FOREWORD INTRODUCTION

1,2,3,4-TETRAHYDRONAPHTHALENE

CAS N°: 119-64-2

SIDS Initial Assessment Report

For

SIAM 19

Berlin, Germany, 19-22 October 2004

1.	**Chemical Name:**	1,2,3,4-Tetrahydronaphthalene
2.	**CAS Number:**	119-64-2
3.	**Sponsor Country:**	Germany Contact Point: BMU (Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit) Contact person: Prof. Dr. Ulrich Schlottmann Postfach 12 06 29 D-53048 Bonn
4.	**Shared Partnership with:**	
5.	**Roles/Responsibilities of the Partners:**	
•	Name of industry sponsor /consortium	Degussa AG, Germany Contact person: Dr. R. Ebert Bennigsenplatz 1 D-40474 Duesseldorf
•	Process used	The BUA Peer Review Process : see next page
6.	**Sponsorship History**	
•	How was the chemical or category brought into the OECD HPV Chemicals Programme?	by ICCA initiative
7.	**Review Process Prior to the SIAM:**	last literature search (update): 3 May 2004 (Human Health): databases medline, toxline; search profile CAS-No. and special search terms 18 March 2004 (Ecotoxicology): databases CA, biosis; search profile CAS-No. and special search terms OECD/ICCA
8.	**Quality check process:**	As basis for the SIDS-Dossier the IUCLID was used. All data have been checked and validated by BUA. A final evaluation of the human health part has been performed by the Federal Institute for Risk Assessment (BfR) and of the ecotoxicological part by the Federal Environment Agency

(UBA).

9. Date of Submission: 23 July 2004

10. Date of last Update:

11. Comments: **OECD/ICCA - The BUA* Peer Review Process**

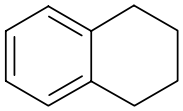
Qualified BUA personnel (toxicologists, ecotoxicologists) perform a quality control on the full SIDS dossier submitted by industry. This quality control process follows internal BUA guidelines/instructions for the OECD/ICCA peer review process and includes:

- a full (or update) literature search to verify completeness of data provided by industry in the IUCLID/HEDSET
- Review of data and assessment of the quality of data
- Review of data evaluation
- Check of adequacy of selection process for key studies for OECD endpoints, and, where relevant, for non-OECD endpoints by checking original reports/publications
- Review of key study description according robust summaries requirements; completeness and correctness is checked against original reports/publications
  (if original reports are missing: reliability (4), i.e. reliability not assignable)
- Review of validity of structure-activity relationships
- Review of full SIDS dossier (including SIAR, SIAP and proposal for conclusion and recommendation for further work)

In case of data gaps, review of testing plan or rationale for not testing

* BUA (GDCh-Beratergremium für Altstoffe): Advisory Committee on Existing Chemicals of the Association of German Chemists (GDCh)

SIDS INITIAL ASSESSMENT PROFILE

CAS No.	119-64-2
Chemical Name	1,2,3,4-Tetrahydronaphthalene
Structural Formula	

SUMMARY CONCLUSIONS OF THE SIAR

Human Health

1,2,3,4-Tetrahydronaphthalene is rapidly absorbed when ingested or inhaled. The chemical is metabolized by hydroxylation at the non-aromatic portion of the molecule. The metabolites are excreted mainly as glucuronides with the urine, but elimination with the feces was also observed. Dark green colored urine, which is observed as a typical symptom in humans, indicates metabolization to a pigment.

The acute toxicity of 1,2,3,4-tetrahydronaphthalene was found to be relatively low with an oral LD_{50} of 2860 mg/kg bw (male rats), a dermal LD_{50} of 16,800 mg/kg bw (male rabbits) and no mortalities within 8 hours inhalation of a saturated atmosphere (ca. 1300 mg/m^3; male rats. In humans, the chemical is known to produce headache, nausea, vomiting, green-gray urine, and restlessness at high concentrations.

1,2,3,4-Tetrahydronaphthalene was a moderate irritant to the skin (OECD TG 404), but not to the eye (OECD TG 405). High exposure from the gas phase may cause irritation of mucous membranes and profuse lacrimation in humans. 1,2,3,4-Tetrahydronaphthalene was not sensitizing in a guinea pig maximization test (OECD TG 406, 1981).

