

Compilation of Biotest Data

Data Collection, Data Evaluation, Recommendations

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Summary

The Waste Water Ordinance (Abwasserverordnung - AbwV) issued on the basis of Article 7 a of the Federal Water Act (Wasserhaushaltsgesetz - WHG) and Article 3 of the Waste Water Charges Act (Abwasserabgabengesetz - AbwAG) requires waste water and waste water discharges to be tested for the noxious effect of waste water ingredients, using biological test methods. The biotests prescribed by the Waste Water Ordinance are the fish, daphniae, luminescent-bacteria and algae tests as well as a test for genotoxic effects (umu test). This means that comprehensive data material is available. What is lacking, however, are cross-sectoral compilations of data from different waste water-generating sectors for the documentation of the present situation, assessments of the comparative biotest data on hand, concepts for future focal points of investigation (sectors generating waste water) as well as proposals for the systematic and incontestable replacement of the fish test required by current administrative regulations. To address these issues, work to compile biotest data was initiated by the Federal Environmental Agency in 1997.

The data available comprised a total of 10,014 results of fish, daphniae, luminescent-bacteria and algae tests on 3,882 samples from 694 plants. In addition, there were 600 umu-test results from 150 plants. Of the about 40 waste water source sectors investigated, those covered by Appendices 1, 22, 40 and 51 to the Waste Water Ordinance were predominant. With a total of 6,511 results, they accounted for two-thirds of all biotest results. The test results evaluated mostly dated from a three year period, which generally did not commence earlier than 1993. For each waste water source sector, tables listing the number of plants, samples and biotests by sources discharging directly and sources discharging indirectly were drawn up and the data subjected to statistical treatment (means, medians, maxima, 80 percentiles, 90 percentiles). In addition, a simulation of the 4-out-of-5 monitoring variant provided for by the Waste Water Ordinance was carried out in cases where the data base was large enough to do so.

As expected, efforts to establish correlations between the various test methods or between the results of the biological tests and the results of chemical analyses did not yield a statistically significant result. As great efforts have been made in recent years to improve water quality, there are at least some areas for which the analysis of the biotest results revealed a gratifying picture. The 90 percentiles of sources generating large volumes of waste water, among them ones covered by Appendix 1 AbwV (domestic and

communal waste water), Appendix 22 AbwV/32nd AbwVwV (mixed waste water), Appendix 31 AbwV (cooling water) and Appendix 46 AbwV (metal processing), show low to moderate biotoxicities.

Contrasting with these major, well-investigated source sectors, there are smaller source sectors (in terms of waste water volume) which have not been investigated in such detail as part of enforcement activities and whose waste waters in some cases exhibit a high toxicity. These include, among others, sources covered by Appendix 9 (coating materials and paint resins), 38th AbwVwV (textile manufacture), Appendix 46 (coal coking), Appendices 36, 45 and 49 ("mineral oil"), waste water from hospitals, and sectors with heavy use of cleaners and disinfectants such as manufacture of food and beverages, dry cleaning installations and laundries.

As for the various tests, deficiencies were found for the algae test in particular. For example, in many source sectors, results from the algae test were not sufficiently available to carry out a statistical analysis. Further investigations are needed here. Limit values for the discharge of waste water should be geared to the 90 percentile of the respective source sector. Obtained for the current inventory of new and existing plants, complying with these values is likely to be possible in future. What is more, as was demonstrated by the example of waste water from the chemical and pharmaceutical industry, this requirement is rendered less stringent by the 4-out-of-5 rule commonly applied in the assessment of results in enforcement practice.

Use of the fish, daphniae, luminescent-bacteria, algae and umu tests appears to be an appropriate measuring programme for initial testing within the framework of enforcement. Subsequent routine testing could then be confined to the two tests found to be the most sensitive for the source sector in question. The complete test programme should, however, be repeated at intervals that are not too long (3 years) in order to identify possible advances in best available waste water treatment techniques or shifts in the toxicity of the waste water.