the description of criterion H14. The *umu*-test is nevertheless a test method considered in the CEN draft (2002) for the description of the H14 criterion.

6.4 Economy

The costs for waste sample testing on their ecotoxicity were evaluated by means of company data and of own budget calculations (Table 8).

A clear cost reduction is already reached when a minimum ecotoxicological test battery is used. The introduction of a limit test reduces the total costs of an ecotoxicological characterization to approximately 315 € / sample. The analysis of the waste sample, according to the parameter list of the Preliminary Implementation Manual, costs 1338 € / sample (oral report TÜV-South), thereof the cost for the dioxin testing alone amounts to 550 €, and for the eluate analysis to 277 €.

Even if it is assumed that, for a decision making in the scope of the Preliminary Implementation Manual, the determination of all parameters is not always necessary (e.g. by excluding the dioxin investigation in the galvanization sludge), compared to that the costs for biotesting remain nevertheless in a justifiable order of magnitude. However, the time requirement for the plant test (approx. 3 weeks) could be a problem when the executive authority has to make fast decisions.

Test	**Costs (€) G-value determination**	**Costs (€) Limit-Test (G_{hw} = 10 or 100)**	**Costs (€) chemical analysis according to Preliminary Implementation Manual**
Luminescent bacteria test	210	70	
Algae test – miniaturized form (own estimation)	150	70	
Daphnia test	210	70	
Plant test (3 species)	700	175	
Bacteria contact test (own estimation)	150	70	
Cost, total	1 420	455	
minimum test battery: algae test, bacteria contact test, plan test	**1 000**	**315**	**1 338**

Table 8: Cost estimation for a waste sample (Company data and own estimation).

7 Recommendations

7.1 Eluate investigation

With the eluate investigation basically, the criterion H13 (leaching product) is checked. The statements in this report impute that an ecotoxicological eluate means at the same time that the waste is ecotoxicological. The EEC Directive 91/689/EC is not very well formulated, in so far as a waste is identified as hazardous solely when the eluate, as a leaching product, fulfills one of the characteristics mentioned above in the list (thus H1 to H12). The subsequent criterion H14 is therewith not considered. There is no conclusive reason for it. An editorial correction of the EEC Directive is suggested.

7.2 Biological test procedures

Plant test

For the testing of the original waste sample, the plant test according to OECD (2000) represents a standardised method. The results showed however a larger range. An important factor of influence on the variability of the G-values is possibly the heterogeneity of the sample material, its miscibility with the standard soil and its water retaining capacity. The germ rate proved to be the less suitable effect criterion, as it is also affected by the sample structure and its water flow capacity. Beyond that, a very small germination during the test leads to a statistic uncertainty of the two other effect criteria. Here, further adjustments of the test system to the test matrix of waste samples and their relatively large heterogeneity with regard to the structure and the water flow capacity should be made. In addition, it is recommended to check for suitable plant types (heat tolerant, representative of the Leguminousae), to select the standard soil and the test design.

Bacteria contact test

The bacteria contact test proved to be a method that is fast to implement and which supplies sensitive and reproducible results within a day. For some waste samples, sample substances led to a reduction of the reaction indicator Resazurine and affected hereby the accuracy of the test results. For some samples the aqueous fraction and other fractions of the sample separate, which can lead to an inaccuracy at the test start. Here, further adjustments should be made to the matrix of the waste samples, before introducing it as a routine method.

Biotest procedure with a representative of the function level consumers

The group of the consumers is not represented in the test battery recommended here. In the scope of the investigation, the daphnia test was performed as their representative, however, it proved not to be sufficiently sensitive. Yet the group of the consumers should, in principle, not be left out. Thus, other methods of ecotoxicological testing are to be checked for their suitability to waste investigation. Firstly, methods which are already included in the CEN regulation, e.g. the Collembola test (CEN 2002) or the Nematode test (Traunsburger et al. 1997) should be primarily investigated. Another, DIN standardised test method, which could be applied to the waste eluate examination, is the fish egg test (DIN 38415-6). For the fish egg test no permission is required according to animal protection laws.

If a suitable test organism can be found for the examination of the trophic level consumers, a comparison of its sensitivity with the test battery recommended here is to be done, in order to minimize the economic expenditures of the waste toxicity investigation.

8. Literature

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9. Appendix

Appendix I: Orientation values of the Preliminary Implementation Manual of the Ministry for Environment and Transport of Baden Württemberg, October 2002

Table Ia: Orientation values of the Preliminary Implementation Manual (Oct. 2002) for solid matter contents

	Parameter	**Contents of hazardous substances in the original substance referred to dry matter mg/kg**
	Antimony, lead, copper, nickel, selenium,	2 500
	Arsenic, chromium (VI), thallium, tin from organic compounds	1 000
	Cadmium	100
	Mercury	50
Sum a	Mercury, cadmium,	100
Sum b	Mercury, cadmium, tin (org. comp.), thallium, chromium (VI), arsenic,	1 000
Sum c	Mercury, cadmium, tin (org. comp.), thallium, chromium (VI), arsenic, selenium, nickel, copper, lead, antimony	2 500
	Benzene /BTEX	Benzen:25/BTEX:1 000
	Dioxins /Furans TCDD_TE	25
	Highly volatile halogenated hydrocarbons	25
	Mineral oil hydrocarbons, to the extent not shown to be irrelevant (e.g. paraffins)	4 000, however maximum up to residual saturation
	PAH (16 after EPA)	200
	Benzo-a-pyrene	50
	PCB total	50
	PCP	5
	Cyanide, total	1 000
	Beryllium	1 000

Appendix I Orientation values of the Preliminary Implementation Manual of the Ministry for Environment and Transport of Baden Württemberg, October 2002

Table Ib: Orientation values of the Preliminary Implementation Manual (October 2002) for the eluates

Parameter	value mg/l
pH-value	5.5-13.0
Phenols	50
Arsenic	0.5
Lead	1
Cadmium	0.1
Chromium (VI)	0.1
Copper	5
Nickel	1
Mercury	0.02
Fluoride	25
NH4 nitrogen	200
Cyanides, highly soluble	0.5
AOX	1.5

Appendix II: Data sheets - Biological test results and chemical analysis

Data Sheet sample no. 1

Waste from MFSU and removal of paints and varnishes - Aqueous sludge containing paints and varnishes with organic solvents or other dangerous substances; liquid sample, no eluate preparation	sample number	waste code	Date
	1	080115	27.06.2002

Ecotoxikological characterization

Algae test

80%-sample	G_A-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	
100	>10	-	-	yes
100	80000	0.0013	0.0025	yes
100	80000	0.0016	0.0029	yes
Median	**80000**	**0.0014**	**0.0027**	**yes**

Daphnia test

100%-sample	G_D-sample	EC_{10}-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	[%]	
100	>10000	-	-	-	yes
100	20000	0.003	0.005	0.014	yes
Median	**20000**	**0.003**	**0.005**	**0.014**	**yes**

Luminescent bacteria test

50%-sample	G_L-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	
100	6400	0.0265	0.0469	yes
100	6400	0.0288	0.0489	yes
Median	**6400**	**0.0276**	**0.0479**	**yes**

Bacteria contact test

50%-sample	G_B-sample	Toxicity
[%Inhibition]		
-	>1000	yes
Median	>1000	**yes**

Plant test

50%-sample	G_P germination rate	G_P Shoot height	G_P dry shoot weight	Toxicity
Brassica	256	64	256	yes
Lycopersicon	1024	256	1024	yes
Avena	1024	256	1024	yes
most representative G_P-value				**1024**

umu-test - without S9 / **Eluate with S9**

	GEU	VD	Genotoxicity		GEU	VD	Genotoxicity
	IR < 1.5	IR < 1.5	GEU > 1.5		IR < 1.5	IR < 1.5	GEU > 1.5
	-	1.67	no		-	1.67	no
	-	1.67	no		3072	0.0003	yes
	-	1.67	no		6140	0.0002	yes
Median		**1.67**	**no**	**Median**	**4606**	**0.0003**	**yes**

Data Sheet sample no. 1

Waste from MFSU and removal of paints and varnishes -
Aqueous sludge containing paints and varnishes with organic solvents or other dangerous substances; liquid sample, no eluate preparation

sample number	waste code	Date
1	080115	27.06.2002

Chemical characterization

liquid sample

Dry weight %	Water content %	pH	Cond. µS/cm
0	100	6.05	2090

Arsenic	Lead	Cadmium	Chromium	Copper	Nickel	Mercury	Zinc
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
0.27	4.9	0.05	4.8	49	5	0	290

Hydrocarbons	Lipophilic subst.	TOC	Benzene	Toluene	Ethylbenzene	Xylene
Gew.%	Gew.%	Gew.%	mg/kg	mg/kg	mg/kg	mg/kg
0.041	5.4	59.8	<0.01	0.3	4.6	29

Sum BTEX	Naphthalene	Acenaphtene	Acenaphtylene	Fluorene	Phenanthrene	Anthracene	Fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
33.9	40	0.3	<0.1	0.83	2.1	<0.1	0.67

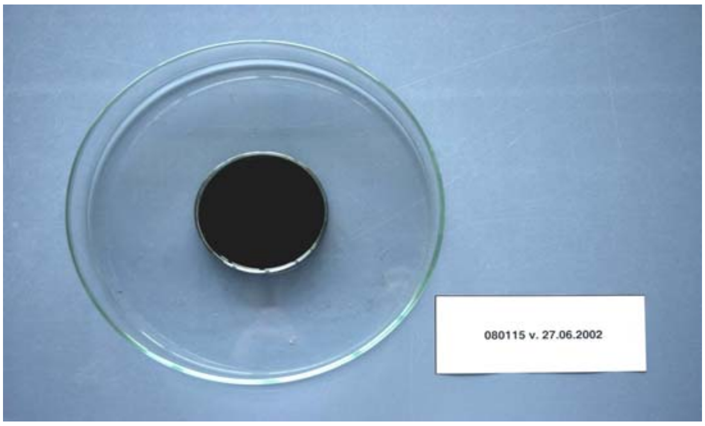
Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
2.8	0.33	1.2	0.56	<0.1

Dibenz(ah)anthracene	Benzo(ghi)perylene	Indeno(1,2,3-cd)pyrene	Benzo(a)pyrene	AOX
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
0.12	0.19	0.1	0.1	420

Water soluble portion	Sum PAH (16 EPA)
Gew.%	mg/kg
9.8	49.3

Remarks

liquid, black, solvent smell, colored up to 1:1000; no eluate preparation, but directly tested, filtered only through glass fiber



Data Sheet samble no. 2

Residues from chemical surface treatment and coating of metals and other materials (for ex. galvanic processes, zinc galvanization, pickling processes, etching, phosphating, alkaline degreasing and anodizing); Sludge and filter cakes from surface treatment containing dangerous substances, galvanization

sample number	waste code	Date
2	110109	16.05.2002

Ecotoxikological characterization

Algae test - eluate

80%-sample [%Inhibition]	G_A-sample	EC_{20}-sample [%]	EC_{50}-sample [%]	Toxicity
86.9	>4	-	-	yes
-27	1.25	-	-	no
-65.2	1.25	-	-	no
Median	**1.25**	**-**	**-**	**no**

Daphnia test - eluate

100%-sample [%Inhibition]	G_D-sample	EC_{10}-sample [%]	EC_{20}-sample [%]	EC_{50}-sample [%]	Toxicity
30	10	6.9	18.6	123.0	yes
50	10	6.9	12.4	38.0	yes
Median	**10**	**6.9**	**15.5**	**80.5**	**yes**

Luminescent bacteria test- eluate

50%-sample [%Inhibition]	G_L-sample	EC_{20}-sample [%]	EC_{50}-sample [%]	Toxicity
5.4	2	-	-	no
6.2	2	-	-	no
Median	**2**	**-**	**-**	**no**

Bacteria contact test - solid matter

50%-sample [%Inhibition]	G_B-sample	Toxicity
92.3	-	yes
103.4	10-100	yes
Median	10-100	**yes**

Plant test - solid matter

50%-sample	G_P germination rate	G_P Shoot height	G_P dry shoot weight	Toxicity
Brassica	>32	>32	>32	yes
	<64	<64	64	yes
Lycopersicon	>32	32	32	yes
	-	<64	<64	yes
Avena	>32	>32	>32	yes
	<64	<64	128	yes
most representative G_P-value				**32**

umu-test - eluate without S9 / **Eluate with S9**

	GEU IR < 1.5	VD IR < 1.5	Genotoxicity GEU > 1.5		GEU IR < 1.5	VD IR < 1.5	Genotoxicity GEU > 1.5
	1.5	0.67	no		1.5	0.67	no
	1.5	0.67	no		1.5	0.67	no
Median	**1.5**	**0.67**	**no**	**Median**	**1.5**	**0.67**	**no**

Data Sheet samble no. 2

Residues from chemical surface treatment and coating of metals and other materials (for ex. galvanic processes, zinc galvanization, pickling processes, etching, phosphating, alkaline degreasing and anodizing); Sludge and filter cakes from surface treatment containing dangerous substances, galvanization

sample number	waste code	Date
2	110109	16.05.2002

Chemical characterization - eluate

Dry weight %	Water content %	pH	Cond. µS/cm
39	61	9.57	5140

DOC	TOC	NH4	Mercury	Cadmium	Chromium, total	Nickel	Copper
mg/l	mg/l	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l
40	-	<	<0.5	<0.1	<0.5	16.6	228

Lead	Zinc	Manganese	Arsenic	Cobalt	AOX
µg/l	µg/l	µg/l	µg/L	µg/l	mg/l
3.37	42	<5	<0.5	2.5	0.11

PCB 8	HCH	PCB 18	PCB 28	PCB 52	PCB 101	PCB 138	PCB 153
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	<	0.007	0.011	0.006

PCB 180	PCB 77	PCB 105	PCB 118	PCB 126	PCB 169	PCB 189
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.001	<	<	<	<	<	<

Naphthalene	Acenaphthylene	Acenaphtene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.23	0.002	0.045	0.023	0.021	<	0.003	0.002

Benzo(a)-anthracene	Chrysene	Benzo(b)-fluoranthene	Benzo(k)-fluoranthene	Benzo(a)-pyrene	Indeno(1,2,3-cd)-pyrene	Dibenz(a,h)-anthracene	Benzo(g,h,i)-perylene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0	0.001	0.001	0	0.001	0	0.001	0.001

Biphenyl	Benzene	Toluene	Ethylbenzene	m-/p-Xylene	o-Xylene	Dichlormethane	1,1-Dichlor-ethene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.003	<	0.27	0.78	1.73	0.84	<	<

cis-1,2-Dichlorethene	trans-1,2-Dichlorethene	Trichlormethane	1,1,1-Trichlorethan	Tetrachlor-methane	1,2-Dichlorethane	Trichlorethene	Bromdichlor-methane
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	0.264	<	<	<	<	<

1,1,2-Trichlorethane	Tetrachlorethene	Dibromchlor-methane	Tribrom-methane	1,2-Dichlor-benzene	1,3-Dichlor-benzene	1,4-Dichlor-benzene	hydrocar.-Index (H53)
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l
<	<	<	<	<	<	<	-

Data Sheet samble no. 2

Residues from chemical surface treatment and coating of metals and other materials (for ex. galvanic processes, zinc galvanization, pickling processes, etching, phosphating, alkaline degreasing and anodizing); Sludge and filter cakes from surface treatment containing dangerous substances, galvanization

sample number	waste code	Date
2	**110109**	**16.05.2002**

Chemical characterization - solid matter

Arsenic	Lead	Cadmium	Chromium	Copper	Nickel	Mercury	Zinc
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
16	230	0.29	36	145200	120	0.06	650

Hydrocarbons	Lipophilic subst.	TOC	Benzene	Toluene	Ethylbenzene	Xylene
GEW.%	Gew.%	Gew.%	mg/kg	mg/kg	mg/kg	mg/kg
0.006	0.016	2.5	<0.01	<0.01	<0.01	0.03

Sum BTEX	Naphthalene	Acenaphtene	Acenaphtylene	Fluorene	Phenanthrene	Anthracene	Fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.04	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.47

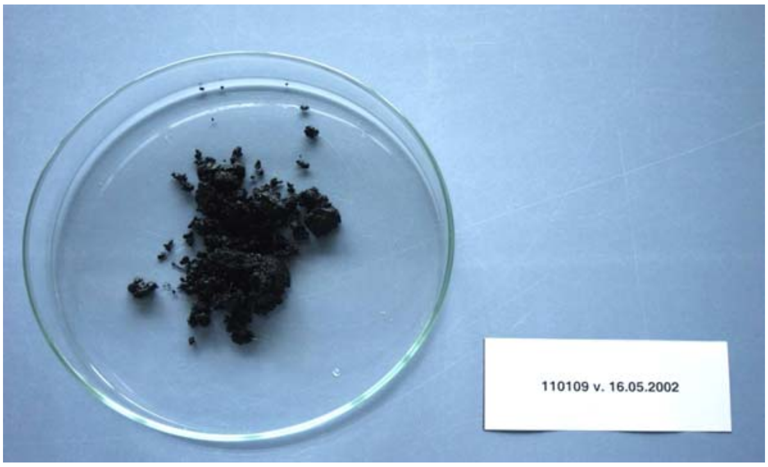
Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.1	<0.1	<0.1	<0.1	<0.1

Dibenz(ah)anthracene	Benzo(ghi)perylene	Indeno(1,2,3-cd)pyrene	Benzo(a)pyrene	AOX
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.1	<0.1	<0.1	<0.1	96

Water soluble portion	Sum PAH (16 EPA)
Weight %	mg/kg
6.8	<1

remarks

pasty-granular, humid, black,



Data Sheet no. 3

	sample number	waste code	Date
Waste from MFSU and removal of paints and varnishes Aqueous sludge containing paints and varnishes other than those mentioned in 080115	3	080116	21.06.2002

Ecotoxikological characterization

Algae test - eluate

80%-sample	G_A-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	
99.8	>4	-	-	yes
100	8	15.7	19.2	yes
100	8	18.4	21.3	yes
Median	**8**	**17.1**	**20.3**	**yes**

Daphnia test - eluate

100%-sample	G_D-sample	EC_{10}-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	[%]	
100	10	16.7	20.4	30.1	yes
100	2	35.1	39.6	50.2	yes
Median	**6**	**25.9**	**30.0**	**40.2**	**yes**

Luminescent bacteria test- eluate

50%-sample	G_L-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	
64.8	16	9.9	29.6	yes
54.2	8	16.5	41.9	yes
Median	**12**	**13.2**	**35.7**	**yes**

Bacteria contact test - solid matter

50%-sample	G_B-sample	Toxicity
[%Inhibition]		
40.9	2-10	yes
Median	**2-10**	**yes**

Plant test - solid matter

50%-sample	G_P Germination rate	G_P Shoot height	$G_{P\,D}$ry shoot weight	Toxicity
Brassica	>32	-	-	yes
	<64	256	512	yes
Lycopersicon	>32	-	-	yes
	<64	512	-	yes
Avena	-	-	-	-
	64	<64	257	yes
most representative G_P-value				**512**

umu-test - eluate without S9				**Eluate with S9**			
	GEU	**VD**	**Genotoxicity**		**GEU**	**VD**	**Genotoxicity**
	IR < 1.5	**IR < 1.5**	**GEU > 1.5**		**IR < 1.5**	**IR < 1.5**	**GEU > 1.5**
	1.5	0.67	no		1.5	0.67	no
	1.5	0.67	no		1.5	0.67	no
Median	**1.5**	**0.67**	**no**	**Median**	**1.5**	**0.67**	**no**