In 13-week inhalation studies on rats and mice (performed within the U.S. National Toxicology Program and currently available only as abstracts plus key tables), no mortalities, no clinical abnormalities, and no gross pathological findings were observed at exposure concentrations up to and including 660 mg/m^3. In mice, transitional epithelial eosinophilic granules were observed in the urinary bladder of all exposed groups (dose-related), the toxicological significance of this finding is however unclear. In female mice, uterus atrophy was found at 82.4 mg/m^3, and atrophy of the ovary at 330 mg/m^3. In rats, a NOAEL could also not be established due to increased liver weight down to the lowest tested concentration (41.2 mg/m^3). The NOAEL for nasal lesions in rats was 82.4 mg/m^3 in males and 41.2 mg/m^3 in females, and 164.8 mg/m^3 in mice.

In a 28 day toxicity study in rats with gavage application of up to 150 mg 1,2,3,4-tetrahydronaphthalene/kg bw/day, no mortalities occurred in any group. Squatting position and closed eyes were observed in all treated groups. There was a transient decrease in absolute body weights of all treated males. Results of hematology were indicative of a hemolytic anemia in males and females of the high dose group, which was still present, though to a lesser degree, at the end of the recovery period. As a secondary reaction to the anemia, the reticulocyte counts for high dose females were increased and the extramedullary hematopoesis in the spleen of both high dose genders was enhanced. Based on the adverse effects on blood and spleen (significant at 150 mg/kg bw/day, but already beginning at 50 mg/kg bw/day), the NOAEL in this study was at 15 mg/kg bw/day.

1,2,3,4-Tetrahydronaphthalene was not genotoxic in bacterial systems *in vitro* (Ames test). In a Mouse Lymphoma test, results were negative and equivocal, without and with metabolic activation, respectively. *In vivo*, no mutagenic activity was detectable in two micronucleus assays on mice according to OECD TG 474 using the oral and inhalation routes of administration.

No specific studies have been performed on the toxicity of 1,2,3,4-tetrahydronaphthalene to reproduction. There were no indications of an adverse effect on vaginal cytology, sperm and on reproductive organs from the 13-week

inhalation study on rats. In mice, no effects on vaginal cytology and sperm were noted in the 13-week inhalation study, but uterus atrophy and atrophy of the ovary were found in the absence of systemic toxicity (*cf.* repeated dose section). Therefore, an effect of the chemical on reproduction cannot fully be excluded.

1,2,3,4-tetrahydronaphthalene did not show any developmental effects in a gavage study with rats performed in accordance with OECD TG 414 (2001) up to and including the highest tested dose level of 135 mg/kg bw/day. The NOAEL for maternal toxicity was 45 mg/kg bw/day, effects at 135 mg/kg bw/day were reduced food consumption and reduced body weight gain. The NOAEL for developmental toxicity was 135 mg/kg bw/day.

Environment

1,2,3,4-Tetrahydronaphthalene has a melting point of -35.8° C, a boiling point of 207.57° C at 1013 hPa, a water solubility of 45 mg/l and a vapor pressure of 0.34 hPa at 20 °C. The measured log K_{ow} is 3.78 (23 °C).

According to Mackay Level I model calculation, the main target compartment for 1,2,3,4-tetrahydronaphthalene will be the atmosphere (94.7 %), followed by water (2.7 %). The experimental Henry's law constant of 138 Pa m^3/mol indicates high volatility from surface waters. With a calculated K_{oc} of 1837 l/kg, the sorption potential to soil or sediment organic matter is expected to be high.

In the atmosphere, 1,2,3,4-tetrahydronaphthalene is removed by reaction with hydroxyl radicals with a calculated half-life of 11.2 hours based on an experimental rate constant. In water, it is not expected to hydrolyze under environmental conditions. Photolytic degradation in surface waters is an additional removal process of unclear significance with a half-life at least above 34 hours. 1,2,3,4-Tetrahydronaphthalene is not readily biodegradable by every inoculum, but is degraded well by several rare microorganisms. Anaerobic degradation was also observed. Calculated bioconcentration factors between 162 and 326 indicate a bioaccumulation potential of 1,2,3,4-tetrahydronaphthalene.

