German Chemical Society
Gesellschaft Deutscher Chemiker

GDCh-Advisory Committee
on Existing Chemicals of
Environmental Relevance (BUA)

BUA Reports 158 and 159

Diethanolamine

BUA Report 158 (October 1994)

Triethanolamine

BUA Report 159 (December 1994)

S. Hirzel
Wissenschaftliche Verlagsgesellschaft 1997

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on Existing Chemicals of Environmental Relevance (BUA)

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Beratergremium für
Umweltrelevante Altstoffe (BUA)

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Foreword

The German Chemicals Act (Chemikaliengesetz - ChemG) of 1980 stipulates that certain existing chemicals must be reported to the competent authority, if they exhibit properties which indicate that they may be hazardous, either alone or in combination with other substances.

In the summer of 1982, an Advisory Committee on Existing Chemicals of Environmental Relevance (BUA) was set up by the German Chemical Society (Gesellschaft Deutscher Chemiker - GDCh). It brings together representatives from the scientific community, the chemical industry and the governmental authorities. This Advisory Committee is responsible for elaborating appropriate solutions for substances of relevance for health and the environment on the basis of voluntary measures. It selects and examines existing chemicals from the aforementioned angles. The testing and evaluation are based on scientific criteria alone.

It was, therefore, necessary to develop priority setting procedures. In a first phase reports were only prepared for priority chemicals. Within the framework of a first priority setting procedure, chemicals were compiled from several priority lists and 135 chemicals were selected for detailed substance reports.

In a second priority setting procedure the survey of the German Chemical Industry Association (VCI) on all substances with a production volume of more than 10 tons per year was used as a starting list. Since this survey covered 4,600 chemicals, BUA decided to process the corresponding list in several stages. The first stage included approx. 1,050 substances with a production volume of more than 1,000 tons per year.

Detailed reports are drawn up on chemicals suspected of having a hazard potential and abridged reports on those presenting only a minor hazard potential, according to the current state of knowledge.

The detailed BUA reports take in both the published literature and data from industry. If data for the evaluation of the chemicals are not available, additional studies are recommended and the results are published as updates to the reports. The reports serve as a basis for the instigation of administrative measures, when there are indications of risks to health or the environment.

Tübingen, May 1993

Ernst Bayer
Chairman of the Advisory Committee
on Existing Chemicals
of Environmental Relevance

Diethanolamine

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(October 1994)

edited by the GDCh-Advisory
Committee on Existing Chemicals
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Beratergremium für
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Contents

Diethanolamine

BUA Report on Diethanolamine

7 Summary, conclusions and recommendations

7.1 Summary and conclusions

Ca. 20 500 t diethanolamine was produced in the Federal Republic of Germany in 1990. In the same year, ca. 11 000 t was exported and ca. 10 500 t was imported by Germany. Federal German consumption of diethanolamine in 1990 was ca. 20 000 t. The principal application areas are detergents raw materials, drilling and cutting fluids, and gas scrubbing.

Manufacture in 1990 resulted in discharge of 13.3 t into factory wastewater. Generally, any diethanolamine and its compounds that are discharged via detergents raw materials and cosmetics into the environment will reach municipal wastewater-treatment plants whereas that discharged from the drilling/cutting fluids and gas-scrubbing sectors is fed into municipal and industrial wastewater.

The emissions declarations of BASF AG and Hüls AG show that 2 400 g diethanolamine was discharged into the waste air during production and processing in 1990. Ca. 200 t y^{-1} is discharged into die geosphere via agrochemicals.

Degradation studies performed on diethanolamine differ in test duration, density and origin of the inoculum, diethanolamine concentration and measured parameters. Accordingly, there is a high degree of scatter among die results, with die values for die extent of biodegradation ranging from 0 to 100 %.

Ecotoxicity studies of diethanolamine produced the following results:

- Fish, expressed in terms of mortality, LC_{50} (24 h): 800 - > 5 000 mg l^{-1}; LC_{50} (48 h): 1 430 – 1 850 mg l^{-1}; LC_{50} (96 h): > 540 – 1 664 mg l^{-1}; NOEC (96 h): > 540 mg l^{-1}; NAEL (no adverse effect level) (96 h): 180 mgl^{-1};

- Entomostracae: EC_{50} (24 h): 170 - 2 800 mg l^{-1}; EC_{50} (48 h): 28.8 - 110 mg l^{-1}; EC_{50} (96 h): 1.4 - ≥ 100 mg l^{-1}; expressed in terms of reproduction, NOEC (21 d): 0.78 mg l^{-1} and LOEC (21 d): 1.56 mg l^{-1}; expressed in terms of parental mortality, NOEC (21 d): 3.13 mg l^{-1};