Data Sheet no. 3							
Waste from MFSU and removal of paints and varnishes					sample number	waste code	Date
Aqueous sludge containing paints and varnishes other than those mentioned in 080115					3	080116	21.06.2002
Chemical characterization - eluate							
Dry weight	**Water content %**	**pH**	**Cond. µS/cm**				
94.3	5.7	8.42	3490				
DOC	**TOC**	**NH4**	**Mercury**	**Cadmium**	**Chromium, total**	**Nickel**	**Copper**
mg/l	mg/l	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l
7.9	-	11	-	<0.1	<0.5	1.4	17.5
Lead	**Zinc**	**Manganese**	**Arsenic**	**Cobalt**	**AOX**		
µg/l	µg/l	µg/l	µg/L	µg/l	mg/l		
3.07	889	<5	<0.5	42.7	0.03		
PCB 8	**HCH**	**PCB 18**	**PCB 28**	**PCB 52**	**PCB 101**	**PCB 138**	**PCB 153**
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	0.004	0.012	0.026	0.012
PCB 180	**PCB 77**	**PCB 105**	**PCB 118**	**PCB 126**	**PCB 169**	**PCB 189**	
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	
0.002	<	0.002	<	<	<	<	
Naphthalene	**Acenaphthylene**	**Acenaphtene**	**Fluorene**	**Phenanthrene**	**Anthracene**	**Fluoranthene**	**Pyrene**
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
n.b.	n.b.	n.b.	n.b.	n.b.	n.b.	0.009	0.008
Benzo(a)-anthracene	**Chrysene**	**Benzo(b)-fluoranthene**	**Benzo(k)-fluoranthene**	**Benzo(a)-pyrene**	**Indeno(1,2,3-cd)-pyrene**	**Dibenz(a,h)-anthracene**	**Benzo(g,h,i)-perylene**
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.001	0.002	0.001	0	0.002	0	<	0.001
Biphenyl	**Benzene**	**Toluene**	**Ethylbenzene**	**m-/p-Xylene**	**o-Xylene**	**Dichlor-methane**	**1,1-Dichlorethene**
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
n.b.	1.04	3.03	0.59	2.22	1.1	<	<
cis-1,2-Dichlorethene	**trans-1,2-Dichlorethene**	**Trichlor-methane**	**1,1,1-Trichlorethan**	**Tetrachlormethane**	**1,2-Dichlorethane**	**Trichlorethene**	**Bromdichlor-methane**
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	0.1	<	<	<	<	<
1,1,2-Trichlorethane	**Tetrachlorethene**	**Dibromchlor-methane**	**Tribrom-methane**	**1,2-Dichlorbenzene**	**1,3-Dichlorbenzene**	**1,4-Dichlorbenzene**	**hydrocar.-Index (H53)**
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l
<	<	<	<	<	<	<	-

Data Sheet no. 3

Waste from MFSU and removal of paints and varnishes	sample number	waste code	Date
Aqueous sludge containing paints and varnishes other than those mentioned in 080115	3	080116	21.06.2002

Chemical characterization - solid matter

Arsenic	Lead	Cadmium	Chromium	Copper	Nickel	Mercury	Zinc
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
0.52	1.6	0.18	5.6	11	3.6	<0.05	135600

Hydrocarbons	Lipophilic subst.	TOC	Benzene	Toluene	Ethylbenzene	Xylene
GEW.%	Gew.%	Gew.%	mg/kg	mg/kg	mg/kg	mg/kg
0.009	0.17	5.2	<0.01	<0.01	0.09	0.38

Sum BTEX	Naphthalene	Acenaphtene	Acenaphtylene	Fluorene	Phenanthrene	Anthracene	Fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
0.47	1.7	<0.1	<0.1	<0.1	0.29	<0.1	0.1

Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.1	<0.1	<0.1	<0.1	<0.1

Dibenz(ah)anthracene	Benzo(ghi)perylene	Indeno(1,2,3-cd)pyrene	Benzo(a)pyrene	AOX
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.1	<0.1	0.1	0.1	<1

Water soluble portion	Sum PAH (16 EPA)
Weight %	mg/kg
0.2	2.09

remarks

solid-lumpy, grey; chalk smell

Data Sheet samble no. 4

Waste from MFSU and removal of paint and varnish, sludges from paint or varnish containing organic solvents or other dangerous substances	sample number	waste code	Date
	4	080113	21.06.2002

Ecotoxikological characterization

Algae test - eluate

80%-sample	G_A-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	
100	40	5.1	6.6	yes
100	40	5.1	6.7	yes
Median	**40**	**5.1**	**6.7**	**yes**

Daphnia test - eluate

100%-sample	G_D-sample	EC_{10}-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	[%]	
100	5	16.2	19.9	29.4	yes
100	5	34.0	38.4	48.4	yes
Median	**5**	**25.1**	**29.1**	**38.9**	**yes**

Luminescent bacteria test- eluate

50%-sample	G_L-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	
47.3	8	17.1	51.8	yes
34.4	4	27.5	73.8	yes
Median	**6**	**22.3**	**62.8**	**yes**

Bacteria contact test - solid matter

50%-sample	G_B-sample	Toxicity
[%Inhibition]		
-	10-100	yes
Median	10-100	**yes**

Plant test - solid matter

50%-sample	G_P Germination rate	G_P Shoot height	G_P Dry shoot weight	Toxicity
Brassica	64	128	64	yes
	>2048	512	512	yes
Lycopersicon	>128	32	32	yes
	>2048	>2048	2048	yes
Avena	32	32	32	yes
	<128	256	256	yes
most representative G_P-value				**32**

umu-test - eluate without S9				**Eluate with S9**			
	GEU	**VD**	**Genotoxicity**		**GEU**	**VD**	**Genotoxicity**
	IR < 1.5	**IR < 1.5**	**GEU > 1.5**		**IR < 1.5**	**IR < 1.5**	**GEU > 1.5**
	1.5	1.67	no		1.5	0.67	no
	1.5	1.67	no		1.5	0.67	no
	1.5	1.67	no				
Median	**1.5**	**1.67**	**no**	**Median**	**1.5**	**0.67**	**no**

Data Sheet samble no. 4

Waste from MFSU and removal of paint and varnish, sludges from paint or varnish containing organic solvents or other dangerous substances	sample number	waste code	Date
	4	080113	21.06.2002

Chemical characterization - eluate

Dry weight	Water content %	pH	Cond. µS/cm
68	**32**	**7.21**	**665**

DOC	TOC	NH4	Mercury	Cadmium	Chromium, total	Nickel	Copper
mg/l	mg/l	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l
74	-	42	5.9	<0.1	<0.5	13.6	9.1

Lead	Zinc	Manganese	Arsenic	Cobalt	AOX
µg/l	µg/l	µg/l	µg/L	µg/l	mg/l
3.5	10100	220	<0.5	158	0.02

PCB 8	HCH	PCB 18	PCB 28	PCB 52	PCB 101	PCB 138	PCB 153
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
-	<	<	<	0.01	0.028	0.064	0.035

PCB 180	PCB 77	PCB 105	PCB 118	PCB 126	PCB 169	PCB 189
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.005		<	<	-	-	-

Naphthalene	Acenaphthylene	Acenaphtene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
2.02	<	<	0.008	0.014	<	0.01	0.012

Benzo(a)-anthracene	Chrysene	Benzo(b)-fluoranthene	Benzo(k)-fluoranthene	Benzo(a)-pyrene	Indeno(1,2,3-cd)-pyrene	Dibenz(a,h)-anthracene	Benzo(g,h,i)-perylene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.002	<	0.004	<	<	<	<	<

Biphenyl	Benzene	Toluene	Ethylbenzene	m-/p-Xylene	o-Xylene	Dichlor-methane	1,1-Dichlorethen
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.012	<	2	~ 100	~ 450	~ 220	<	<

cis-1,2-Dichlorethene	trans-1,2-Dichlorethene	Trichlor-methane	1,1,1-Trichlorethan	Tetrachlor-methane	1,2-Dichlorethane	Trichlorethene	Bromdichlor-methane
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	<	<	<	<

1,1,2-Trichlorethane	Tetrachlorethene	Dibromchlor-methane	Tribrom-methane	1,2-Dichlorbenzene	1,3-Dichlorbenzene	1,4-Dichlorbenzene	hydrocar.-Index (H53)
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l
<	<	<	<	<	<	<	-

Data Sheet samble no. 4

	Ifd Nr.	EAV	Datum
Waste from MFSU and removal of paint and varnish Sludges from paint or varnish containing organic solvents or other dangerous substances	4	080113	21.06.2002

Chemical characterization - solid matter

Arsenic	Lead	Cadmium	Chromium	Copper	Nickel	Mercury	Zinc
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
1.7	9.9	0.37	3.2	170	1.9	<0.05	21600

Hydrocarbons	Lipophilic subst.	TOC	Benzene	Toluene	Ethylbenzene	Xylene
Weight %	Weight %	Weight %	mg/kg	mg/kg	mg/kg	mg/kg
9.3	7.4	29.4	0.02	0.27	47	230

Sum BTEX	Naphthalene	Acenaphtene	Acenaphtylene	Fluorene	Phenanthrene	Anthracene	Fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
277	16	<0.1	<0.1	<0.1	0.29	<0.1	<0.1

Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.1	<0.1	<0.1	<0.1	<0.1

Dibenz(ah)anthracene	Benzo(ghi)perylene	Indeno(1,2,3-cd)pyrene	Benzo(a)pyrene	AOX
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.1	<0.1	<0.1	<0.1	430

Water soluble portion	Sum PAH (16 EPA)
Weight %	mg/kg
0.5	16.7

Remarks

solid-pasty, grey, ammonia smell

Data Sheet samble no. 6

Wastes from casting of non-ferrous species, Casting cores and moulds after metal pouring other than those mentioned in 101007, moulding sand	sample number	waste code	Date
	6	101008	11.07.2002

Ecotoxikological characterization

Algae test - eluate

80%-sample	G_A-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	
100	80	3.1	15.7	yes
100	80	2.3	9.9	yes
Median	**80**	**2.7**	**12.8**	**yes**

Daphnia test - eluate

100%-sample	G_D-sample	EC_{10}-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	[%]	
0	1	-	-	-	no
0	1	-	-	-	no
Median	**1**	**-**	**-**	**-**	**no**

Luminescent bacteria test- eluate

50%-sample	G_L-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	
68.8	16	7.9	24.8	yes
66.3	16	7.1	26.8	yes
Median	**16**	**7.5**	**25.8**	**yes**

Bacteria contact test - solid matter

50%-sample	G_B-sample	Toxicity
[%Inhibition]		
94.1	10-100	yes
Median	**10-100**	**yes**

Plant test - solid matter

50%-sample	G_P germination ra	G_P Shoot height	G_P dry shoot weight	Toxicity
Brassica	-	-	-	
	2	2	2	no
Lycopersicon	-	-	-	
	4	2	2	yes
Avena	-	-	-	
	2	2	32	yes
most representative G_P-value				**2**

umu-test - eluate without S9 / **Eluate with S9**

	GEU	VD	Genotoxicity		GEU	VD	Genotoxicity
	IR < 1.5	IR < 1.5	GEU > 1.5		IR < 1.5	IR < 1.5	GEU > 1.5
	1.5	0.67	no		1.5	0.67	no
	3	0.33	yes		1.5	0.67	no

Data Sheet samble no. 6

	sample number	waste code	Date
Wastes from casting of non-ferrous species, Casting cores and moulds after metal pouring other than those mentioned in 101007, moulding sand	6	101008	11.07.2002

Chemical characterization - eluate

Dry weight %	Water content %	pH	Cond. µS/cm
96.7	3.27	7	439

DOC	TOC	NH4	Mercury	Cadmium	Chromium, total	Nickel	Copper
mg/l	mg/l	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l
85	-	1.4	0.1	1	95.2	87.7	189

Lead	Zinc	Manganese	Arsenic	Cobalt	AOX
µg/l	µg/l	µg/l	µg/L	µg/l	mg/l
36	1280	1420	2.3	43.4	0.05

PCB 8	HCH	PCB 18	PCB 28	PCB 52	PCB 101	PCB 138	PCB 153
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	0.012	0.043	0.093	0.048

PCB 180	PCB 77	PCB 105	PCB 118	PCB 126	PCB 169	PCB 189
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.007	<	0.007	<	<	<	<

Naphthalene	Acenaphthylene	Acenaphtene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
10	0.23	0.27	0.64	5.1	0.83	1.2	1

Benzo(a)-anthracene	Chrysene	Benzo(b)-fluoranthene	Benzo(k)-fluoranthene	Benzo(a)-pyrene	Indeno(1,2,3-cd)-pyrene	Dibenz(a,h)-anthracene	Benzo(g,h,i)-perylene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.19	0.72	0.03	0.006	0.011	<	0.002	0.004

Biphenyl	Benzene	Toluene	Ethylbenzene	m-/p-Xylene	o-Xylene	Dichlor-methane	1,1-Dichlorethene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
1.1	0.58	1.43	1.03	2.24	1.81	<	<

cis-1,2-Dichlorethene	trans-1,2-Dichlorethene	Trichlor-methane	1,1,1-Trichlorethan	Tetrachlor-methane	1,2-Dichlorethane	Trichlorethene	Bromdichlor-methane
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	<	<	<	<

1,1,2-Trichlorethane	Tetrachlor-ethene	Dibromchlor-methane	Tribrom-methane	1,2-Dichlorbenzene	1,3-Dichlorbenzene	1,4-Dichlorbenzene	hydrocar.-Index (H53)
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l
<	<	<	<	<	<	<	-

Data Sheet samble no.6

Description	sample number	waste code	Date
Wastes from casting of non-ferrous species, Casting cores and moulds after metal pouring other than those mentioned in 101007, moulding sand	6	101008	11.07.2002

Chemical characterization - solid matter

Arsenic	Lead	Cadmium	Chromium	Copper	Nickel	Mercury	Zinc
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
1.8	5.2	0.19	17	56	11	<0.05	144

Hydrocarbons	Lipophilic subst.	TOC	Benzene	Toluene	Ethylbenzene	Xylene
Weight %	Weight %	Weight %	mg/kg	mg/kg	mg/kg	mg/kg
0.14	0.15	1.9	0.07	0.22	0.07	0.18

Sum BTEX	Naphthalene	Acenaphtene	Acenaphtylene	Fluorene	Phenanthrene	Anthracene	Fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
0.54	7.8	0.12	<0.1	0.21	2.4	0.3	0.19

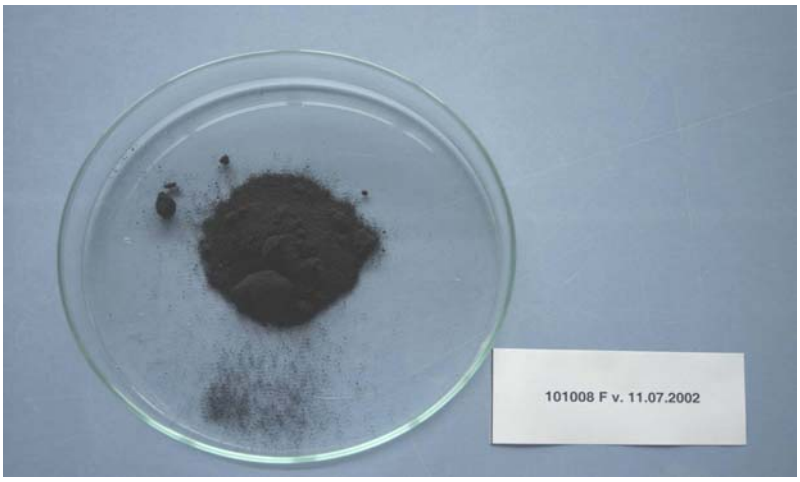
Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
0.3	<0.1	0.1	0.11	<0.1

Dibenz(ah)anthracene	Benzo(ghi)perylene	Indeno(1,2,3-cd)pyrene	Benzo(a)pyrene	AOX
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.1	<0.1	<0.1	<0.1	20

Water soluble portion	Sum PAH (16 EPA)
Weight %	mg/kg
0.3	11.5

Remarks

moulding sand,powdery, sooty



Data Sheet samble no.7

Wastes from shaping and physical and mechanical surface treatment of metals and plastics, Machining sludges containing dangerous substances	sample number	waste code	Date
	7	120114	27.06.2002

Ecotoxikological characterization

Algae test - eluate

80%-sample [%Inhibition]	G_A-sample	EC_{20}-sample [%]	EC_{50}-sample [%]	Toxicity
51.9	2	-	-	yes
-78.3	1.25	-	-	no
Median	**1.6**	**-**	**-**	**yes**

Daphnia test - eluate

100%-sample [%Inhibition]	G_D-sample	EC_{10}-sample [%]	EC_{20}-sample [%]	EC_{50}-sample [%]	Toxicity
80	2	-	-	-	yes
0	1	-	-	-	no
Median	**1.5**	**-**	**-**	**-**	**yes**

Luminescent bacteria test- eluate

50%-sample [%Inhibition]	G_L-sample	EC_{20}-sample [%]	EC_{50}-sample [%]	Toxicity
100	128	1.2	4.5	yes
100	64	2.0	6.1	yes
Median	**96**	**1.6**	**5.3**	**yes**

Bacteria contact test - solid matter

50%-sample [%Inhibition]	G_B-sample	Toxicity
78.3		yes
-	10-100	yes
Median	**10-100**	**yes**

Plant test - solid matter

50%-sample	G_P germination rate	G_P Shoot height	G_P dry shoot weight	Toxicity
Brassica	128	128	128	yes
	<128	<128	1024	yes
Lycopersicon	-	256	>256	yes
	256	<128	<128	yes
Avena	<16	32	32	yes
	>2048	256	<2048	yes
most representative G_P-value				**not detectable**

umu-test - eluate without S9				**Eluate with S9**			
	GEU	**VD**	**Genotoxicity**		**GEU**	**VD**	**Genotoxicity**
	IR < 1.5	**IR < 1.5**	**GEU > 1.5**		**IR < 1.5**	**IR < 1.5**	**GEU > 1.5**
	1.5	0.67	no		1.5	0.67	no
	1.5	0.67	no		1.5	0.67	no
Median	**1.5**	**0.67**	**no**	**Median**	**1.5**	**0.67**	**no**

Data Sheet samble no.7

	sample number	waste code	Date
Wastes from shaping and physical and mechanical surface treatment of metals and plastics, Machining sludges containing dangerous substances	7	120114	27.06.2002

Chemical characterization - eluate

Dry weight %	Water content %	pH	Cond. µS/cm
60.9	39.1	7.8	800

DOC	TOC	NH4	Mercury	Cadmium	Chromium, total	Nickel	Copper
mg/l	mg/l	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l
110	-	0.55		<0.1	<05	18.4	11.2

Lead	Zinc	Manganese	Arsenic	Cobalt	AOX
µg/l	µg/l	µg/l	µg/L	µg/l	mg/l
3.74	302	231	<0.5	3.7	0.04

PCB 8	HCH	PCB 18	PCB 28	PCB 52	PCB 101	PCB 138	PCB 153
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
-	<	<	<	<	0.009	0.016	0.01

PCB 180	PCB 77	PCB 105	PCB 118	PCB 126	PCB 169	PCB 189	
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	
<	-	<	<	-	-	-	