The lowest valid acute test results of aquatic testing determined for fish, invertebrates, and algae were as follows:

Danio rerio: 96-h-LC_{50} = 3.2 mg/l
Daphnia magna: 48-h-EC_{50} = 9.5 mg/l
Daphnia pulex: 48-h-EC_{50} = 2.4 mg/l
Desmodesmus subspicatus: 72-h-E_rC_{50} = 11.0 mg/l; 72-h E_bC_{50} = 7.0 mg/l
Long term aquatic toxicity data are available for one trophic level:
Desmodesmus subspicatus: 72-h E_rC_{10} = 5.3 mg/l; 72-h E_bC_{10} = 3.8 mg/l

From the lowest among the acute values, an aquatic PNEC of 2.4 µg/l is calculated using an assessment factor of 1000 according to the EU Technical Guidance Document.

Exposure

1,2,3,4-Tetrahydronaphthalene is produced in the Czech Republic, Germany, Japan, and the United States of America with production capacities of < 1000, 9000, < 1000, and 12,000 t/year, respectively. Production rates are known or assumed to be well below capacities. The annual quantity on the market is estimated to be below 10,000 t/a. Use as an intermediate and as an industrial solvent are the only applications of 1,2,3,4-tetrahydronaphthalene with significant quantities. Direct use and use as an intermediate are of approximately equal importance. Beside 1-naphthol, from which Carbaryl® is made, the most important substance made from 1,2,3,4-tetrahydronaphthalene is decahydronaphthalene. 1,2,3,4-Tetrahydronaphthalene is used as a solvent in a wide variety of applications including viscosity adjustment. In European product registers products are listed for both professional and consumer use that contain 1,2,3,4-tetrahydronaphthalene in concentrations up to 50 % (higher for two professional use products).

1,2,3,4-Tetrahydronaphthalene also occurs in fossil materials such as coal and petroleum and their downstream products, and it is formed in various plants as well as in combustion processes.

Releases of synthetic 1,2,3,4-tetrahydronaphthalene into the environment may occur during production, solvent use, formulation, and use of formulations as well as from its use as a starting material for organic syntheses. Release from production in the Sponsor country is negligible because a closed system is used, there is no water involved in

the process, and solid waste is incinerated. Releases into the terrestrial compartment may occur from the use of 1,2,3,4-tetrahydronaphthalene as solvent in herbicides. Further data for anthropogenic 1,2,3,4-tetrahydronaphthalene are not available.

Release of fossil 1,2,3,4-tetrahydronaphthalene may occur when fossil materials are stored in open containers, burnt incompletely, spilt, or disposed of improperly. Naturally formed 1,2,3,4-tetrahydronaphthalene already occurs in the environment.

The order of magnitude of background concentrations is approximately 10 – 30 ng/l in surface waters, based on monitoring data from around 1990.

The most probable human exposure to 1,2,3,4-tetrahydronaphthalene is through dermal contact or inhalation during manufacture or use. In the Sponsor country, exposure is controlled in occupational settings.
Consumers may be exposed to 1,2,3,4-tetrahydronaphthalene used as solvents in paints, varnishes, lacquers, waxes, shoe polishes, and in petroleum products (gasoline, motor oils).

RECOMMENDATION AND RATIONALE FOR THE RECOMMENDATION AND NATURE OF FURTHER WORK RECOMMENDED

Human Health: The chemical is a candidate for further work. The chemical possesses properties indicating a hazard for human health (irritant to skin and mucous membranes, repeated dose toxicity, potential effect on reproduction). Based on data presented by the Sponsor country, adequate risk management measures are being applied for occupational settings. A high potential for consumer exposure exists as a result of the use as solvent in e.g. paints, waxes, and polishes. It is therefore recommended to perform an exposure assessment and, if then indicated, a risk assessment. It is further noted that the chemical is currently being tested in a 2 year inhalation carcinogenicity study on mice and rats under the US National Toxicology Program.

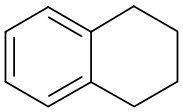
Environment: The chemical is a candidate for further work. The chemical possesses properties indicating a hazard for the environment. Based on data presented by one company in the Sponsor country, exposure from production is low. However, environmental exposure may result from the use of 1,2,3,4-tetrahydronaphthalene as solvent and from the formulation and use of products containing the substance. Therefore, an exposure assessment and, if then indicated, an environmental risk assessment is recommended.