- Algae, expressed in terms of cell proliferation: TTC (8 d): 4.4 mg l^{-1} (neutralized) and 10 mg l^{-1} (not neutralized); EC_{10} (3 d): 2.5 - 23 mg l^{-1}; EC_{50} (3 - 4 d): 2.1 - > 100 mg l^{-1}; EC_{90} (3 d): 88 - > 100 mg l^{-1}; and

- Bacteria, expressed in terms of growth: TTC (16 h): 16 mg l^{-1} (not neutralized) and > 10 000 mg l^{-1} (neutralized) (*Pseudomonas putida, Pseudomonas fluorescens*); TTC (8 d): 16 - 17 mg l^{-1} (*Microcystis aeruginosa*).

When compling its priority lists, the Advisory Committee on Existing Chemicals of Environmental Relevance (BUA) had classified diethanolamine as a compound that does not constitute an identifiable potential risk to humans or the environment.

However, this report has shown in several instances - some ecotoxicological end points (toxicity to *Daphnia magna, Scenedesmus quadricauda* and *Scenedesmus subspicatus*), the usage pattern and the likelihood of exposure - that it is not possible to entirely rule out a potential risk to the environment.

The paucity of data precludes a final assessment of the compound‘s toxicity profile. Data are required on its sensitizing effect, its toxicity on repeated inhalation and its teratogenic effect, as these results are not yet available.

7.2 Recommendations

Ecology

There is not enough information available to assess the hazardousness of diethanolamine to the environment.

In order to be able to garn a complete picture of the fate of diethanolamine in the detergents raw materials and cosmetics sectors, information is needed as to the amounts of diethanolamine used unchanged and in derivatized form (soaps, fatty acid amides and esters, etc.). Should it transpire that fatty acid esters are used in considerable amounts, their hydrolysis characteristics should be tested under use conditions (pH, temperature).

The BUA will make inquiries of the following associations: IPP (Industrial Association of Cleaners and Polishes), TEGEWA (Association of Textile Auxiliaries, Leather Auxiliaries, Tanning and Detergents Raw Materials Industries e.V.), the Fachvereinigung Industriereiniger im Verband der chemischen Industrie e.V. (Expert Association of Industrial Cleaners in the Association of the Chemical Industry) and the IKW (Industrial Association for Body Care and Detergents).

The following information will be requested:

- Forms of application: These have to be registered completely, i.e., as pure bases (in alkaline media), ammonium salts or soaps, esters, amides, etc.

- Esters: Application conditions for clarifying the question of hydrolysis.

- Areas of application: Detergents and cleaners, textile auxiliaries, cosmetics, body-care products, cleaning agents and related areas.

- Information about the market shares of the member companies in the association.

Since crop-protection agents are a significant source of discharge into the geosphere, information is required as to behaviour in soil:

- Adsorption and desorption as laid down in OECD Guideline 106, but using soils typical of the EU;

- Respiratory or dehydrogenase-activity measurements in soil (BBA Guideline from 1987);

- Biodegradation test in soils, e.g., in line with OECD Guideline 304 A.

The applications and discharge levels of the 2 000 t y^{-1} listed under “Miscellaneous“ in the dossier could not be explained by the manufacturer and require further clarification.

The degree of elimination and level of discharge into surface waters should be determined by means of representative measurements in the influent and effluent of municipal (for the sectors detergents, cleaners and cosmetics) and industrial wastewater-treatment plants (for the sectors drilling and cutting fluids).

Toxicology

The Employers‘ Liability Association of the Chemical Industry plans to conduct the following tests (see page 21):

- 90-day inhalation trial on rats, including neurotoxicity test

- Sensitization test on guinea pigs

- Inhalational teratogenicity/embryotoxicity study on rats

Once the results are available, the Association will publish an up-to-date Toxicological Evaluation.

Triethanolamine

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Triethanolamine

BUA Report on Triethanolamine

7 Summary, conclusions and recommendations

7.1 Summary and conclusions

Approximately 22 500 t triethanolamine was produced in the Federal Republic of Germany in 1990. 16 910 t was exported from and 6 500 t imported into the Federal Republic of Germany in 1990. German consumption of triethanolamine in 1990 was ca. 13 100 t. The main application areas are detergents raw materials, cement additives and cooling lubricants.