Naphthalene	Acenaphthylene	Acenaphtene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.381	0.016	<	0.034	0.029	<	0.019	0.041

Benzo(a)-anthracene	Chrysene	Benzo(b)-fluoranthene	Benzo(k)-fluoranthene	Benzo(a)-pyrene	Indeno(1,2,3-cd)-pyrene	Dibenz(a,h)-anthracene	Benzo(g,h,i)-perylene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	<	<	<	<

Biphenyl	Benzene	Toluene	Ethylbenzene	m-/p-Xylene	o-Xylene	Dichlor-methane	1,1-Dichlorethene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.008	<	<	14	55	21	<	<

cis-1,2-Dichlorethene	trans-1,2-Dichlorethene	Trichlor-methane	1,1,1-Trichlorethan	Tetrachlor-methane	1,2-Dichlorethane	Trichlorethene	Bromdichlor-methane
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	<	<	<	<

1,1,2-Trichlorethane	Tetrachlorethene	Dibromchlor-methane	Tribrom-methane	1,2-Dichlorbenzene	1,3-Dichlorbenzene	1,4-Dichlorbenzene	hydrocar.-Index (H53)
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l
<	<	<	<	<	<	<	-

Data Sheet samble no.7

Wastes from shaping and physical and mechanical surface treatment of metals and plastics, Machining sludges containing dangerous substances	sample number	waste code	Date
	7	120114	27.06.2002

Chemical characterization - solid matter

Arsenic	Lead	Cadmium	Chromium	Copper	Nickel	Mercury	Zinc
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
10	130	0.92	310	340	120	0.45	2085

Hydrocarbons	Lipophilic subst.	TOC	Benzene	Toluene	Ethylbenzene	Xylene
Weight %	Weight %	Weight %	mg/kg	mg/kg	mg/kg	mg/kg
47	5.4	59.8	<0.01	0.3	4.6	29

Sum BTEX	Naphthalene	Acenaphtene	Acenaphtylene	Fluorene	Phenanthrene	Anthracene	Fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
72.2	4.3	<0.1	<0.1	1.3	7.6	<0.1	0.65

Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
1.4	8.3	3.8	0.18	<0.1

Dibenz(ah)anthracene	Benzo(ghi)perylene	Indeno(1,2,3-cd)pyrene	Benzo(a)pyrene	AOX
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.1	<0.1	<0.1	0.19	390

Water soluble portion	Sum PAH (16 EPA)
Weight %	mg/kg
0.5	27.7

Remarks

liquid, pasty, black, solvent smell, liquid supernatant portion, eluate showed oily characteristic

Data Sheet samble no.8

Waste from MFSU and removal of paint and varnish, Sludges from paint or varnish containing organic solvents or other dangerous substances	sample number	waste code	Date
	8	080113	27.06.2002

Ecotoxikological characterization

Algae test - eluate

80%-sample	G_A-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	
100	40	5.6	7.3	yes
100	40	2.7	5.6	yes
100	40	2.7	5.1	yes
Median	**40**	**2.7**	**5.6**	**yes**

Daphnia test - eluate

100%-sample	G_D-sample	EC_{10}-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	[%]	
100	5	38.8	42.1	49.2	yes
90	5	42.9	48.5	61.2	yes
90	2	49.4	55.8	70.5	yes
Median	**5**	**42.9**	**48.5**	**61.2**	**yes**

Luminescent bacteria test- eluate

50%-sample	G_L-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	
79	64	1.9	9.8	yes
78.7	64	1.8	9.6	yes
Median	**64**	**1.8**	**9.7**	**yes**

Bacteria contact test - solid matter

50%-sample	G_B-sample	Toxicity
[%Inhibition]		
44.5	-	yes
43.4	2-10	yes
Median	**2-10**	**yes**

Plant test - solid matter

50%-sample	G_P Germination rate	G_P Shoot height	G_P Dry shoot weight	Toxicity
Brassica				
	8	16	8	yes
Lycopersicon	-	-	-	-
	>32	8	8	yes
Avena	-	-	-	
	8	4	8	yes
most representative G_P-value				**8**

umu-test - eluate without S9 / **Eluate with S9**

	GEU	VD	Genotoxicity		GEU	VD	Genotoxicity
	IR < 1.5	**IR < 1.5**	**GEU > 1.5**		**IR < 1.5**	**IR < 1.5**	**GEU > 1.5**
	1.5	0.67	no		1.5	0.67	no
	1.5	0.67	no		1.5	0.67	no
Median		**0.67**	**no**	**Median**	**1.5**	**0.67**	**no**

Data Sheet samble no.8

Waste from MFSU and removal of paint and varnish, Sludges from paint or varnish containing organic solvents or other dangerous substances	sample number	waste code	Date
	8	080113	27.06.2002

Chemical characterization - eluate

Dry weight %	Water content %	pH	Cond. µS/cm
64.5	35.5	6	747

DOC	TOC	NH4	Mercury	Cadmium	Chromium, total	Nickel	Copper
mg/l	mg/l	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l
410	-	13	<0.05	<0.1	<0.5	15.1	116

Lead	Zinc	Manganese	Arsenic	Cobalt	AOX
µg/l	µg/l	µg/l	µg/L	µg/l	mg/l
2.72	10100	295	<0.5	151	0.03

PCB 8	HCH	PCB 18	PCB 28	PCB 52	PCB 101	PCB 138	PCB 153
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	<	0.012	0.022	0.012

PCB 180	PCB 77	PCB 105	PCB 118	PCB 126	PCB 169	PCB 189	
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	
0.002	<	<	<	<	<	<	

Naphthalene	Acenaphthylene	Acenaphtene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
11	<	0.004	0.04	0.019	<	0.009	0.009

Benzo(a)-anthracene	Chrysene	Benzo(b)-fluoranthene	Benzo(k)-fluoranthene	Benzo(a)-pyrene	Indeno(1,2,3-cd)-pyrene	Dibenz(a,h)-anthracene	Benzo(g,h,i)-perylene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.001	0.004	0.001	<	0.002	<	<	0.001

Biphenyl	Benzene	Toluene	Ethylbenzene	m-/p-Xylene	o-Xylene	Dichlor-methane	1,1-Dichlorethene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
n.b.	<	14	450	1040	410	<	<

cis-1,2-Dichlorethene	trans-1,2-Dichlorethene	Trichlor-methane	1,1,1-Trichlorethan	Tetrachlor-methane	1,2-Dichlorethane	Trichlorethene	Bromdichlor-methane
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	<	<	<	<

1,1,2-Trichlorethane	Tetrachlorethene	Dibromchlor-methane	Tribrom-methane	1,2-Dichlorbenzene	1,3-Dichlorbenzene	1,4-Dichlorbenzene	hydrocar.-Index (H53)
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l
<	<	<	<	<	<	<	-

Data Sheet samble no.8

Waste from MFSU and removal of paint and varnish, Sludges from paint or varnish containing organic solvents or other dangerous substances	sample number	waste code	Date
	8	080113	27.06.2002

Chemical characterization - solid matter

Arsenic	Lead	Cadmium	Chromium	Copper	Nickel	Mercury	Zinc
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
1.7	1025	6.2	100	70	67	<0,05	119200

Hydrocarbons	Lipophilic subst.	TOC	Benzene	Toluene	Ethylbenzene	Xylene
Weight %	Weight %	Weight %	mg/kg	mg/kg	mg/kg	mg/kg
6.2	10	24.3	0.05	1.3	150	640

Sum BTEX	Naphthalene	Acenaphtene	Acenaphtylene	Fluorene	Phenanthrene	Anthracene	Fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
791	50	<0.1	<0.1	0.42	0.98	<0.1	<0.1

Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
0.1	0.47	1.2	0.56	<0.1

Dibenz(ah)anthracene	Benzo(ghi)perylene	Indeno(1,2,3-cd)pyrene	Benzo(a)pyrene	AOX
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.1	<0.1	<0.1	<0.1	210

Water soluble portion	Sum PAH (16 EPA)
Weight %	mg/kg
1.7	52.1

Remarks

liquid-pasty, black, solvent smell, liquid supernatant portion

Data Sheet samble no. 9

Wastes from casting of non-ferrous species, Casting cores and moulds after metal pouring other than those mentioned in 101007, core sand

sample number	waste code	Date
9	101008	11.07.2002

Ecotoxikological characterization

Algae test - eluate

80%-sample	G_A-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	
13.9	1.25	-	-	no
-3.5	1.25	-	-	no
16.2	1.25	-	-	no
Median	**1.25**	**-**	**-**	**no**

Daphnia test - eluate

100%-sample	G_D-sample	EC_{10}-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	[%]	
100	2	-	-	-	yes
70	2	-	-	-	yes
Median	**2**	**-**	**-**	**-**	**yes**

Luminescent bacteria test- eluate

50%-sample	G_L-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	
27.5	4	32.7	119.9	yes
29.9	4	26.7	109.7	yes
Median	**4**	**29.7**	**114.8**	**yes**

Bacteria contact test - solid matter

50%-sample	G_B-sample	Toxicity
[%Inhibition]		
16.3	2	no
Median	2	**no**

Plant test - solid matter

50%-sample	G_P Germination rate	G_P Shoot height	G_P Dry shoot weight	Toxicity
Brassica	-	4	8	yes
	<32	64	<32	yes
Lycopersicon	32	8	8	yes
	64	64	64	yes
Avena	2	2	2	no
	<32	<32	64	yes
most representative G_P-value				**32**

umu-test - eluate without S9				**Eluate with S9**			
	GEU	**VD**	**Genotoxicity**		**GEU**	**VD**	**Genotoxicity**
	IR < 1.5	**IR < 1.5**	**GEU > 1.5**		**IR < 1.5**	**IR < 1.5**	**GEU > 1.5**
	1.5	0.67	no		1.5	0.67	no
	1.5	0.67	no		1.5	0.67	no
Median		**0.67**	**no**	**Median**	**1.5**	**0.67**	**no**

Data Sheet samble no. 9

Wastes from casting of non-ferrous species, Casting cores and moulds after metal pouring other than those mentioned in 101007, core sand

sample number	waste code	Date
9	101008	11.07.2002

Chemical characterization - eluate

Dry weight %	Water content %	pH	Cond. µS/cm
99.9	0.1	5 adj. to 7.3	85.2

DOC	TOC	NH4	Mercury	Cadmium	Chromium, total	Nickel	Copper
mg/l	mg/l	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l
13	-	0.05	<0.05	<0.1	<0.5	<0.5	4.1

Lead	Zinc	Manganese	Arsenic	Cobalt	AOX
µg/l	µg/l	µg/l	µg/L	µg/l	mg/l
2.87	91	<5	<0.5	1.1	0.02

PCB 8	HCH	PCB 18	PCB 28	PCB 52	PCB 101	PCB 138	PCB 153
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	<	0.006	0.01	0.005

PCB 180	PCB 77	PCB 105	PCB 118	PCB 126	PCB 169	PCB 189	
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	
0.001	<	<	<	<	<	<	

Naphthalene	Acenaphthylene	Acenaphtene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
22	0.002	0.003	0.004	0.006	0.007	0.002	0.002

Benzo(a)-anthracene	Chrysene	Benzo(b)-fluoranthene	Benzo(k)-fluoranthene	Benzo(a)-pyrene	Indeno(1,2,3-cd)-pyrene	Dibenz(a,h)-anthracene	Benzo(g,h,i)-perylene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0	0.001	0	<	0.001	<	<	0

Biphenyl	Benzene	Toluene	Ethylbenzene	m-/p-Xylene	o-Xylene	Dichlor-methane	1,1-Dichlorethene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.005	<	<	<	0.94	1.09	<	<

cis-1,2-Dichlorethene	trans-1,2-Dichlorethene	Trichlor-methane	1,1,1-Trichlorethan	Tetrachlor-methane	1,2-Dichlorethane	Trichlor-ethene	Bromdichlor-methane
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	<	<	<	<

1,1,2-Trichlorethane	Tetrachlorethene	Dibromchlor-methane	Tribrom-methane	1,2-Dichlorbenzene	1,3-Dichlorbenzene	1,4-Dichlorbenzene	hydrocar.-Index (H53)
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l
<	<	<	<	<	<	<	-

Data Sheet samble no. 9

Wastes from casting of non-ferrous species, Casting cores and moulds after metal pouring other than those mentioned in 101007, core sand

sample number	waste code	Date
9	101008	11.07.2002

Chemical characterization - solid matter

Arsenic	Lead	Cadmium	Chromium	Copper	Nickel	Mercury	Zinc
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.1	1	0.02	1.3	2.2	<1	0.07	12

Hydrocarbons	Lipophilic subst.	TOC	Benzene	Toluene	Ethylbenzene	Xylene
Weight %	Weight %	Weight %	mg/kg	mg/kg	mg/kg	mg/kg
0.002	<0.01	0.6	<0.01	0.01	0.04	0.26

Sum BTEX	Naphthalene	Acenaphtene	Acenaphtylene	Fluorene	Phenanthrene	Anthracene	Fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
0.31	3.3	0.1	<0.1	<0.1	0.15	<0.1	<0.1

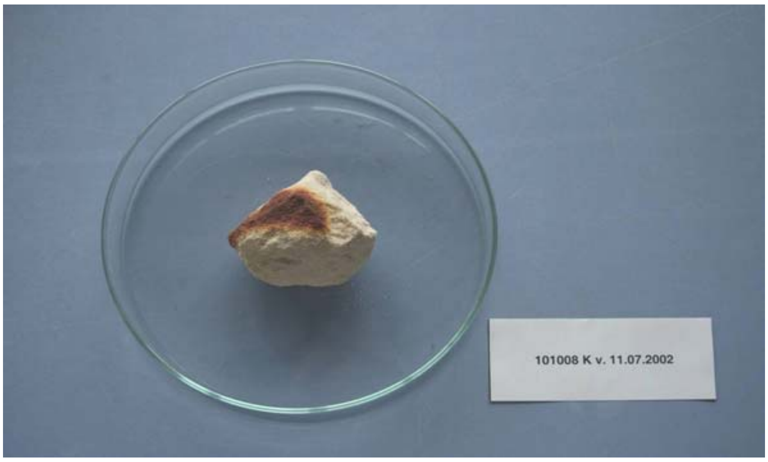
Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.1	<0.1	<0.1	<0.1	<0.1

Dibenz(ah)anthracene	Benzo(ghi)perylene	Indeno(1,2,3-cd)pyrene	Benzo(a)pyrene	AOX
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.1	<0.1	<0.1	<0.1	15

Water soluble portion	Sum PAH (16 EPA)
Weight %	mg/kg
<0.1	3.55

Remarks

core sand, solid-stony, beige



Data Sheet samble no. 11

Wastes from shredding of metal containing wastes, Fluff-light fraction and dust, other than those mentioned in 191003	sample number	waste code	Date
	11	191004	21.05.2002

Ecotoxikological characterization

Algae test - eluate

80%-sample	G_A-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	
100	10	9.9	14.2	yes
100	10	14.3	16.4	yes
89.1	4	29.1	42.6	yes
Median	**10**	**14.3**	**16.4**	**yes**

Daphnia test - eluate

100%-sample	G_D-sample	EC_{10}-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	[%]	
30	2	63.8	77.2	111.2	yes
10	1	100.0	-	-	no
Median	**1.5**	**81.9**	**77.2**	**111.2**	**yes**

Luminescent bacteria test- eluate

50%-sample	G_L-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	
60.6	16	11.64	35.14	yes
59.2	16	11.56	36.74	yes
Median	**16**	**11.6**	**35.9**	**yes**

Bacteria contact test - solid matter

50%-sample	G_B-sample	Toxicity
[%Inhibition]		
76.8	-	yes
98.4	10-100	yes
Median	**10-100**	**yes**

Plant test - solid matter

50%-sample	G_P Germination rate	G_P Shoot height	G_P Dry shoot weight	Toxicity
Brassica	2	8	>32	yes
	>32	>32	>32	yes
Lycopersicon	16	8	16	yes
	>32	>32	>32	yes
Avena	2	2	2	no
	4	4	>32	yes
most representative G_P-value				**>32**

umu-test - eluate without S9 / **Eluate with S9**

	GEU	VD	Genotoxicity		GEU	VD	Genotoxicity
	IR < 1.5	IR < 1.5	GEU > 1.5		IR < 1.5	IR < 1.5	GEU > 1.5
	1.5	0.67	no		1.5	0.67	no
	1.5	0.67	no		1.5	0.67	no
Median	**1.5**	**0.67**	**no**	**Median**	**1.5**	**0.67**	**no**

Data Sheet samble no. 11

Description	sample number	waste code	Date
Wastes from shredding of metal containing wastes, Fluff-light fraction and dust, other than those mentioned in 191003	11	191004	21.05.2002

Chemical characterization - eluate

Dry weight %	Water content %	pH	Cond. µS/cm
92.69	7.31	8.1	983

DOC	TOC	NH4	Mercury	Cadmium	Chromium, total	Nickel	Copper
mg/l	mg/l	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l
85	-	0.1	0.5	8.7	<0.5	69.6	210

Lead	Zinc	Manganese	Arsenic	Cobalt	AOX
µg/l	µg/l	µg/l	µg/L	µg/l	mg/l
16.3	3510	854	<0.5	12.1	0.47

PCB 8	HCH	PCB 18	PCB 28	PCB 52	PCB 101	PCB 138	PCB 153
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	<	0.01	0.023	0.013

PCB 180	PCB 77	PCB 105	PCB 118	PCB 126	PCB 169	PCB 189	
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	
0.002	<	0.001	<	<	<	<	

Naphthalene	Acenaphthylene	Acenaphtene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.32	0.077	0.12	0.11	0.2	0.017	0.024	0.019

Benzo(a)-anthracene	Chrysene	Benzo(b)-fluoranthene	Benzo(k)-fluoranthene	Benzo(a)-pyrene	Indeno(1,2,3-cd)-pyrene	Dibenz(a,h)-anthracene	Benzo(g,h,i)-perylene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	0.002	0.001	<	0.002	0.001	0	0.001

Biphenyl	Benzene	Toluene	Ethylbenzene	m-/p-Xylene	o-Xylene	Dichlor-methane	1,1-Dichlorethene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.083	2.17	6.17	2.35	4.57	11	0.46	<

cis-1,2-Dichlorethene	trans-1,2-Dichlorethene	Trichlor-methane	1,1,1-Trichlorethan	Tetrachlor-methane	1,2-Dichlorethane	Trichlorethene	Bromdichlor-methane
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	<	<	0.11	<

1,1,2-Trichlorethane	Tetrachlorethene	Dibromchlor-methane	Tribrom-methane	1,2-Dichlorbenzene	1,3-Dichlorbenzene	1,4-Dichlorbenzene	hydrocar.-Index (H53)
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l
<	<	<	<	<	<	<	-

Data Sheet samble no. 11

Wastes from shredding of metal containing wastes, Fluff-light fraction and dust, other than those mentioned in 191003	sample number	waste code	Date
	11	191004	21.05.2002

Chemische Charakterisierung - Feststoff

Arsenic	Lead	Cadmium	Chromium	Copper	Nickel	Mercury	Zinc
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
32	3300	31	520	10650	340	189	17130

Hydrocarbons	Lipophilic subst.	TOC	Benzene	Toluene	Ethylbenzene	Xylene
Weight %	Weight %	Weight %	mg/kg	mg/kg	mg/kg	mg/kg
1.8	2.2	22.1	4	20	8.3	35

Sum BTEX	Naphthalene	Acenaphtene	Acenaphtylene	Fluorene	Phenanthrene	Anthracene	Fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
67.3	3.1	0.47	0.14	1.3	6.4	0.4	5.8

Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
6.9	1.9	2	1.9	0.85

Dibenz(ah)anthracene	Benzo(ghi)perylene	Indeno(1,2,3-cd)pyrene	Benzo(a)pyrene	AOX
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
0.31	1.2	0.89	1.7	6000

Water soluble portion	Sum PAH (16 EPA)
Weight %	mg/kg
0.9	35.2

Remarks

heterogeneous sample with particles of various sizes,

Data Sheet samble no. 12

	sample number	waste code	Date
Waste from MFSU and removal of paint and varnish, Aqueous sludges containing paint or varnish containing organic solvents or other dangerous substances	12	080115	12.09.2002

Ecotoxikological characterization

Algae test - eluate

80%-sample	G_A-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	
100	1280	0.1	0.2	yes
100	640	0.2	0.3	yes
100	800	0.3	0.3	yes
Median	**800**	**0.2**	**0.3**	**yes**

Daphnientest - Eluat

100%-Probe	G_D-sample	EC_{10}-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	[%]	
100	>20	7.3	7.9	9.2	yes
100	40	2.1	2.3	2.7	yes
100	20	11.2	13.0	17.2	yes
Median	**30**	**7.3**	**7.9**	**9.2**	**yes**

Luminescent bacteria test- eluate

50%-sample	G_L-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	
100	32	5.3	15.2	yes
100	32	5.5	15.8	yes
100	32	5.8	16.3	yes
Median	**32**	**5.5**	**15.8**	**yes**

Bacteria contact test - solid matter

50%-sample	G_B-sample	Toxicity
[%Inhibition]		
101.8	>100	yes
99.8	10-100	yes
Median	10-100	**yes**

Plant test - solid matter

50%-sample	G_P Germination rate	G_P Shoot height	G_P Dry shoot weight	Toxicity
Brassica	-	<64	<64	yes
	64	64	64	yes
Lycopersicon	256	<64	128	yes
	128	128	128	yes
Avena	-	<64	<64	yes
	<16	32	64	yes
most representative G_P-value				**64**

umu-test - eluate without S9				**Eluate with S9**			
	GEU	**VD**	**Genotoxicity**		**GEU**	**VD**	**Genotoxicity**
	IR < 1.5	**IR < 1.5**	**GEU > 1.5**		**IR < 1.5**	**IR < 1.5**	**GEU > 1.5**
	sample cytotoxic	-	-		1.5	0.67	no
	sample cytotoxic	-	-		1.5	0.67	no
Median	sample cytotoxic		**-**	**Median**	**1.5**	**0.67**	**no**

Data Sheet samble no. 12

Description	sample number	waste code	Date
Waste from MFSU and removal of paint and varnish, Aqueous sludges containing paint or varnish containing organic solvents or other dangerous substances	12	080115	12.09.2002

Chemical characterization - eluate

Dry weight %	Water content %	pH	Cond. µS/cm
36.8	63.2	8.1	1238

DOC	TOC	NH4	Mercury	Cadmium	Chromium, total	Nickel	Copper
mg/l	mg/l	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l
270	-	0.05	0.1	<0,1	<0,5	44.2	14.4

Lead	Zinc	Manganese	Arsenic	Cobalt	AOX
µg/l	µg/l	µg/l	µg/L	µg/l	mg/l
3.06	304	173	2.5	1.4	1.3

PCB 8	HCH	PCB 18	PCB 28	PCB 52	PCB 101	PCB 138	PCB 153
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	<	0.009	0.019	0.011

PCB 180	PCB 77	PCB 105	PCB 118	PCB 126	PCB 169	PCB 189	
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	
0.001	<	<	<	<	<	<	

Naphthalene	Acenaphthylene	Acenaphtene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.14	<	<	0.029	0.013	0.029	0.005	0.004

Benzo(a)-anthracene	Chrysene	Benzo(b)-fluoranthene	Benzo(k)-fluoranthene	Benzo(a)-pyrene	Indeno(1,2,3-cd)-pyrene	Dibenz(a,h)-anthracene	Benzo(g,h,i)-perylene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	0.001	<	0	<	0	<	0.001

Biphenyl	Benzene	Toluene	Ethylbenzene	m-/p-Xylene	o-Xylene	Dichlor-methane	1,1-Dichlorethene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.046	<	<	11	59	17	<	<

cis-1,2-Dichlorethene	trans-1,2-Dichlorethene	Trichlor-methane	1,1,1-Trichlorethan	Tetrachlor-methane	1,2-Dichlorethane	Trichlorethene	Bromdichlor-methane
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	0.112	<	<	<	<	<

1,1,2-Trichlorethane	Tetrachlorethene	Dibromchlor-methane	Tribrom-methane	1,2-Dichlorbenzene	1,3-Dichlorbenzene	1,4-Dichlorbenzene	hydrocar.-Index (H53)
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l
<	<	<	<	<	<	<	5.1

Data Sheet samble no. 12

	sample number	waste code	Date
Waste from MFSU and removal of paint and varnish, Aqueous sludges containing paint or varnish containing organic solvents or other dangerous substances	12	080115	12.09.2002

Chemical characterization - solid matter

Arsenic	Lead	Cadmium	Chromium	Copper	Nickel	Mercury	Zinc
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
8.9	11	0.13	8.1	30	78	<0,05	440

Hydrocarbons	Lipophilic subst.	TOC	Benzene	Toluene	Ethylbenzene	Xylene
Weight %	Weight %	Weight %	mg/kg	mg/kg	mg/kg	mg/kg
2.9	4.5	33	<0,01	0.01	0.75	5.5

Sum BTEX	Naphthalene	Acenaphtene	Acenaphtylene	Fluorene	Phenanthrene	Anthracene	Fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
6.26	4.1	0.36	0.1	0.9	2.5	<0.1	0.11

Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
0.77	0.2	0.28	<0.1	<0.1

Dibenz(ah)anthracene	Benzo(ghi)perylene	Indeno(1,2,3-cd)pyrene	Benzo(a)pyrene	AOX
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.1	<0.1	<0.1	<0.1	920

Water soluble portion	Sum PAH (16 EPA)
Weight %	mg/kg
1.9	9.32

Remarks

grey, pasty,

Data Sheet samble no. 13

Waste from MFSU and removal of paint and varnish, Aqueous sludges containing paint or varnish other than those mentioned in 080115.	sample number	waste code	Date
	13	080116	12.09.2002

Ecotoxikological characterization

Algae test - eluate

80%-sample	G_A-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	
100	40	5.9	7.9	yes
100	40	3.4	5.5	yes
Median	**40**	**4.6**	**6.7**	**yes**

Daphnia test - eluate

100%-sample	G_D-sample	EC_{10}-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	[%]	
100	5	36.4	39.5	46.2	yes
100	5	27.0	28.5	31.6	yes
Median	**5**	**31.7**	**34.0**	**38.9**	**yes**

Luminescent bacteria test- eluate

50%-sample	G_L-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	
42.9	8	22.2	62.5	yes
48.6	8	17.0	50.3	yes
Median	**8**	**19.6**	**56.4**	**yes**

Bacteria contact test - solid matter

50%-sample	G_B-sample	Toxicity
[%Inhibition]		
73	10-100	yes
Median	10-100	**yes**

Plant test - solid matter

50%-sample	G_P Germination rate	G_P Shoot height	G_P Dry shoot weight	Toxicity
Brassica	>128	64	128	yes
	1024	<128	<128	yes
Lycopersicon	>128	64	128	yes
	512	256	256	yes
Avena	>128	32	32	yes
	<128	<128	<128	-
most representative G_P-value				**64**

umu-test - eluate without S9 / **Eluate with S9**

	GEU	VD	Genotoxicity		GEU	VD	Genotoxicity
	IR < 1.5	IR < 1.5	GEU > 1.5		IR < 1.5	IR < 1.5	GEU > 1.5
	1.5	0.67	no		1.5	0.67	no
	1.5	0.67	no		1.5	0.67	no
Median	**1.5**	**0.67**	**no**	**Median**	**1.5**	**0.67**	**no**

Data Sheet samble no. 13

Waste from MFSU and removal of paint and varnish, Aqueous sludges containing paint or varnish other than those mentioned in 080115.	sample number	waste code	Date
	13	080116	12.09.2002

Chemical characterization - eluate

Dry weight %	Water content %	pH	Cond. µS/cm
37.3	62.7	7.6	1880

DOC	TOC	NH4	Mercury	Cadmium	Chromium, total	Nickel	Copper
mg/l	mg/l	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l
3100	-	78	-	<0.1	<0,5	3.6	14.2

Lead	Zinc	Manganese	Arsenic	Cobalt	AOX
µg/l	µg/l	µg/l	µg/L	µg/l	mg/l
3.84	357	204	<0.5	2.8	0.27

PCB 8	HCH	PCB 18	PCB 28	PCB 52	PCB 101	PCB 138	PCB 153
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
not detectable (extract formed a gel)							

PCB 180	PCB 77	PCB 105	PCB 118	PCB 126	PCB 169	PCB 189	
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	
not detectable (extract formed a gel)							

Naphthalene	Acenaphthylene	Acenaphtene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
not detectable (extract formed a gel)							

Benzo(a)-anthracene	Chrysene	Benzo(b)-fluoranthene	Benzo(k)-fluoranthene	Benzo(a)-pyrene	Indeno(1,2,3-cd)-pyrene	Dibenz(a,h)-anthracene	Benzo(g,h,i)-perylene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
not detectable (extract formed a gel)							

Biphenyl	Benzene	Toluene	Ethylbenzene	m-/p-Xylene	o-Xylene	Dichlor-methane	1,1-Dichlorethene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
-	0.6	<	0.9	8.1	7.65	<	<

cis-1,2-Dichlorethene	trans-1,2-Dichlorethene	Trichlor-methane	1,1,1-Trichlorethan	Tetrachlor-methane	1,2-Dichlorethane	Trichlorethene	Bromdichlor-methane
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	<	<	<	<

1,1,2-Trichlorethane	Tetrachlorethene	Dibromchlor-methane	Tribrom-methane	1,2-Dichlorbenzene	1,3-Dichlorbenzene	1,4-Dichlorbenzene	hydrocar.-Index (H53)
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l
<	<	<	<	<	<	<	-

Data Sheet samble no. 13

	sample number	waste code	Date
Waste from MFSU and removal of paint and varnish, Aqueous sludges containing paint or varnish other than those mentioned in 080115.	13	080116	12.09.2002

Chemical characterization - solid matter

Arsenic	Lead	Cadmium	Chromium	Copper	Nickel	Mercury	Zinc
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
3	1.3	0.15	250	170	5.5	<0.05	140

Hydrocarbons	Lipophilic subst.	TOC	Benzene	Toluene	Ethylbenzene	Xylene
Weight %	Weight %	Weight %	mg/kg	mg/kg	mg/kg	mg/kg
20	21	55.1	<0.01	<0.01	0.17	2.3

Sum BTEX	Naphthalene	Acenaphtene	Acenaphtylene	Fluorene	Phenanthrene	Anthracene	Fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
2.47	10	<0.1	<0.1	48	11	<0.1	<0.1

Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
0.22	<0.1	0.11	<0.1	<0.1

Dibenz(ah)anthracene	Benzo(ghi)perylene	Indeno(1,2,3-cd)pyrene	Benzo(a)pyrene	AOX
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.1	<0.1	<0.1	<0.1	1260

Water soluble portion	Sum PAH (16 EPA)
Weight %	mg/kg
3.1	69.3

Remarks

pasty, black-grey, with an aqueous phase, light solvent smell

Data Sheet samble no. 14

Wastes from shaping and physical and mechanical surface treatment of metals and plastics, Machining sludges containing dangerous substances	sample number	waste code	Date
	14	120114	12.09.2002

Ecotoxikological characterization

Algae test - eluate

80%-sample	G_A-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	
100	80	2.7	3.4	yes
100	80	2.4	1.6	yes
Median	**80**	**2.5**	**2.5**	**yes**

Daphnia test - eluate

100%-sample	G_D-sample	EC_{10}-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	[%]	
100	>10	-	-	-	yes
100	>20	3.5	4.2	5.9	yes
100	80	-	-	-	yes
Median	**80**	**3.5**	**4.2**	**5.9**	**yes**

Luminescent bacteria test- eluate

50%-sample	G_L-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	
47.3	8	14.5	51.2	yes
45.7	8	17.1	53.5	yes
Median	**8**	**15.8**	**52.4**	**yes**

Bacteria contact test - solid matter

50%-sample	G_B-sample	Toxicity
[%Inhibition]		
97.8	-	yes
94.7	>100	yes
Median	**>100**	**yes**

Plant test - solid matter

50%-sample	G_P Germination rate	G_P Shoot height	G_P Dry shoot weight	Toxicity
Brassica				
	-	32	32	yes
Lycopersicon	<16	32	64	yes
	>128	>128	32	yes
Avena	<16	<16	<16	yes
	>128	16	-	yes
most representative G_P-value				**32**

umu-test - eluate without S9 / **Eluate with S9**

	GEU	VD	Genotoxicity		GEU	VD	Genotoxicity
	IR < 1.5	**IR < 1.5**	**GEU > 1.5**		**IR < 1.5**	**IR < 1.5**	**GEU > 1.5**
	1.5	0.67	no		1.5	0.67	no
	6	0.17	yes		1.5	0.67	no
	1.5	0.67	no				
Median	**1.5**	**0.67**	**no**	**Median**	**1.5**	**0.67**	**no**

Data Sheet samble no. 14

Description	sample number	waste code	Date
Wastes from shaping and physical and mechanical surface treatment of metals and plastics, Machining sludges containing dangerous substances	14	120114	12.09.2002

Chemical characterization - eluate

Dry weight %	Water content %	pH	Cond. µS/cm
89.85	10.15	10.6 adj. to 7	478

DOC	TOC	NH4	Mercury	Cadmium	Chromium, total	Nickel	Copper
mg/l	mg/l	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l
30	-	0.23	-	0.1	2.2	37.9	113

Lead	Zinc	Manganese	Arsenic	Cobalt	AOX
µg/l	µg/l	µg/l	µg/L	µg/l	mg/l
18.8	26400	173	<0.5	1.8	0.05

PCB 8	HCH	PCB 18	PCB 28	PCB 52	PCB 101	PCB 138	PCB 153
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	0.029	0.13	0.2	0.12

PCB 180	PCB 77	PCB 105	PCB 118	PCB 126	PCB 169	PCB 189	
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	
0.008	<	0.037	<	<	<	<	

Naphthalene	Acenaphthylene	Acenaphtene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.12	0.012	0.029	0.009	0.032	0.004	0.034	0.031

Benzo(a)-anthracene	Chrysene	Benzo(b)-fluoranthene	Benzo(k)-fluoranthene	Benzo(a)-pyrene	Indeno(1,2,3-cd)-pyrene	Dibenz(a,h)-anthracene	Benzo(g,h,i)-perylene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.006	0.011	<	<	<	<	0.005	0.009

Biphenyl	Benzene	Toluene	Ethylbenzene	m-/p-Xylene	o-Xylene	Dichlor-methane	1,1-Dichlorethene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.001	<	<	<	<	<	<	<

cis-1,2-Dichlorethene	trans-1,2-Dichlorethene	Trichlor-methane	1,1,1-Trichlorethan	Tetrachlor-methane	1,2-Dichlorethane	Trichlorethene	Bromdichlor-methane
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	<	<	<	<

1,1,2-Trichlorethane	Tetrachlorethene	Dibromchlor-methane	Tribrom-methane	1,2-Dichlorbenzene	1,3-Dichlorbenzene	1,4-Dichlorbenzene	hydrocar.-Index (H53)
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l
<	<	<	<	<	<	<	-

Data Sheet samble no. 14

Wastes from shaping and physical and mechanical surface treatment of metals and plastics, Machining sludges containing dangerous substances	sample number	waste code	Date
	14	120114	12.09.2002

Chemical characterization - solid matter

Arsenic	Lead	Cadmium	Chromium	Copper	Nickel	Mercury	Zinc
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
15	4.4	0.22	160	360	120	<0,05	77000

Hydrocarbons	Lipophilic subst.	TOC	Benzene	Toluene	Ethylbenzene	Xylene
GEW.%	Gew.%	Gew.%	mg/kg	mg/kg	mg/kg	mg/kg
0.27	0.44	1.8	<0.01	<0.01	0.01	0.13

Sum BTEX	Naphthalene	Acenaphtene	Acenaphtylene	Fluorene	Phenanthrene	Anthracene	Fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
0.14	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

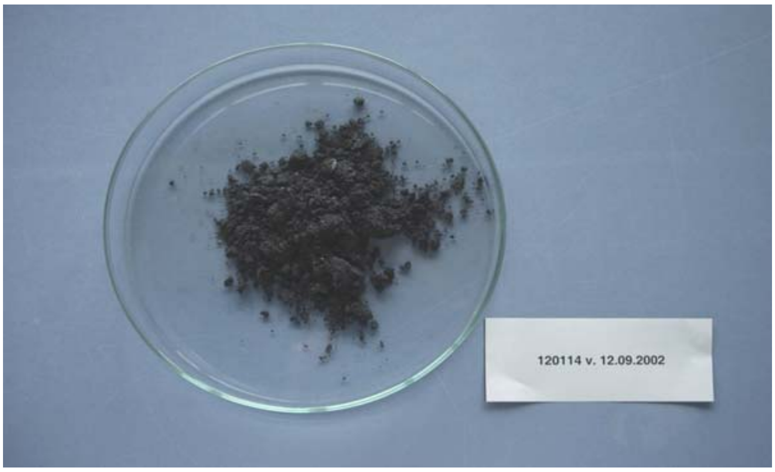
Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.1	<0.1	<0.1	<0.1	<0.1

Dibenz(ah)anthracene	Benzo(ghi)perylene	Indeno(1,2,3-cd)pyrene	Benzo(a)pyrene	AOX
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.1	<0.1	<0.1	<0.1	<1

Water soluble portion	Sum PAH (16 EPA)
Weight %	mg/kg
0.5	<1

Remarks

powdery, black, light solvent smell



Data Sheet samble no. 16

	sample number	waste code	Date
Wastes from shaping and physical and mechanical surface treatment of metals and plastics, Waste blasting material containing dangerous substances	16	120116	10.10.2002

Ecotoxikological characterization

Algae test - eluate

80%-sample	G_A-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	
-1.1	1.25	-	-	no
-4.8	1.25	-	-	no
Median	**1.25**	**-**	**-**	**no**

Daphnia test - eluate

100%-sample	G_D-sample	EC_{10}-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	[%]	
0	1	-	-	-	no
0	1	-	-	-	no
Median	**1**	**-**	**-**	**-**	**no**

Luminescent bacteria test- eluate

50%-sample	G_L-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	
5.9	2	-	-	no
11.8	2	81.7		no
Median	**2**	**81.7**	**-**	**no**

Bacteria contact test - solid matter

50%-sample	G_B-sample	Toxicity
[%Inhibition]		
80.29	-	yes
56.41	2-100	yes
70.36	10-100	yes
Median	**2-10**	**yes**