Manufacture in the Federal Republic of Germany in 1990 led to discharge of 19 t triethanolamine into factory wastewater. Triethanolamine and its compounds that are released into the environment via detergents raw materials and cosmetics are generally treated in municipal wastewater-treatment plants whereas those used in drilling/cutting fluids and gas scrubbing are fed into both municipal and industrial wastewater.

According to the emissions registers of BASF AG and Hüls AG, production and processing of triethanolamine in 1990 led to discharge of ca. 30 g and ca. 100 g triethanolamine respectively into the waste air. Application as cement grinding auxiliary results in discharge of 20 - 60 g triethanolamine per tonne cement during cement grinding, equivalent to 13 - 20 mg m^{-3} in the waste air from grinding.

Triethanolamine has proved to be inherently biodegradable. In view of the log P_{OW} values of -2.3 to -1.32, bioaccumulation is not expected. The bioconcentration factors (BCFs) of 0.001 - 0.26 calculated therefrom suggest that bioconcentration of triethanolamine in aquatic organisms is negligible.

Ecotoxicity studies on triethanolamine have produced the following results:

- Fish 24-h LC_{50} > 5 000 mg l^{-1} and 48-h LC_{50} 10 000 mg l^{-1};

- Daphnia 24-h EC_0: 875 – 1 530 and 24-h EC_{50} 1 390 – 2 038 mg l^{-1}, 21-d NOEC: 16 mg l^{-1};

- Green algae 8-d TTC: 1.8 mg l^{-1} (neutralized) to 715 mg l^{-1} (not neutralized), 72-h EC_{10} 7.9 mg l^{-1} (not neutralized) to 26 mg l^{-1} (neutralized); EC_{50} 216 mg l^{-1} (not neutralized) to 512 mg l^{-1} (neutralized);

- Bacteria 16-h TTC: > 10 000 mg l^{-1}, 8-d TTC: 19 - 47 mg l^{-1}, 30-min EC_{10}: 140 mg l^{-1} (not neutralized) and 3 154 mg l^{-1} (neutralized).

When drawing up its list of priority chemicals, the Advisory Committee on Existing Chemicals of Environmental Relevance (BUA) had classified triethanolamine as a compound that does not currently constitute an identifiable potential risk to humans or the environment.

This report has confirmed this classification with regard to the toxicological effect of triethanolamine, in concentrations encountered in the environment, on humans. However, in view of several end points - toxicity to *Scenedesmus quadricauda* and *Scenedesmus subspicatus*, the usage pattern and the likelihood of exposure - it is not possible to entirely rule out a potential risk to the environment.

The toxicity profile will be processed and evaluated with a view to updating “Toxicological Evaluation No. 57 dated 5/90“ issued by the BG-Chemie.

7.2 Recommendations

There is not enough information available to assess the hazardousness of triethanolamine to the environment.

In order to be able to gain a complete picture of the fate of triethanolamine in the cleaners and detergents, and cosmetics and textile auxiliaries sectors, information is needed as to the amounts of triethanolamine used unchanged and in derivatized form (soaps, fatty acid amides and esters, etc.). Since hydrolysis of the derivatives (e.g., esters) is expected, their hydrolysis characteristics should be tested under use conditions (pH, temperature).

The BUA will make inquiries of the following associations: IPP (Industrial Association of Cleaners and Polishes), TEGEWA (Association of Textile Auxiliaries, Leather Auxiliaries, Tanning and Detergents Raw Materials Industries), the Fachvereinigung Industriereiniger im Verband der chemischen Industrie e.V. (Expert Association of Industrial Cleaners in the Association of the Chemical Industry) and the IKW (Industrial Association for Body Care and Detergents).

The following information will be requested:

- Forms of application: These have to be registered completely, i.e., as pure bases (in alkaline media), ammonium salts or soaps, esters, amides, and so on.

- Esters: Application conditions for clarifying the question of hydrolysis.

- Areas of application: Detergents and cleaners, textile auxiliaries, cosmetics, body-care products, cleaning agents and related areas.

- Information about market shares of the member companies in the association.

The applications and discharge levels of the < 660 t y^{-1} listed under “Miscellaneous“ in the dossier could not be explained by the manufacturer and require further clarification.

The degree of elimination in wastewater-treatment plants and level of discharge into surface waters should be determined by means of representative measurements in the influent and effluent of municipal (for the sectors detergents, cleaners and cosmetics) and industrial wastewater-treatment plants (for the sectors drilling and cutting fluids).