Plant test - solid matter

50%-sample	G_P germination rate	G_P Shoot height	G_P dry shoot weight	Toxicity
Brassica	16	4	8	yes
	2	2	2	yes
Lycopersicon	-	4	4	yes
	2	4	4	yes
Avena	32	4	4	yes
	-	2	16	yes
most representative G_P-value				**4**

umu-test - eluate without S9 / **Eluate with S9**

	GEU	VD	Genotoxicity		GEU	VD	Genotoxicity
	IR < 1.5	**IR < 1.5**	**GEU > 1.5**		**IR < 1.5**	**IR < 1.5**	**GEU > 1.5**
	1.5	0.67	no		1.5	0.67	no
	1.5	0.67	no		1.5	0.67	no
Median	**1.5**	**0.67**	**no**	**Median**	**1.5**	**0.67**	**no**

Data Sheet samble no. 16

Wastes from shaping and physical and mechanical surface treatment of metals and plastics, Waste blasting material containing dangerous substances	sample number	waste code	Date
	16	120116	10.10.2002

Chemical characterization - eluate

Dry weight %	Water content %	pH	Cond. µS/cm
100	0	8.15	39.5

DOC	TOC	NH4	Mercury	Cadmium	Chromium, total	Nickel	Copper
mg/l	mg/l	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l
13	-	0.46	<0.05	<0.1	<0.5	38.7	4.1

Lead	Zinc	Manganese	Arsenic	Cobalt	AOX
µg/l	µg/l	µg/l	µg/L	µg/l	mg/l
4.29	58	198	<0.5	1.7	0.05

PCB 8	HCH	PCB 18	PCB 28	PCB 52	PCB 101	PCB 138	PCB 153
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	<	0.012	0.026	0.012

PCB 180	PCB 77	PCB 105	PCB 118	PCB 126	PCB 169	PCB 189	
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	
0.002	<	0.001	<	<	<	<	

Naphthalene	Acenaphthylene	Acenaphtene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.2	0.003	0.006	0.01	0.024	0.001	0.009	0.009

Benzo(a)-anthracene	Chrysene	Benzo(b)-fluoranthene	Benzo(k)-fluoranthene	Benzo(a)-pyrene	Indeno(1,2,3-cd)-pyrene	Dibenz(a,h)-anthracene	Benzo(g,h,i)-perylene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.001	0.002	0.002	0.003	0.001	<	<	<

Biphenyl	Benzene	Toluene	Ethylbenzene	m-/p-Xylene	o-Xylene	Dichlor-methane	1,1-Dichlorethene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.003	<	<	<	<	<	<	<

cis-1,2-Dichlorethene	trans-1,2-Dichlorethene	Trichlor-methane	1,1,1-Trichlorethan	Tetrachlor-methane	1,2-Dichlorethane	Trichlorethene	Bromdichlor-methane
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	<	<	<	<

1,1,2-Trichlorethane	Tetrachlorethene	Dibromchlor-methane	Tribrom-methane	1,2-Dichlorbenzene	1,3-Dichlorbenzene	1,4-Dichlorbenzene	hydrocar.-Index (H53)
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l
<	<	<	<	<	<	<	-

Data Sheet samble no. 16

Wastes from shaping and physical and mechanical surface treatment of metals and plastics, Waste blasting material containing dangerous substances	sample number	waste code	Date
	16	120116	10.10.2002

Chemical characterization - solid matter

Arsenic	Lead	Cadmium	Chromium	Copper	Nickel	Mercury	Zinc
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
62	12	0.04	177000	4900	83300	0.35	2300

Hydrocarbons	Lipophilic subst.	TOC	Benzene	Toluene	Ethylbenzene	Xylene
Weight %	Weight %	Weight %	mg/kg	mg/kg	mg/kg	mg/kg
0.014	0.024	0.3	<0.01	<0.01	0.04	0.27

Sum BTEX	Naphthalene	Acenaphtene	Acenaphtylene	Fluorene	Phenanthrene	Anthracene	Fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
0.31	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.1	<0.1	<0.1	<0.1	<0.1

Dibenz(ah)anthracene	Benzo(ghi)perylene	Indeno(1,2,3-cd)pyrene	Benzo(a)pyrene	AOX
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.1	<0.1	<0.1	<0.1	2

Water soluble portion	Sum PAH (16 EPA)
Weight %	mg/kg
<0.1	<1

Remarks

blasting material made of stainless steel, powdery, grey

Data Sheet samble no. 17

Wastes from chemical surface treatment and coating of metals and other materials (for ex. galvanic processes, zinc coating processes, pickling processes, etching, phosphating, alkaline degreasing and anodizing), Sludges and filter cakes other than those mentioned in 110109

sample number	waste code	Date
17	110110	16.10.2002

Ecotoxikological characterization

Algae test - eluate

80%-sample	G_A-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	
50.8	6	13.6	70.5	yes
79.6	10	10.4	27.1	yes
81.2	4	30.3	48.6	yes
Median	**6**	**13.6**	**48.6**	**yes**

Daphnia test - eluate

100%-sample	G_D-sample	EC_{10}-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	[%]	
20	2	-	-	-	yes
10	1	-	-	-	no
Median	**1.5**	**-**	**-**	**-**	**yes**

Luminescent bacteria test- eluate

50%-sample	G_L-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	
11.9	2	106.2	-	no
10.2	2	-	-	no
Median	**2**	**106.2**	**-**	**no**

Bacteria contact test - solid matter

50%-sample	G_B-sample	Toxicity
[%Inhibition]		
75.9	-	yes
71.7	10-100	yes
78.1	10-100	yes
Median	**10-100**	**yes**

Plant test - solid matter

50%-sample	G_P germination rate	G_P Shoot height	G_P dry shoot weight	Toxicity
Brassica	-	2	2	no
	2	2	2	no
Lycopersicon	2	4	4	yes
	8	8	8	yes
Avena	-	2	2	no
	4	4	-	yes
most representative G_P-value				**8**

umu-test - eluate without S9 / **Eluate with S9**

	GEU	VD	Genotoxicity		GEU	VD	Genotoxicity
	IR < 1.5	IR < 1.5	GEU > 1.5		IR < 1.5	IR < 1.5	GEU > 1.5
	1.5	0.67	no		1.5	0.67	no
	1.5	0.67	no		1.5	0.67	no
Median	**1.5**	**0.67**	**no**	**Median**	**1.5**	**0.67**	**no**

Data Sheet samble no. 17

Wastes from chemical surface treatment and coating of metals and other materials (for ex. galvanic processes, zinc coating processes, pickling processes, etching, phosphating, alkaline degreasing and anodizing), Sludges and filter cakes other than those mentioned in 110109

sample number	waste code	Date
17	110110	16.10.2002

Chemical characterization - eluate

Dry weight %	Water content %	pH	Cond. µS/cm
22.1	77	7.8	4900

DOC	TOC	NH4	Mercury	Cadmium	Chromium, total	Nickel	Copper
mg/l	mg/l	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l
56	-	0.03		<0.1	<0.5	121	11.4

Lead	Zinc	Manganese	Arsenic	Cobalt	AOX
µg/l	µg/l	µg/l	µg/L	µg/l	mg/l
2.57	110	132	<0,5	1	0.02

PCB 8	HCH	PCB 18	PCB 28	PCB 52	PCB 101	PCB 138	PCB 153
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	0.005	0.013	0.023	0.022

PCB 180	PCB 77	PCB 105	PCB 118	PCB 126	PCB 169	PCB 189
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	<	<	<

Naphthalene	Acenaphthylene	Acenaphtene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.047	0.002	0.027	0.02	0.13	<	0.036	0.021

Benzo(a)-anthracene	Chrysene	Benzo(b)-fluoranthene	Benzo(k)-fluoranthene	Benzo(a)-pyrene	Indeno(1,2,3-cd)-pyrene	Dibenz(a,h)-anthracene	Benzo(g,h,i)-perylene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	0.004	0.002	0	0.003	<	<	<

Biphenyl	Benzene	Toluene	Ethylbenzene	m-/p-Xylene	o-Xylene	Dichlor-methane	1,1-Dichlorethene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	<	<	<	<

cis-1,2-Dichlorethene	trans-1,2-Dichlorethene	Trichlor-methane	1,1,1-Trichlorethan	Tetrachlor-methane	1,2-Dichlorethane	Trichlorethene	Bromdichlor-methane
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	<	<	<	<

1,1,2-Trichlorethane	Tetrachlorethene	Dibromchlor-methane	Tribrom-methane	1,2-Dichlorbenzene	1,3-Dichlorbenzene	1,4-Dichlorbenzene	hydrocar.-Index (H53)
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l
<	<	<	<	<	<	<	-

Data Sheet samble no. 17

	sample number	waste code	Date
Wastes from chemical surface treatment and coating of metals and other materials (for ex. galvanic processes, zinc coating processes, pickling processes, etching, phosphating, alkaline degreasing and anodizing), Sludges and filter cakes other than those mentioned in 110109	17	110110	16.10.2002

Chemical characterization - solid matter

Arsenic	Lead	Cadmium	Chromium	Copper	Nickel	Mercury	Zinc
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
12	83	<0.01	200	730	47	<0.05	340

Hydrocarbons	Lipophilic subs	TOC	Benzene	Toluene	Ethylbenzene	Xylene
Weight %	Weight %	Weight %	mg/kg	mg/kg	mg/kg	mg/kg
0.021	0.021	1.6	<0.01	<0.01	<0.01	<0.01

Sum BTEX	Naphthalene	Acenaphtene	Acenaphtylene	Fluorene	Phenanthrene	Anthracene	Fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.04	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.38

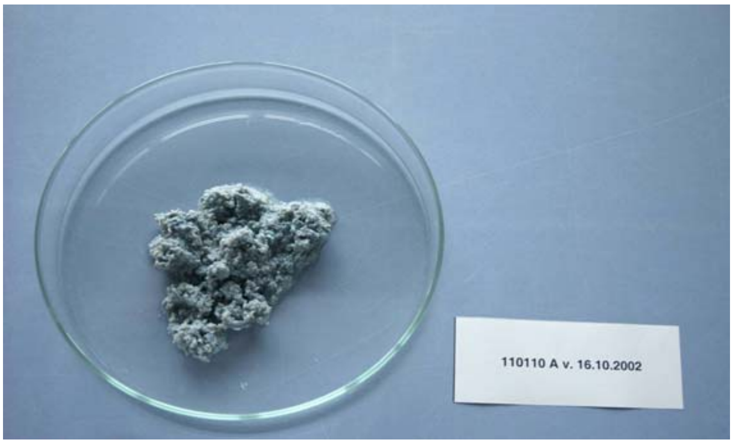
Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
0.16	<0.1	<0.1	<0.1	<0.1

Dibenz(ah)anthracene	Benzo(ghi)perylene	Indeno(1,2,3-cd)pyrene	Benzo(a)pyrene	AOX
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.1	<0.1	<0.1	<0.1	9

Water soluble portion	Sum PAH (16 EPA)
Weight %	mg/kg
3.2	<1

Remarks

granular, blue



Data Sheet samble no. 18

Wastes from waste water treatment plants not otherwise specified, Sludge containing dangerous substances from other treatment of industrial waste water	sample number	waste code	Date
	18	190813	17.10.2002

Ecotoxikological characterization

Algae test - eluate

80%-sample	G_A-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	
99.9	>4	-	-	yes
100	200	0.7	1.0	yes
100	200	0.85	1.1	yes
Median	**200**	**0.8**	**1.0**	**yes**

Daphnia test - eluate

100%-sample	G_D-sample	EC_{10}-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	[%]	
100	20	3.1	3.7	5.3	yes
100	10	10.6	12.2	15.9	yes
Median	**15**	**6.8**	**8.0**	**10.6**	**yes**

Luminescent bacteria test- eluate

50%-sample	G_L-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	
100	32	3.7	9.6	yes
100	64	2.4	7.7	yes
Median	**48**	**3.0**	**8.7**	**yes**

Bacteria contact test - solid matter

50%-sample	G_B-sample	Toxicity
[%Inhibition]		
96.8	-	yes
98.4	10-100	yes
Median	**10-100**	**yes**

Plant test - solid matter

50%-sample	G_P germination rate	G_P Shoot height	G_P dry shoot weight	Toxicity
Brassica	>1024	256	256	yes
	-	<256	<256	-
Lycopersicon	1024	256	256	yes
	<256	<256	<256	-
Avena	>1024	256	>1024	yes
	>4096	1024	-	yes
most representative G_P-value				**256**

umu-test - eluate without S9				**Eluate with S9**			
	GEU	**VD**	**Genotoxicity**		**GEU**	**VD**	**Genotoxicity**
	IR < 1.5	**IR < 1.5**	**GEU > 1.5**		**IR < 1.5**	**IR < 1.5**	**GEU > 1.5**
	1.5	0.67	no		1.5	0.67	no
	1.5	0.67	no		1.5	0.67	no
Median	**1.5**	**0.67**	**no**	**Median**	**1.5**	**0.67**	**no**

Data Sheet samble no. 18

	sample number	waste code	Date
Wastes from waste water treatment plants not otherwise specified, Sludge containing dangerous substances from other treatment of industrial waste water	18	190813	17.10.2002

Chemical characterization - eluate

Dry weight %	Water content %	pH	Cond. µS/cm
59.6	40.4	9 adj. to 7.5	3170

DOC	TOC	NH4	Mercury	Cadmium	Chromium, total	Nickel	Copper
mg/l	mg/l	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l
390	-	19	-	<0,1	<0.5	93.5	78.8

Lead	Zinc	Manganese	Arsenic	Cobalt	AOX
µg/l	µg/l	µg/l	µg/L	µg/l	mg/l
2.87	31	37	<0.5	35.9	2.1

PCB 8	HCH	PCB 18	PCB 28	PCB 52	PCB 101	PCB 138	PCB 153
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	<	<	<	<

PCB 180	PCB 77	PCB 105	PCB 118	PCB 126	PCB 169	PCB 189
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	<	<	<

Naphthalene	Acenaphthylene	Acenaphtene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.075	<	<	<	0.015	<	n.b.	n.b.

Benzo(a)-anthracene	Chrysene	Benzo(b)-fluoranthene	Benzo(k)-fluoranthene	Benzo(a)-pyrene	Indeno(1,2,3-cd)-pyrene	Dibenz(a,h)-anthracene	Benzo(g,h,i)-perylene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
n.b.	n.b.	<	<	<	<	<	<

Biphenyl	Benzene	Toluene	Ethylbenzene	m-/p-Xylene	o-Xylene	Dichlor-methane	1,1-Dichlorethene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.005	76	160	0.4	3.34	1.34	<	<

cis-1,2-Dichlorethene	trans-1,2-Dichlorethene	Trichlor-methane	1,1,1-Trichlorethan	Tetrachlor-methane	1,2-Dichlorethane	Trichlorethene	Bromdichlor-methane
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	0.146	<	<	<	<	<

1,1,2-Trichlorethane	Tetrachlorethene	Dibromchlor-methane	Tribrom-methane	1,2-Dichlorbenzene	1,3-Dichlorbenzene	1,4-Dichlorbenzene	hydrocar.-Index (H53)
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l
<	<	<	<	<	<	<	-

Data Sheet samble no. 18

	sample number	waste code	Date
Wastes from waste water treatment plants not otherwise specified, Sludge containing dangerous substances from other treatment of industrial waste water	18	190813	17.10.2002

Chemical characterization - solid matter

Arsenic	Lead	Cadmium	Chromium	Copper	Nickel	Mercury	Zinc
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.1	19	0.34	101	30	330	2.4	400

Hydrocarbons	Lipophilic subst.	TOC	Benzene	Toluene	Ethylbenzene	Xylene
Weight %	Weight %	Weight %	mg/kg	mg/kg	mg/kg	mg/kg
0.77	2.1	9.6	5.9	34	0.04	0.26

Sum BTEX	Naphthalene	Acenaphtene	Acenaphtylene	Fluorene	Phenanthrene	Anthracene	Fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
40.2	0.5	0.6	<0.1	0.4	0.5	<0.1	0.4

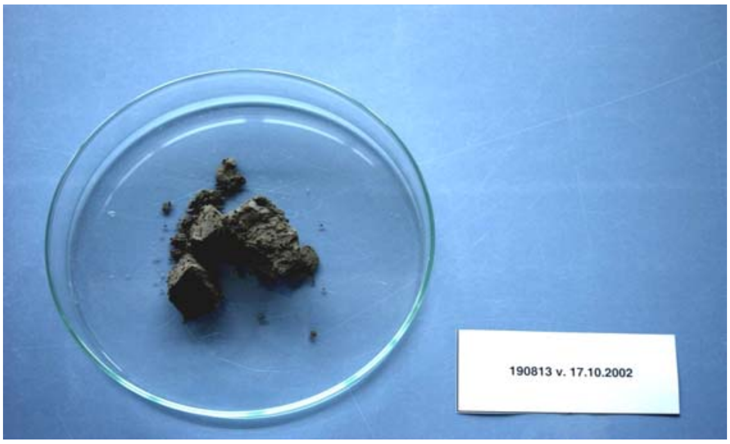
Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
0.2	0.1	0.2	0.1	<0.1

Dibenz(ah)anthracene	Benzo(ghi)perylene	Indeno(1,2,3-cd)pyrene	Benzo(a)pyrene	AOX
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.1	<0.1	<0.1	<0.1	820

Water soluble portion	Sum PAH (16 EPA)
Weight %	mg/kg
3	3

Remarks

granular-lumpy, brown-black, rubber smell



Data Sheet samble no.19

Waste from MFSU and removal of paint and varnish, Aqueous sludges containing paint or varnish containing organic solvents or other dangerous substances

sample number	waste code	Date
19	080115	21.10.2002

Ecotoxikological characterization

Algae test - eluate

80%-sample	G_A-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	
53.9	4	30.7	67.8	yes
59.8	3	32.8	63.3	yes
Median	**3.5**	**31.8**	**65.5**	**yes**

Daphnia test - eluate

100%-sample	G_D-sample	EC_{10}-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	[%]	
0	1	-	-	-	no
20	2	-	-	-	yes
Median	**1.5**	**-**	**-**	**-**	**yes**

Luminescent bacteria test- eluate

50%-sample	G_L-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	
50	8	13.2	50.4	yes
49.9	8	14.6	50.6	yes
Median	**8**	**13.9**	**50.5**	**yes**

Bacteria contact test - solid matter

50%-sample	G_B-sample	Toxicity
[%Inhibition]		
47.7	-	yes
63.2	2-10	yes
Median	**2-10**	**yes**

Plant test - solid matter

50%-sample	G_P germination rate	G_P Shoot height	G_P dry shoot weight	Toxicity
Brassica				
	>128	16	16	yes
Lycopersicon	>32	16	16	yes
	64	>128	128	yes
Avena	>32	>32	>32	yes
	>128	16	16	yes
most representative G_P-value				**16**

umu-test - eluate without S9 / **Eluate with S9**

	GEU	VD	Genotoxicity		GEU	VD	Genotoxicity
	IR < 1.5	**IR < 1.5**	**GEU > 1.5**		**IR < 1.5**	**IR < 1.5**	**GEU > 1.5**
	1.5	0.67	no		1.5	0.67	no
	1.5	0.67	no		1.5	0.67	no
Median	**1.5**	**0.67**	**no**	**Median**	**1.5**	**0.67**	**no**

Data Sheet samble no. 19

	sample number	waste code	Date
Waste from MFSU and removal of paint and varnish, Aqueous sludges containing paint or varnish containing organic solvents or other dangerous substances	19	080115	21.10.2002

Chemical characterization - eluate

Dry weight %	Water content %	pH	Cond. µS/cm
59.8	40.2	9.7 adj. to 7.2	875

DOC	TOC	NH4	Mercury	Cadmium	Chromium, total	Nickel	Copper
mg/l	mg/l	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l
150	-	0.06	-	<0.1	1.6	5.1	12.6

Lead	Zinc	Manganese	Arsenic	Cobalt	AOX
µg/l	µg/l	µg/l	µg/L	µg/l	mg/l
10.3	87	<5	<0.5	1.8	0.05

PCB 8	HCH	PCB 18	PCB 28	PCB 52	PCB 101	PCB 138	PCB 153
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
	<	<	<	<	0.009	0.013	0.008

PCB 180	PCB 77	PCB 105	PCB 118	PCB 126	PCB 169	PCB 189
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	-	0.001	<	-	-	-

Naphthalene	Acenaphthylene	Acenaphtene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
5.908	0.007	0.011	0.009	0.016	<	0.006	0.007

Benzo(a)-anthracene	Chrysene	Benzo(b)-fluoranthene	Benzo(k)-fluoranthene	Benzo(a)-pyrene	Indeno(1,2,3-cd)-pyrene	Dibenz(a,h)-anthracene	Benzo(g,h,i)-perylene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.001	0.001	<	<	<	<	<	<

Biphenyl	Benzene	Toluene	Ethylbenzene	m-/p-Xylene	o-Xylene	Dichlor-methane	1,1-Dichlorethene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.021	<	0.7	18	79	49	<	<

cis-1,2-Dichlorethene	trans-1,2-Dichlorethene	Trichlor-methane	1,1,1-Trichlorethane	Tetrachlor-methane	1,2-Dichlorethane	Trichlorethene	Bromdichlor-methane
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	<	<	<	<

1,1,2-Trichlorethane	Tetrachlorethene	Dibromchlor-methane	Tribrom-methane	1,2-Dichlorbenzene	1,3-Dichlorbenzene	1,4-Dichlorbenzene	hydrocar.-Index (H53)
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l
<	<	<	<	<	<	<	-

Data Sheet samble no. 19

Waste from MFSU and removal of paint and varnish, Aqueous sludges containing paint or varnish containing organic solvents or other dangerous substances	sample number	waste code	Date
	19	080115	21.10.2002

Chemical characterization - solid matter

Arsenic	Lead	Cadmium	Chromium	Copper	Nickel	Mercury	Zinc
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
1	195	0.14	11	24	5.1	<0.05	5330

Hydrocarbons	Lipophilic subst.	TOC	Benzene	Toluene	Ethylbenzene	Xylene
Weight %	Weight %	Weight %	mg/kg	mg/kg	mg/kg	mg/kg
0.78	0.61	31.8	0.07	0.3	43	240

Sum BTEX	Naphthalene	Acenaphtene	Acenaphtylene	Fluorene	Phenanthrene	Anthracene	Fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
283	90	<0.1	<0.1	<0.1	0.18	0.12	<0.1

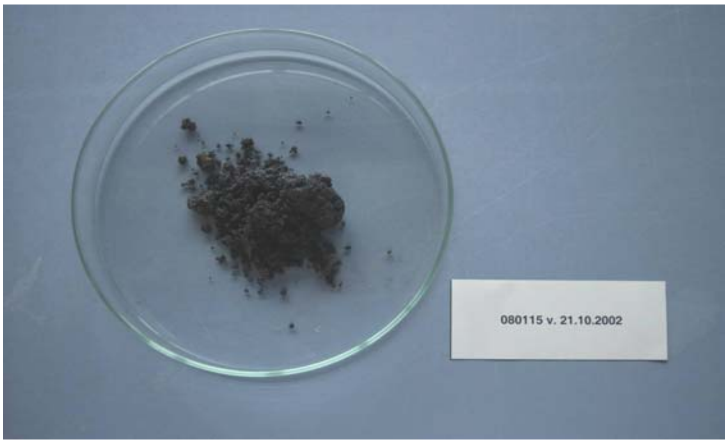
Pyrene	Benz(a)anthracen	Chrysen	Benzo(b)fluoranthen	Benzo(k)fluoranthen
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.1	<0.1	<0.1	<0.1	<0.1

Dibenz(ah)anthracene	Benzo(ghi)perylene	Indeno(1,2,3-cd)pyrene	Benzo(a)pyrene	AOX
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.1	<0.1	<0.1	<0.1	210

Water soluble portion	Sum PAH (16 EPA)
Weight %	mg/kg
0.6	90.3

Remarks

granular, black, solvent smell



Data Sheet samble no. 21

Wastes from shaping and physical and mechanical surface treatment of metals and plastics, Waste blasting material containing dangerous substances and waste blasting material, other than mentioned in 120116	sample number	waste code	Date
	21	120116/120117	16.10.2002

Ecotoxikological characterization

Algae test - eluate

80%-sample [%Inhibition]	G_A-sample	EC_{20}-sample [%]	EC_{50}-sample [%]	Toxicity
100	10	10.1	12.2	yes
100	>10	-	-	yes
100	20	6.0	24.6	yes
Median	**15**	**8.0**	**18.4**	**yes**

Daphnia test - eluate

100%-sample [%Inhibition]	G_D-sample	EC_{10}-sample [%]	EC_{20}-sample [%]	EC_{50}-sample [%]	Toxicity
50	2	-	-	-	yes
10	1	-	-	-	no
Median	**1.5**	**-**	**-**	**-**	**yes**

Luminescent bacteria test- eluate

50%-sample [%Inhibition]	G_L-sample	EC_{20}-sample [%]	EC_{50}-sample [%]	Toxicity
69.4	16	8.0	25.4	yes
68.6	16	9.8	27.4	yes
Median	**16**	**8.9**	**26.4**	**yes**

Bacteria contact test - solid matter

50%-sample [%Inhibition]	G_B-sample	Toxicity
82.7	>100	yes
Median	**>100**	**yes**

Plant test - solid matter

50%-sample	G_P germination rate	G_P Shoot height	G_P dry shoot weight	Toxicity
Brassica				
	>32	16	4	yes
Lycopersicon	16	<8	<8	yes
	>32	16	16	yes
Avena	-	<8	<8	yes
	2	4	4	yes
most representative G_P-value				**8**

umu-test - eluate without S9 / **Eluate with S9**

	GEU IR < 1.5	VD IR < 1.5	Genotoxicity GEU > 1.5		GEU IR < 1.5	VD IR < 1.5	Genotoxicity GEU > 1.5
	1.5	0.67	no		1.5	0.67	no
	1.5	0.67	no		1.5	0.67	no
Median	**1.5**	**0.67**	**no**	**Median**	**1.5**	**0.67**	**no**

Data Sheet samble no. 21

Wastes from shaping and physical and mechanical surface treatment of metals and plastics, Waste blasting material containing dangerous substances and waste blasting material, other than mentioned in 120116	sample number	waste code	Date
	21	120116/120117	16.10.2002

Chemical characterization - eluate

Dry weight %	Water content %	pH	Cond. µS/cm
100	0	9.2 adj. to 7.1	221

DOC	TOC	NH4	Mercury	Cadmium	Chromium, total	Nickel	Copper
mg/l	mg/l	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l
26	-	0.49	0.1	0.9	71.2	44.7	140

Lead	Zinc	Manganese	Arsenic	Cobalt	AOX
µg/l	µg/l	µg/l	µg/L	µg/l	mg/l
16.4	86	6	<0.5	1.8	0.07

PCB 8	HCH	PCB 18	PCB 28	PCB 52	PCB 101	PCB 138	PCB 153
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	<	0.011	0.029	0.014

PCB 180	PCB 77	PCB 105	PCB 118	PCB 126	PCB 169	PCB 189	
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	
0.004	<	0.002	<	<	<	<	

Naphthalene	Acenaphthylene	Acenaphtene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.307	0.014	0.017	0.02	0.071	<	0.025	0.027

Benzo(a)-anthracene	Chrysene	Benzo(b)-fluoranthene	Benzo(k)-fluoranthene	Benzo(a)-pyrene	Indeno(1,2,3-cd)-pyrene	Dibenz(a,h)-anthracene	Benzo(g,h,i)-perylene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	0.007	0.003	<	0.002	0.001	<	0.002

Biphenyl	Benzene	Toluene	Ethylbenzene	m-/p-Xylene	o-Xylene	Dichlor-methane	1,1-Dichlorethene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.005	0.2	0.27	0.35	2.56	1.48	<	<

cis-1,2-Dichlorethene	trans-1,2-Dichlorethene	Trichlor-methane	1,1,1-Trichlorethane	Tetrachlor-methane	1,2-Dichlorethane	Trichlorethene	Bromdichlor-methane
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	<	<	<	<

1,1,2-Trichlorethane	Tetrachlorethene	Dibromchlor-methane	Tribrom-methane	1,2-Dichlorbenzene	1,3-Dichlorbenzene	1,4-Dichlorbenzene	hydrocar.-Index (H53)
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l
<	<	<	<	<	<	<	-

Data Sheet samble no. 21

Description	sample number	waste code	Date
Wastes from shaping and physical and mechanical surface treatment of metals and plastics, Waste blasting material containing dangerous substances and waste blasting material, other than mentioned in 120116	21	120116/120117	16.10.2002

Chemical characterization - solid matter

Arsenic	Lead	Cadmium	Chromium	Copper	Nickel	Mercury	Zinc
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
6.9	120	0.49	7300	460	3650	3.7	1330

Hydrocarbons	Lipophilic subst.	TOC	Benzene	Toluene	Ethylbenzene	Xylene
Weight %	Weight %	Weight %	mg/kg	mg/kg	mg/kg	mg/kg
0.024	0.04	0.8	<0.01	0.01	0.03	0.22

Sum BTEX	Naphthalene	Acenaphtene	Acenaphtylene	Fluorene	Phenanthrene	Anthracene	Fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
0.26	<0.1	<0.1	<0.1	<0.1	0.13	<0.1	0.11

Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
0.13	<0.1	<0.1	<0.1	<0.1

Dibenz(ah)anthracene	Benzo(ghi)perylene	Indeno(1,2,3-cd)pyrene	Benzo(a)pyrene	AOX
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.1	<0.1	<0.1	<0.1	10

Water soluble portion	Sum PAH (16 EPA)
Weight %	mg/kg
0.8	<1

Remarks

powdery, black-grey

Data Sheet samble no. 22

Wastes from incineration and pyrolysis of waste, Bottom ash and slag other than those mentioned in 190111	sample number	waste code	Date
	22	190112	17.10.2002

Ecotoxikological characterization

Algae test - eluate

80%-sample [%Inhibition]	G_A-sample	EC_{20}-sample [%]	EC_{50}-sample [%]	Toxicity
100	6	25.0	-	yes
66.8	3	45.9	59.5	yes
Median	**4.5**	**35.4**	**59.5**	**yes**

Daphnia test - eluate

100%-sample [%Inhibition]	G_D-sample	EC_{10}-sample [%]	EC_{20}-sample [%]	EC_{50}-sample [%]	Toxicity
70	2	-	-	-	yes
100	2	-	-	-	yes
Median	**2**	**-**	**-**	**-**	**yes**

Luminescent bacteria test- eluate

50%-sample [%Inhibition]	G_L-sample	EC_{20}-sample [%]	EC_{50}-sample [%]	Toxicity
22.2	4	41.4	138.6	yes
20.5	4	48.2	122.4	yes
Median	**4**	**44.8**	**130.5**	**yes**

Bacteria contact test - solid matter

50%-sample [%Inhibition]	G_B-sample	Toxicity
106.4	-	yes
92.4	10-100	yes
105.0	10-100	yes
Median	**10-100**	**yes**

Plant test - solid matter

50%-sample	G_P germination rate	G_P Shoot height	G_P dry shoot weight	Toxicity
Brassica	8	4	4	yes
	>32	2	2	yes
Lycopersicon	4	4	8	yes
	>32	8	8	yes
Avena	2	4	4	yes
	32	8	8	yes
most representative G_P-value				**8**

umu-test - eluate without S9				**Eluate with S9**			
	GEU	**VD**	**Genotoxicity**		**GEU**	**VD**	**Genotoxicity**
	IR < 1.5	**IR < 1.5**	**GEU > 1.5**		**IR < 1.5**	**IR < 1.5**	**GEU > 1.5**
	1.5	0.67	no		1.5	0.67	no
	1.5	0.67	no		1.5	0.67	no
Median	**1.5**	**0.67**	**no**	**Median**	**1.5**	**0.67**	**no**

Data Sheet samble no. 22

Wastes from incineration and pyrolysis of waste, Bottom ash and slag other than those mentioned in 190111	sample number	waste code	Date
	22	190112	17.10.2002

Chemical characterization - eluate

Dry weight %	Water content %	pH	Cond. µS/cm
60.4	39.6	12.5 adj. to 7	8220

DOC	TOC	NH4	Mercury	Cadmium	Chromium, total	Nickel	Copper
mg/l	mg/l	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l
13	-	1.3	0.1	0.2	7.4	<0.5	112

Lead	Zinc	Manganese	Arsenic	Cobalt	AOX
µg/l	µg/l	µg/l	µg/L	µg/l	mg/l
562	740	<5	<0.5	1.4	0.02

PCB 8	HCH	PCB 18	PCB 28	PCB 52	PCB 101	PCB 138	PCB 153
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	<	0.011	<	0.008

PCB 180	PCB 77	PCB 105	PCB 118	PCB 126	PCB 169	PCB 189
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	<	<	<

Naphthalene	Acenaphthylene	Acenaphtene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.031	0.003	0.002	0.004	0.011	<	0.005	0.005

Benzo(a)-anthracene	Chrysene	Benzo(b)-fluoranthene	Benzo(k)-fluoranthene	Benzo(a)-pyrene	Indeno(1,2,3-cd)-pyrene	Dibenz(a,h)-anthracene	Benzo(g,h,i)-perylene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0	0.001	0	<	0.002	<	<	<

Biphenyl	Benzene	Toluene	Ethylbenzene	m-/p-Xylene	o-Xylene	Dichlor-methane	1,1-Dichlorethene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.004	0.4	0.22	<	<	<	<	<

cis-1,2-Dichlorethene	trans-1,2-Dichlorethene	Trichlor-methane	1,1,1-Trichlorethan	Tetrachlor-methane	1,2-Dichlorethane	Trichlorethene	Bromdichlor-methane
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	<	<	<	<

1,1,2-Trichlorethane	Tetrachlorethene	Dibromchlor-methane	Tribrom-methane	1,2-Dichlorbenzene	1,3-Dichlorbenzene	1,4-Dichlorbenzene	hydrocar.-Index (H53)
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l
<	<	<	<	<	<	<	-

Data Sheet samble no. 22

Wastes from incineration and pyrolysis of waste, Bottom ash and slag other than those mentioned in 190111	sample number	waste code	Date
	22	190112	17.10.2002

Chemical characterization - solid matter

Arsenic	Lead	Cadmium	Chromium	Copper	Nickel	Mercury	Zinc
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
7.4	210	4.7	96	1020	49	4.5	1900

Hydrocarbons	Lipophilic subst.	TOC	Benzene	Toluene	Ethylbenzene	Xylene
Weight %	Weight %	Weight %	mg/kg	mg/kg	mg/kg	mg/kg
0.002	<0.01	1	0.01	0.01	0.08	0.49

Sum BTEX	Naphthalene	Acenaphtene	Acenaphtylene	Fluorene	Phenanthrene	Anthracene	Fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
0.59	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

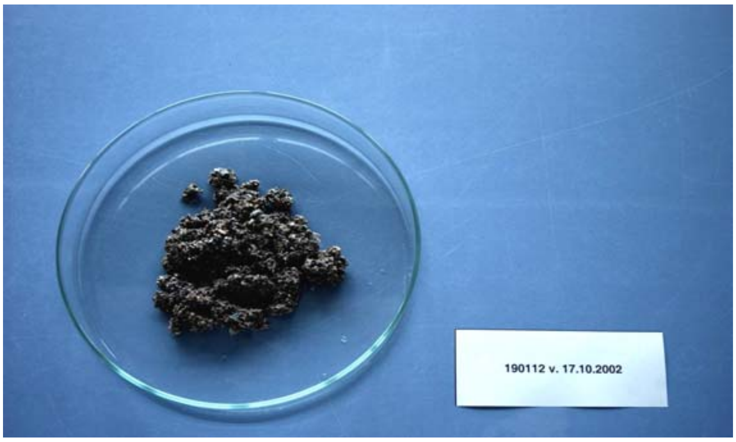
Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.1	<0.1	<0.1	<0.1	<0.1

Dibenz(ah)anthracene	Benzo(ghi)perylene	Indeno(1,2,3-cd)pyrene	Benzo(a)pyrene	AOX
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.1	<0.1	<0.1	<0.1	120

Water soluble portion	Sum PAH (16 EPA)
Weight %	mg/kg
3.2	<1

Remarks

slag, grey-black, solid, coarsely granular, humid



Data Sheet samble no. 23

Wastes from incineration and pyrolysis of waste, Solid wastes from flue-gas treatment	sample number	waste code	Date
	23	190107	17.10.2002

Ecotoxikological characterization

Algae test - eluate

80%-sample [%Inhibition]	G_A-sample	EC_{20}-sample [%]	EC_{50}-sample [%]	Toxicity
100	>10	-	-	yes
100	20	8.6	10.0	yes
100	10	11.2	12.2	yes
Median	**15**	**9.9**	**11.1**	**yes**

Daphnia test - eluate

100%-sample [%Inhibition]	G_D-sample	EC_{10}-sample [%]	EC_{20}-sample [%]	EC_{50}-sample [%]	Toxicity
100	100	-	-	-	yes
100	50	2.8	3.1	3.8	yes
100	40	3.9	4.2	4.9	yes
Median	**50**	**3.3**	**3.7**	**4.4**	**yes**

Luminescent bacteria test- eluate

50%-sample [%Inhibition]	G_L-sample	EC_{20}-sample [%]	EC_{50}-sample [%]	Toxicity
18.2	2	-	-	no
19.4	2	-	-	no
Median	**2**	**-**	**-**	**no**

Bacteria contact test - solid matter

50%-sample [%Inhibition]	G_B-sample	Toxicity
92.5	-	yes
99.5	>100	yes
Median	**>100**	**yes**

Plant test - solid matter

50%-sample	G_P germination rate	G_P Shoot height	G_P dry shoot weight	Toxicity
Brassica				
	>4096	2048	2048	yes
Lycopersicon	>128	>128	>128	yes
	1024	2048	2048	yes
Avena	>128	>128	>128	yes
	<256	1024	>4096	yes
most representative G_P-value				**2048**

umu-test - eluate without S9 / **Eluate with S9**

	GEU	VD	Genotoxicity		GEU	VD	Genotoxicity
	IR < 1.5	**IR < 1.5**	**GEU > 1.5**		**IR < 1.5**	**IR < 1.5**	**GEU > 1.5**
	1.5	0.67	no		1.5	0.67	no
	1.5	0.67	no		1.5	0.67	no
Median	**1.5**	**0.67**	**no**	**Median**	**1.5**	**0.67**	**no**

Data Sheet samble no. 23

Wastes from incineration and pyrolysis of waste, Solid wastes from flue-gas treatment	sample number	waste code	Date
	23	190107	17.10.2002

Chemical characterization - eluate

Dry weight %	Water content %	pH	Cond. µS/cm
100	0	8.04	97700

DOC	TOC	NH4	Mercury	Cadmium	Chromium, total	Nickel	Copper
mg/l	mg/l	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l
24	-	0.76	6.6	3010	20.9	20.2	33.9

Lead	Zinc	Manganese	Arsenic	Cobalt	AOX
µg/l	µg/l	µg/l	µg/L	µg/l	mg/l
1070	284	2480	395	17.8	0.25

PCB 8	HCH	PCB 18	PCB 28	PCB 52	PCB 101	PCB 138	PCB 153
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	0.001	<	<	<	0.008	0.011	0.006

PCB 180	PCB 77	PCB 105	PCB 118	PCB 126	PCB 169	PCB 189
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	<	<	<

Naphthalene	Acenaphthylene	Acenaphtene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.028	0.001	0.002	0.002	0.006	0	0.003	0.004

Benzo(a)-anthracene	Chrysene	Benzo(b)-fluoranthene	Benzo(k)-fluoranthene	Benzo(a)-pyrene	Indeno(1,2,3-cd)-pyrene	Dibenz(a,h)-anthracene	Benzo(g,h,i)-perylene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0	0	0	<	0.001	<	<	<

Biphenyl	Benzene	Toluene	Ethylbenzene	m-/p-Xylene	o-Xylene	Dichlor-methane	1,1-Dichlorethene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.001	<	0.3	0.3	1.91	0.97	<	<

cis-1,2-Dichlorethene	trans-1,2-Dichlorethene	Trichlor-methane	1,1,1-Trichlorethane	Tetrachlor-methane	1,2-Dichlorethane	Trichlorethene	Bromdichlor-methane
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	0.11	<	<	<	<	<

1,1,2-Trichlorethane	Tetrachlorethene	Dibromchlor-methane	Tribrom-methane	1,2-Dichlorbenzene	1,3-Dichlorbenzene	1,4-Dichlorbenzene	hydrocar.-Index (H53)
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l
<	<	<	<	<	<	<	-

Data Sheet samble no. 23

Wastes from incineration and pyrolysis of waste, Solid wastes from flue-gas treatment	sample number	waste code	Date
	23	190107	17.10.2002

Chemical characterization - solid matter

Arsenic	Lead	Cadmium	Chromium	Copper	Nickel	Mercury	Zinc
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
3	570	37	24	79	13	50	1240

Hydrocarbons	Lipophilic subst.	TOC	Benzene	Toluene	Ethylbenzene	Xylene
Weight %	Weight %	Weight %	mg/kg	mg/kg	mg/kg	mg/kg
<0.002	<0.01	1.1	<0.01	0.02	0.16	0.8

Sum BTEX	Naphthalene	Acenaphtene	Acenaphtylene	Fluorene	Phenanthrene	Anthracene	Fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
0.98	0.14	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

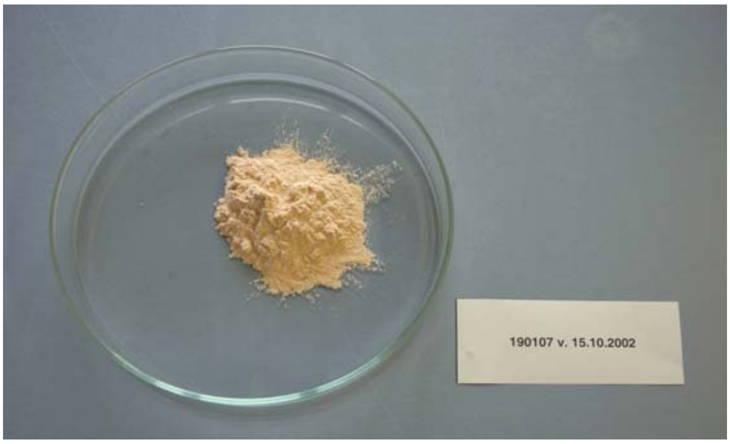
Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.1	<0.1	<0.1	<0.1	<0.1

Dibenz(ah)anthracene	Benzo(ghi)perylene	Indeno(1,2,3-cd)pyrene	Benzo(a)pyrene	AOX
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.1	<0.1	<0.1	<0.1	55

Water soluble portion	Sum PAH (16 EPA)
Weight %	mg/kg
96	<1

Remarks

flue-gas desulfurization, flue-gas residue, hygroscopic; no salt added for LB-test; heat development caused by dest. water addition for eluate preparation, pH 10-11; pH 8 after filtration



Data Sheet samble no. 24

Wastes from incineration and pyrolysis of waste, Fly ash containing dangerous substances	sample number	waste code	Date
	24	190113	17.10.2002

Ecotoxikological characterization

Algae test - eluate

80%-sample	G_A-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	
100	>10	-	-	yes
100	20	9.1	17.8	yes
100	80	2.4	5.8	yes
Median	**50**	**5.7**	**11.8**	**yes**

Daphnia test - eluate

100%-sample	G_D-sample	EC_{10}-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	[%]	
100	5	-	-	-	yes
100	5	27	28.5	31.6	yes
Median	**5**	**27**	**28.5**	**31.6**	**yes**

Luminescent bacteria test- eluate

50%-sample	G_L-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	
33.8	8	24.8	95.0	yes
25.4	4	38.8	100.4	yes
Median	**6**	**31.8**	**97.7**	**yes**

Bacteria contact test - solid matter

50%-sample	G_B-sample	Toxicity
[%Inhibition]		
99.4	-	yes
106.5	>100	yes
Median	**>100**	**yes**

Plant test - solid matter

50%-sample	G_P Germination rate	G_P Shoot height	G_P Dry shoot weight	Toxicity
Brassica	128	64	64	yes
	<128	256	512	yes
Lycopersicon	>128	128	128	yes
	256	512	512	yes
Avena	>128	128	128	yes
	<128	256	512	yes
most representative G_P-value				**128**

umu-test - eluate without S9				Eluate with S9			
	GEU	VD	Genotoxicity		GEU	VD	Genotoxicity
	IR < 1.5	IR < 1.5	GEU > 1.5		IR < 1.5	IR < 1.5	GEU > 1.5
	1.5	0.67	no		1.5	0.67	no
	1.5	0.67	no		1.5	0.67	no
Median	**1.5**	**0.67**	**no**	**Median**	**1.5**	**0.67**	**no**

Data Sheet samble no. 24

Wastes from incineration and pyrolysis of waste, Fly ash containing dangerous substances	sample number	waste code	Date
	24	190113	17.10.2002

Chemical characterization - eluate

Dry weight %	Water content %	pH	Cond. µS/cm
100	0	11.8 adj. to 7.4	37500

DOC	TOC	NH4	Mercury	Cadmium	Chromium, total	Nickel	Copper
mg/l	mg/l	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l
4	-	0.08	1	2.1	234	152	45.5

Lead	Zinc	Manganese	Arsenic	Cobalt	AOX
µg/l	µg/l	µg/l	µg/L	µg/l	mg/l
19000	1610	<5	28	1.7	0.04

PCB 8	HCH	PCB 18	PCB 28	PCB 52	PCB 101	PCB 138	PCB 153
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	0.007	0.011	0.019	0.01

PCB 180	PCB 77	PCB 105	PCB 118	PCB 126	PCB 169	PCB 189
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.002	<	0.001	<	<	<	<

Naphthalene	Acenaphthylene	Acenaphtene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.25	0	0.001	0.003	0.008	0	0.005	0.005

Benzo(a)-anthracene	Chrysene	Benzo(b)-fluoranthene	Benzo(k)-fluoranthene	Benzo(a)-pyrene	Indeno(1,2,3-cd)-pyrene	Dibenz(a,h)-anthracene	Benzo(g,h,i)-perylene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0	0.001	0.001	0	0.001	0	0	<

Biphenyl	Benzene	Toluene	Ethylbenzene	m-/p-Xylene	o-Xylene	Dichlor-methane	1,1-Dichlorethene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.001	<	<	0.25	2.2	0.86	<	<

cis-1,2-Dichlorethene	trans-1,2-Dichlorethene	Trichlor-methane	1,1,1-Trichlorethane	Tetrachlor-methane	1,2-Dichlorethane	Trichlorethene	Bromdichlor-methane
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	<	<	<	<

1,1,2-Trichlorethane	Tetrachlor-ethene	Dibromchlor-methane	Tribrom-methane	1,2-Dichlorbenzene	1,3-Dichlorbenzene	1,4-Dichlorbenzene	hydrocar.-Index (H53)
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l
<	<	<	<	<	<	<	-

Data Sheet samble no. 24

Wastes from incineration and pyrolysis of waste, Fly ash containing dangerous substances	sample number	waste code	Date
	24	190113	17.10.2002

Chemical characterization - solid matter

Arsenic	Lead	Cadmium	Chromium	Copper	Nickel	Mercury	Zinc
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
33	6100	270	250	990	83	11	16500

Hydrocarbons	Lipophilic subst.	TOC	Benzene	Toluene	Ethylbenzene	Xylene
Weight %	Weight %	Weight %	mg/kg	mg/kg	mg/kg	mg/kg
<0,002	<0.01	1	<0.01	0.01	0.13	0.56

Sum BTEX	Naphthalene	Acenaphtene	Acenaphtylene	Fluorene	Phenanthrene	Anthracene	Fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
0.7	0.12	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.1	<0.1	<0.1	<0.1	<0.1

Dibenz(ah)anthracene	Benzo(ghi)perylene	Indeno(1,2,3-cd)pyrene	Benzo(a)pyrene	AOX
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.1	<0.1	<0.1	<0.1	380

Water soluble portion	Sum PAH (16 EPA)
Weight %	mg/kg
27.7	<1

Remarks

filter dust, hygroscopic, fine powder, light grey; no salt added for LB-test; yellow flocculation after pH adjustment of the eluate

Data Sheet samble no. 26

	sample number	waste code	Date
Sludge from on-site effluent treatment, Sludge from on-site effluent treatment other than those mentioned in 060502	26	060503	27.06.2002

Ecotoxikological characterization

Algae test - eluate

80%-sample	G_A-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	
100	8	17.1	22.4	yes
100	8	13.1	17.4	yes
Median	**8**	**15.1**	**19.9**	**yes**

Daphnia test - eluate

100%-sample	G_D-sample	EC_{10}-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	[%]	
100	5	34.5	38.0	45.6	yes
100	2	-	-	-	yes
Median	**3.5**	**34.5**	**38.0**	**45.6**	**yes**

Luminescent bacteria test- eluate

50%-sample	G_L-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	
68.1	32	4.5	20.7	yes
65.7	16	6.8	25.8	yes
Median	**24**	**5.6**	**23.2**	**yes**

Bacteria contact test - solid matter

50%-sample	G_B-sample	Toxicity
[%Inhibition]		
82.2	10-100	yes
Median	**10-100**	**yes**

Plant test - solid matter

50%-sample	G_P germination rate	G_P Shoot height	G_P dry shoot weight	Toxicity
Brassica	>32	>32	16	yes
	-	-	-	
Lycopersicon	32	>32	>32	yes
	>256	>256	>256	yes
Avena	8	16	16	yes
	<16	128	>256	yes
most representative G_P-value				**64**

umu-test - eluate without S9				**Eluate with S9**			
	GEU	**VD**	**Genotoxicity**		**GEU**	**VD**	**Genotoxicity**
	IR < 1.5	**IR < 1.5**	**GEU > 1.5**		**IR < 1.5**	**IR < 1.5**	**GEU > 1.5**
	1.5	0.67	no		1.5	0.67	no
	1.5	0.67	no		1.5	0.67	no
Median	**1.5**	**0.67**	**no**	**Median**	**1.5**	**0.67**	**no**

Data Sheet samble no. 26

Sludge from on-site effluent treatment, Sludge from on-site effluent treatment other than those mentioned in 060502	sample number	waste code	Date
	26	060503	27.06.2002

Chemical characterization - eluate

Dry weight %	Water content %	pH	Cond. µS/cm
77.7	22.3	8.25	1601

DOC	TOC	NH4	Mercury	Cadmium	Chromium, total	Nickel	Copper
mg/l	mg/l	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l
250	-	77	1.4	0.5	1.7	802	24.1

Lead	Zinc	Manganese	Arsenic	Cobalt	AOX
µg/l	µg/l	µg/l	µg/L	µg/l	mg/l
2.16	132	86	7	3	0.03

PCB 8	HCH	PCB 18	PCB 28	PCB 52	PCB 101	PCB 138	PCB 153
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
-	<	<	<	0.006	0.018	0.018	0.012

PCB 180	PCB 77	PCB 105	PCB 118	PCB 126	PCB 169	PCB 189
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	-	<	<	-	-	-

Naphthalene	Acenaphthylene	Acenaphtene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
1.696	0.03	0.134	0.089	0.067	<	0.015	0.042

Benzo(a)-anthracene	Chrysene	Benzo(b)-fluoranthene	Benzo(k)-fluoranthene	Benzo(a)-pyrene	Indeno(1,2,3-cd)-pyrene	Dibenz(a,h)-anthracene	Benzo(g,h,i)-perylene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.004	<	0.002	0.001	0.002	0.009	<	0.001

Biphenyl	Benzene	Toluene	Ethylbenzene	m-/p-Xylene	o-Xylene	Dichlor-methane	1,1-Dichlorethene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.032	<	<	7	16	8	<	<

cis-1,2-Dichlorethene	trans-1,2-Dichlorethene	Trichlor-methane	1,1,1-Trichlorethane	Tetrachlor-methane	1,2-Dichlorethane	Trichlorethene	Bromdichlor-methane
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	<	<	<	<

1,1,2-Trichlorethane	Tetrachlorethene	Dibromchlor-methane	Tribrom-methane	1,2-Dichlorbenzene	1,3-Dichlorbenzene	1,4-Dichlorbenzene	hydrocar.-Index (H53)
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l
<	<	<	<	<	<	<	-

Data Sheet samble no. 26

	sample number	waste code	Date
Sludge from on-site effluent treatment, Sludge from on-site effluent treatment other than those mentioned in 060502	26	060503	27.06.2002

Chemical characterization - solid matter

Arsenic	Lead	Cadmium	Chromium	Copper	Nickel	Mercury	Zinc
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
11	21	0.29	11	114	190	0.09	1000

Hydrocarbons	Lipophilic subst.	TOC	Benzene	Toluene	Ethylbenzene	Xylene
GEW.%	Gew.%	Gew.%	mg/kg	mg/kg	mg/kg	mg/kg
24	13	16.2	<0.01	0.01	0.08	0.3

Sum BTEX	Naphthalene	Acenaphtene	Acenaphtylene	Fluorene	Phenanthrene	Anthracene	Fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
0.39	8.6	0.23	<0.1	0.55	3.8	0.1	0.94

Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
1.1	4.9	0.28	<0.1	<0.1

Dibenz(ah)anthracene	Benzo(ghi)perylene	Indeno(1,2,3-cd)pyrene	Benzo(a)pyrene	AOX
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.1	<0.1	<0.1	<0.1	21

Water soluble portion	Sum PAH (16 EPA)
Weight %	mg/kg
0.7	20.5

Remarks

solid, granular, grey-brown, solvent smell

Data Sheet samble no. 27

Waste from MFSU and removal of paint and varnish, Waste Paint and varnish containing organic solvents or other dangerous substances	sample number	waste code	Date
	27	080111	27.06.2002

Ecotoxikological characterization

Algae test - eluate

80%-sample	G_A-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	
100	>10	-	-	yes
100	80	1.6	2.2	yes
100	100	1.1	1.4	yes
Median	**90**	**1.3**	**1.8**	**yes**

Daphnia test - eluate

100%-sample	G_D-sample	EC_{10}-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	[%]	
100	100	2.1	2.4	3.2	yes
100	50	2.8	3.1	3.8	yes
Median	**75**	**2.4**	**2.7**	**3.5**	**yes**

Luminescent bacteria test- eluate

50%-sample	G_L-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	
96.4	>16	1.2	3.6	yes
100	128	0.8	2.9	yes
100	128	0.7	2.7	yes
Median	**128**	**0.8**	**2.9**	**yes**

Bacteria contact test - solid matter

50%-sample	G_B-sample	Toxicity
[%Inhibition]		
104.1	>100	yes
Median	**>100**	**yes**

Plant test - solid matter

50%-sample	G_P germination rate	G_P Shoot height	G_P dry shoot weight	Toxicity
Brassica	>1024	1024	-	yes
	-	-	-	-
Lycopersicon	>1024	>1024	>1024	yes
	>16384	16384	16384	yes
Avena	<64	256	-	yes
	<1024	4196	>16384	yes
most representative G_P-value				**16384**

umu-test - eluate without S9				Eluate with S9			
	GEU	VD	Genotoxicity		GEU	VD	Genotoxicity
	IR < 1.5	IR < 1.5	GEU > 1.5		IR < 1.5	IR < 1.5	GEU > 1.5
	1.5	0.67	no		1.5	0.67	no
	6	0.17	yes		1.5	0.67	no
	6	0.17	yes		1.5	0.67	no
Median	**6**	**0.17**	**yes**	**Median**	**1.5**	**0.67**	**no**

Data Sheet samble no. 27

	sample number	waste code	Date
Waste from MFSU and removal of paint and varnish, Waste Paint and varnish containing organic solvents or other dangerous substances	27	080111	27.06.2002

Chemical characterization - eluate

Dry weight %	Water content %	pH	Cond. µS/cm
49	51	6.65	63.7

DOC	TOC	NH4	Mercury	Cadmium	Chromium, total	Nickel	Copper
mg/l	mg/l	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l
11000	-	0.14	0.2	2.7	<0.5	9.8	20.7

Lead	Zinc	Manganese	Arsenic	Cobalt	AOX
µg/l	µg/l	µg/l	µg/L	µg/l	mg/l
0.93	11200	7	<0.2	-	0.03

PCB 8	HCH	PCB 18	PCB 28	PCB 52	PCB 101	PCB 138	PCB 153
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	<	0.004	<	<

PCB 180	PCB 77	PCB 105	PCB 118	PCB 126	PCB 169	PCB 189
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	<	<	<

Naphthalene	Acenaphthylene	Acenaphtene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
-	-	0.007	0.018	0.004	0.019	0.001	0.002

Benzo(a)-anthracene	Chrysene	Benzo(b)-fluoranthene	Benzo(k)-fluoranthene	Benzo(a)-pyrene	Indeno(1,2,3-cd)-pyrene	Dibenz(a,h)-anthracene	Benzo(g,h,i)-perylene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0	<	<	<	0.001	<	<	<

Biphenyl	Benzene	Toluene	Ethylbenzene	m-/p-Xylene	o-Xylene	Dichlor-methane	1,1-Dichlorethene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
-	-	-	-	-	-	-	-

cis-1,2-Dichlorethene	trans-1,2-Dichlorethene	Trichlor-methane	1,1,1-Trichlorethane	Tetrachlor-methane	1,2-Dichlorethane	Trichlorethene	Bromdichlor-methane
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
-	-	-	-	-	-	-	-

1,1,2-Trichlorethane	Tetrachlorethene	Dibromchlor-methane	Tribrom-methane	1,2-Dichlorbenzene	1,3-Dichlorbenzene	1,4-Dichlorbenzene	hydrocar.-Index (H53)
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l
-	-	-	-	-	-	-	-

Data Sheet samble no. 27

Waste from MFSU and removal of paint and varnish, Waste Paint and varnish containing organic solvents or other dangerous substances	sample number	waste code	Date
	27	080111	27.06.2002

Chemical characterization - solid matter

Arsenic	Lead	Cadmium	Chromium	Copper	Nickel	Mercury	Zinc
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
0.92	224	0.32	15	2.1	13	<0.05	35400

Hydrocarbons	Lipophilic subst.	TOC	Benzene	Toluene	Ethylbenzene	Xylene
Weight %	Weight %	Weight %	mg/kg	mg/kg	mg/kg	mg/kg
13	3.9	35.1	0.87	100	8200	31000

Sum BTEX	Naphthalene	Acenaphtene	Acenaphtylene	Fluorene	Phenanthrene	Anthracene	Fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
39301	1007	0.66	0.2	<0.1	1.4	<0.1	0.82

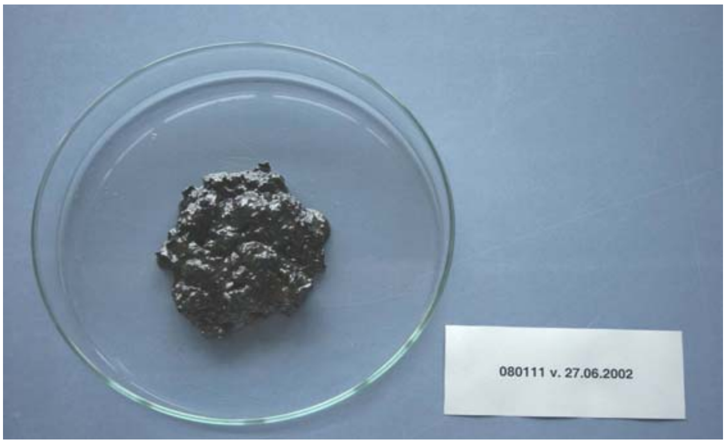
Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.1	0.29	0.2	<0.1	<0.1

Dibenz(ah)anthracene	Benzo(ghi)perylene	Indeno(1,2,3-cd)pyrene	Benzo(a)pyrene	AOX
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.1	0.3	0.3	0.23	420

Water soluble portion	Sum PAH (16 EPA)
Weight %	mg/kg
<0.1	1011

Remarks

liquid-pasty, dark black colored; high solvent content in the eluate causes a two-phase system; solvent phase was decanted in a separation funnel and discarded; membrane filter (Cellulose-Nitrate) dissolved, sample filtered only with glass fiber



Data Sheet samble no. 28

Wastes from chemical surface treatment and coating of metals and other materials (for ex. galvanic processes, zinc coating processes, pickling processes, etching, phosphating, alkaline degreasing and anodizing), Sludges and filter cakes other than those mentioned in 110109	sample number	waste code	Date
	28	110110	16.10.2002

Ecotoxikological characterization

Algae test - eluate

80%-sample	G_A-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	
-4.8	1.25	-	-	no
-31.8	1.25	-	-	no
Median	**1.25**	**-**	**-**	**no**

Daphnia test - eluate

100%-sample	G_D-sample	EC_{10}-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	[%]	
0	1	-	-	-	no
0	1	-	-	-	no
Median	**1**	**-**	**-**	**-**	**no**

Luminescent bacteria test- eluate

50%-sample	G_L-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	
-0.8	2	-	-	no
-4.9	2	-	-	no
Median	**2**	**-**	**-**	**no**

Bacteria contact test - solid matter

50%-sample	G_B-sample	Toxicity
[%Inhibition]		
48.7	2-10	yes
59.7	2-10	yes
Median	**2-10**	**yes**

Plant test - solid matter

50%-sample	G_P Germination rate	G_P Shoot height	G_P Dry shoot weight	Toxicity
Brassica	>32	4	4	yes
	16	8	4	yes
Lycopersicon	4	2	2	yes
	4	4	4	yes
Avena	-	2	4	yes
	8	4	2	yes
most representative G_P-value				**4**

umu-test - eluate without S9 / **Eluate with S9**

	GEU	VD	Genotoxicity		GEU	VD	Genotoxicity
	IR < 1.5	IR < 1.5	GEU > 1.5		IR < 1.5	IR < 1.5	GEU > 1.5
	1.5	0.67	no		1.5	0.67	no
	1.5	0.67	no		1.5	0.67	no
Median	**1.5**	**0.67**	**no**	**Median**	**1.5**	**0.67**	**no**

Data Sheet samble no. 28

Wastes from chemical surface treatment and coating of metals and other materials (for ex. galvanic processes, zinc coating processes, pickling processes, etching, phosphating, alkaline degreasing and anodizing), Sludges and filter cakes other than those mentioned in 110109

sample number	waste code	Date
28	110110	16.10.2002

Chemical characterization - eluate

Dry weight %	Water content %	pH	Cond. µS/cm
18.4	81.6	7.92	1679

DOC	TOC	NH4	Mercury	Cadmium	Chromium, total	Nickel	Copper
mg/l	mg/l	mg/L	µg/l	µg/l	µg/l	µg/l	µg/l
14	-	9.8	0.1	0.3	<0.5	81.6	8.3

Lead	Zinc	Manganese	Arsenic	Cobalt	AOX
µg/l	µg/l	µg/l	µg/L	µg/l	mg/l
0.92	113	18	<0.2	0.7	0.02

PCB 8	HCH	PCB 18	PCB 28	PCB 52	PCB 101	PCB 138	PCB 153
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	0.004	0.011	0.016	0.008

PCB 180	PCB 77	PCB 105	PCB 118	PCB 126	PCB 169	PCB 189
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.001	<	0.001	<	<	<	<

Naphthalene	Acenaphthylene	Acenaphtene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.081	<	0.003	<	0.008	<	0.005	0.004

Benzo(a)-anthracene	Chrysene	Benzo(b)-fluoranthene	Benzo(k)-fluoranthene	Benzo(a)-pyrene	Indeno(1,2,3-cd)-pyrene	Dibenz(a,h)-anthracene	Benzo(g,h,i)-perylene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	0.003	<	<	<	<	0.01	0

Biphenyl	Benzene	Toluene	Ethylbenzene	m-/p-Xylene	o-Xylene	Dichlor-methane	1,1-Dichlorethene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.002	<	<	<	0.33	0.15	<	<

cis-1,2-Dichlorethene	trans-1,2-Dichlorethene	Trichlor-methane	1,1,1-Trichlorethane	Tetrachlor-methane	1,2-Dichlorethane	Trichlorethene	Bromdichlor-methane
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	<	<	<	<

1,1,2-Trichlorethane	Tetrachlorethene	Dibromchlor-methane	Tribrom-methane	1,2-Dichlorbenzene	1,3-Dichlorbenzene	1,4-Dichlorbenzene	hydrocar.-Index (H53)
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l
<	<	<	<	<	<	<	-

Data Sheet samble no. 28

	sample number	waste code	Date
Wastes from chemical surface treatment and coating of metals and other materials (for ex. galvanic processes, zinc coating processes, pickling processes, etching, phosphating, alkaline degreasing and anodizing), Sludges and filter cakes other than those mentioned in 110109	28	110110	16.10.2002

Chemical characterization - solid matter

Arsenic	Lead	Cadmium	Chromium	Copper	Nickel	Mercury	Zinc
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
16	12	0.05	180	94	1100	<0.05	1020

Hydrocarbons	Lipophilic subst.	TOC	Benzene	Toluene	Ethylbenzene	Xylene
Weight %	Weight %	Weight %	mg/kg	mg/kg	mg/kg	mg/kg
0.15	0.15	2	<0.01	<0.01	<0.01	<0.01

Sum BTEX	Naphthalene	Acenaphtene	Acenaphtylene	Fluorene	Phenanthrene	Anthracene	Fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.04	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0,1

Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.1	<0.1	<0.1	<0.1	<0.1

Dibenz(ah)anthracene	Benzo(ghi)perylene	Indeno(1,2,3-cd)pyrene	Benzo(a)pyrene	AOX
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.1	<0.1	<0.1	<0.1	20

Water soluble portion	Sum PAH (16 EPA)
Weight %	mg/kg
1.1	<1

Remarks

pasty-solid, grey-blue

Data Sheet samble no. 30

Wastes from chemical surface treatment and coating of metals and other materials (for ex. galvanic processes, zinc coating processes, pickling processes, etching, phosphating, alkaline degreasing and anodizing), Sludges and filter cakes containing dangerous substances,

sample number	waste code	Date
30	110109	27.01.2003

Ecotoxikological characterization

Algae test - eluate

80%-sample	G_A-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	
100	32000	0.0050	0.0079	yes
100	20000	0.0048	0.0081	yes
100	24000	0.0052	0.0098	yes
Median	**24000**	**0.0050**	**0.0081**	**yes**

Daphnia test - eluate

100%-sample	G_D-sample	EC_{10}-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	[%]	
100	50000	-	-	-	yes
Median	**50000**	**-**	**-**	**-**	**yes**

Luminescent bacteria test- eluate

50%-sample	G_L-sample	EC_{20}-sample	EC_{50}-sample	Toxicity
[%Inhibition]		[%]	[%]	
100	2500	0.04	0.3012	yes
100	2500	0.06	0.255	yes
Median	**2500**	**0.05**	**0.28**	**yes**

Bacteria contact test - solid matter

50%-sample	G_B-sample	Toxicity
[%Inhibition]		
-	>100	yes
85.7	>100	yes
Median	**>100**	**yes**

Plant test - solid matter

50%-sample	G_P germination rate	G_P Shoot height	G_P dry shoot weight	Toxicity
Brassica	>65536	>65536	8192	yes
	>131072	>131072	>131072	yes
Lycopersicon	>65536	>65536	>65536	yes
	65536	65536	65536	yes
Avena	8192	<4096	8192	yes
	<8192	16384	16384	yes
most representative G_P-value				**65536**

umu-test - eluate without S9 / **Eluate with S9**

	GEU	VD	Genotoxicity		GEU	VD	Genotoxicity
	IR < 1.5	IR < 1.5	GEU > 1.5		IR < 1.5	IR < 1.5	GEU > 1.5
	>3072		yes		3072	0.0003	yes
	6140	0.0002	yes		1540	0.0006	yes
	12280	0.0001	yes		1540	0.0006	yes
Median	**9210**	**0.0001**	**yes**	**Median**	**1540**	**0.0006**	**yes**

Data Sheet samble no. 30

Wastes from chemical surface treatment and coating of metals and other materials (for ex. galvanic processes, zinc coating processes, pickling processes, etching, phosphating, alkaline degreasing and anodizing), Sludges and filter cakes containing dangerous substances,	lfd Nr.	EAV	Datum
	30	110109	27.01.2003

Chemical characterization - eluate

Dry weight %	Water content %	pH	Cond. µS/cm
75.7	24.3	1.45 adj. to 7	20900

DOC	TOC	NH4	Mercury	Cadmium	Chromium, total	Nickel	Copper
mg/l	mg/l	mg/L	µg/l	µg/l	mg/l	µg/l	µg/l
50	-	n.b	<50	<10	3 520	1830	340

Lead	Zinc	Manganese	Arsenic	Cobalt	AOX	Chromium VI
µg/l	µg/l	µg/l	µg/L	µg/l	mg/l	mg/l
56	1290	110	<0.5	<0.2	<0.5	3460

PCB 8	HCH	PCB 18	PCB 28	PCB 52	PCB 101	PCB 138	PCB 153
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	0.005	0.016	0.031	0.017

PCB 180	PCB 77	PCB 105	PCB 118	PCB 126	PCB 169	PCB 189
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
0.002	<	<	<	<	<	<

Naphthalene	Acenaphthylene	Acenaphtene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
n.b.	<	0.006	0.006	0.01	<	0.006	0.005

Benzo(a)-anthracene	Chrysene	Benzo(b)-fluoranthene	Benzo(k)-fluoranthene	Benzo(a)-pyrene	Indeno(1,2,3-cd)-pyrene	Dibenz(a,h)-anthracene	Benzo(g,h,i)-perylene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	<	<	<	<

Biphenyl	Benzene	Toluene	Ethylbenzene	m-/p-Xylene	o-Xylene	Dichlor-methane	1,1-Dichlorethene
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
n.b.	<	<	5.98	14	11	<	<

cis-1,2-Dichlorethene	trans-1,2-Dichlorethene	Trichlor-methane	1,1,1-Trichlorethane	Tetrachlor-methane	1,2-Dichlorethane	Trichlorethene	Bromdichlor-methane
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
<	<	<	<	<	<	<	<

1,1,2-Trichlorethane	Tetrachlorethene	Dibromchlor-methane	Tribrom-methane	1,2-Dichlorbenzene	1,3-Dichlorbenzene	1,4-Dichlorbenzene	hydrocar.-Index (H53)
µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	mg/l
<	0.1	<	<	<	<	<	-

Data Sheet samble no. 30

Wastes from chemical surface treatment and coating of metals and other materials (for ex. galvanic processes, zinc coating processes, pickling processes, etching, phosphating, alkaline degreasing and anodizing), Sludges and filter cakes containing dangerous substances,

Ifd Nr.	EAV	Datum
30	110109	27.01.2003

Chemical characterization - solid matter

Arsenic	Lead	Cadmium	Chromium	Copper	Nickel	Mercury	Zinc
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
24	57000	0.05	136000	108	2500	<0.05	168

Hydrocarbons	Lipophilic subst.	TOC	Benzene	Toluene	Ethylbenzene	Xylene
GEW.%	Gew.%	Gew.%	mg/kg	mg/kg	mg/kg	mg/kg
0.07	0.09	n.b.	<0.01	<0.01	0.3	1.7

Sum BTEX	Naphthalene	Acenaphtene	Acenaphtylene	Fluorene	Phenanthrene	Anthracene	Fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

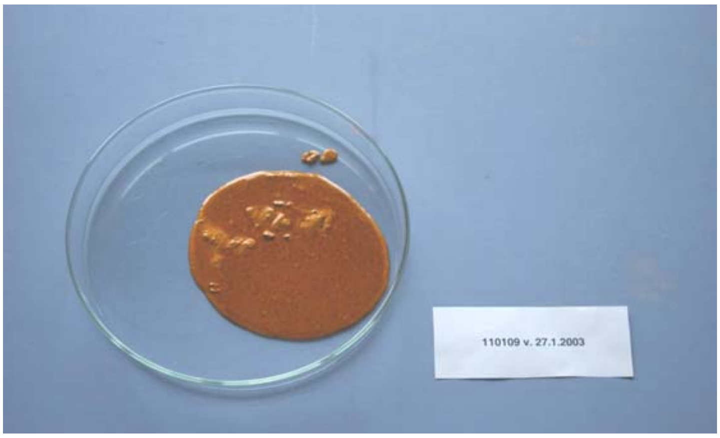
Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.1	<0.1	<0.1	<0.1	<0.1

Dibenz(ah)anthracene	Benzo(ghi)perylene	Indeno(1,2,3-cd)pyrene	Benzo(a)pyrene	AOX
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
<0.1	<0.1	<0.1	<0.1	n.b.

Water soluble portion	Sum PAH (16 EPA)	Chrom VI
Weight %	mg/kg	mg/kg
6.9	<1	82000

Remarks

sludge containing lead chromate, orange, pasty-solid; for pH-adjustment turbid-olive brown precipitation with yellow foam; for pH-adjustment (pH=7) ca. 20 NaOH-tablets necessary for 1 l; precipitate was filtered with glass filter;



chemical analysis –detection limit

Parameter	Detection limit	Parameter	Detection limit	Parameter	Detection limit
Solid matter		Eluate		Eluate	
Arsenic	0,1 mg/kg	DOC	0,3 mg/l	Naphthalene	0,002 µg/l
Lead	0,5 mg/kg	NH4	0,02 mg/l	Acenaphthylene	0,002 µg/l
Cadmium	0,01 mg/kg	Cadmium	0,1 µg/l	Acenaphtene	0,002 µg/l
Chromium	0,5 mg/kg	Chromium	0,5 µg/l	Fluorene	0,002µg/l
Copper	0,5 mg/kg	Nickel	0,5 µg/l	Phenanthrene	0,002 µg/l
Nickel	0,5 mg/kg	Copper	0,5µg/l	Anthracene	0,002 µg/l
Mercury	0,05 mg/kg	Lead	0,5 µg/l	Fluoranthene	0,002 µg/l
Zinc	0,1 mg/kg	Zinc	10 µg/l	Pyrene	0,002 µg/l
AOX	1 mg/kg	Maganese	5 µg/l	Benzo(a)anthracene	0,002 µg/l
Hydrocarbons	0,002 Gew. %	Arsenic	0,5 µg/l	Chrysene	0,002 µg/l
Lipohilic substances	0,01 Gew. %	Cobalt	0,5 µg/l	Benzo(b)fluoranthene	0,002 µg/l
TOC	0,1 Gew. %	PCB 8	0,002 µg/l	Benzo(k)fluoranthene	0,002µg/l
Benzene	0,01 mg/kg	HCH	0,002 µg/l	Benzo(a)pyrene	0,002 µg/l
Toluene	0,01 mg/kg	PCB 18	0,002 µg/l	Indeno(1,2,3-cd)pyrene	0,002 µg/l
Ethylbenzene	0,01 mg/kg	PCB 28	0,002 µg/l	Dibenz(a,h)anthracene	0,002 µg/l
Xylene	0,01 mg/kg	PCB 52	0,002 µg/l	Benzo(g,h,i)perylene	0,002 µg/l
Sum BTEX	0,04 mg/kg	PCB 101	0,002 µg/l	Biphenyl	0,002 µg/l
Naphthalene	0,1 mg/kg	PCB 138	0,002 µg/l	Benzene	3 µg/l
Acenaphtene	0,1 mg/kg	PCB 153	0,002 µg/l	Toluene	3 µg/l
Acenaphtylene	0,1 mg/kg	PCB 180	0,002 µg/l	Ethylbenzene	3 µg/l
Fluorene	0,1 mg/kg	PCB 77	0,002µg/l	m-/p-Xylene	3 µg/l
Phenanthrene	0,1 mg/kg	PCB 105	0,002µg/l	o-Xylene	3 µg/l
Anthracene	0,1 mg/kg	PCB 118	0,002 µg/l	Dichlormethane	3 µg/l
Fluoranthene	0,1 mg/kg	PCB 126	0,002µg/l	1,1-Dichlorethene	0,05 µg/l
Pyrene	0,1 mg/kg	PCB 169	0,002 µg/l	cis-1,2-Dichlorethene	0,25µg/l
Benz(a)anthracene	0,1 mg/kg	PCB 189	0,002µg/l	trans-1,2-Dichlorethene	0,25µg/l
Chrysene	0,1 mg/kg			Trichlormethane	0,01µg/l
Benzo(b)fluoranthene	0,1 mg/kg			1,1,1-Trichlorethane	0,01 µg/l
Benzo(k)fluoranthene	0,1 mg/kg			Tetrachlormethane	0,01 µg/l
Benzo(a)pyrene	0,1 mg/kg			1,2-Dichlorethane	0,1 µg/l
Dibenz(ah)anthracene	0,1 mg/kg			Trichlorethene	0,01 µg/l
Benzo(ghi)perylene	0,1 mg/kg			Bromdichlormethane	0,01 µg/l
Indeno(1,2,3-cd)pyrene	0,1 mg/kg			1,1,2-Trichlorethane	0,01 µg/l
Sum PAH (16 EPA)	1 mg/kg			Tetrachlorethene	0,01 µg/l
Water soluble portion	0,1 Gew. %			Dibromchlormethane	0,01 µg/l
				Tribrommethane	0,01µg/l
				1,2-Dichlorbenzene	0,1 µg/l
				1,3-Dichlorbenzene	0,1 µg/l
				1,4-Dichlorbenzene	0,1 µg/l
				Hydrocarbon-Index (H53)	0,1 mg/l
				AOX (Eluate acc. to DIN 38414-S4)	0,01 mg/l