SIDS Initial Assessment Report

1 IDENTITY

1.1 Identification of the Substance

CAS Number: 119-64-2
IUPAC Name: 1,2,3,4-Tetrahydronaphthalene
Molecular Formula: $C_{10}H_{12}$
Structural Formula:



Molecular Weight: 132.21 g/mol
Synonyms: 5,6,7,8-Tetrahydronaphthalene
Benzocyclohexane
Tetralin ®
Tetrahydronaphthalene
Tetranap
THN

1.2 Purity/Impurities/Additives

The purity of the 1,2,3,4-tetrahydronaphthalene produced by Degussa AG is at least 98.0 % w/w, typically 98.9 %. Identified impurities are decahydronaphthalene (max. 1.5 %), naphthalene (max. 0.7 %), ethylbenzene (ca. 0.06 %), toluene (ca. 0.02 %), benzene (ca. 0.01 %), water (< 0.02 %), and 1,2,3,4-tetrahydro-1-naphthyl hydroperoxide (0.005 - 0.01 %). Normally no additives are used (BUA, 1992).

1.3 Physico-Chemical properties

Table 1 Summary of physico-chemical properties

Property	Value	Reference
Physical state	liquid	Mair and Streiff (1941)
Melting point	-35.80 +/- 0.02 °C	Mair and Streiff (1941)
Boiling point	207.57+/-0.10 °C (1013.25 hPa)	Mair and Streiff (1941)
Relative density	0.9702+/-0.0002 g/cm^3	Mair and Streiff (1941)
Vapor pressure	0.34 hPa (20 °C)	Kudchadker, Kudchadker and Wilhoit (1978)
Water solubility	45.0 +/-0.4 mg/l	Burris and MacIntyre (1987)
Partition coefficient n-octanol/water (log value)	3.78 at 23 °C	Hüls AG (1989 c)
Henry's law constant	138 Pa m^3/mol at 20 °C	Ashworth et al. (1988)
K_{oc}	1,837 l/kg	Degussa AG (2004 a)

The selection of the vapor pressure is based on best agreement with data at higher temperatures as well as with the Henry's law constant / water solubility ratio, which would correspond to 47 Pa (0.045 g/l · 138 Pa m^3/mol · 1000 l/m^3 / 132.21 g/mol).

2 GENERAL INFORMATION ON EXPOSURE

1,2,3,4-Tetrahydronaphthalene is not only generated by synthetic manufacture. It also occurs in fossil materials and is formed in natural organisms. While occupational exposure is dominated by synthetic 1,2,3,4-tetrahydronaphthalene, any other exposure is determined by the three sources anthropogenic, fossil, and natural.

2.1 Production Volumes and Use Pattern

1,2,3,4-Tetrahydronaphthalene is produced in the Czech Republic, Germany, Japan, and the United States of America with production capacities of < 1000, 9000, < 1000, and 12,000 tonnes/year, respectively (Degussa AG, 2004 b). Discontinuation by one out of two producers world wide of the manufacture of the biocide Carbaryl® (1-Naphthyl-N-methylcarbamate), for which 1,2,3,4-tetrahydronaphthalene is a precursor, led to a dramatic decrease in sales of 1,2,3,4-tetrahydronaphthalene between 1989 and 1990 and a hard competition for the remaining market shares (BUA, 1992). Production rates are known or assumed to be well below capacities. The annual quantity on the market is estimated to be below 10,000 tonnes/year (Degussa AG, 2004 b).

Use as an intermediate and as an industrial solvent are the only applications of 1,2,3,4-tetrahydronaphthalene with significant quantities. Direct use and use as an intermediate are of approximately equal importance. Beside 1-naphthol, from which Carbaryl® is made, the most important substance made from 1,2,3,4-tetrahydronaphthalene is decahydronaphthalene (BUA, 1992).

1,2,3,4-Tetrahydronaphthalene dissolves fats, oils, linoxyn, rubber, waxes, asphalt, bitumen, pitch, phenol, naphthalene, iodine, sulfur, and other materials. Because it dissolves colophony, congo copals, oil glyptals, coumarone resins and modified formaldehyde resins, it is widely used in the

production of high-grade lacquers, as it imparts a good flow to the lacquers and gives high gloss, smooth film surfaces. The very high dissolving power for organic substances of all types promotes the adhesion of the individual paint layers to one another. The substance is also used as a solvent for herbicides (Degussa AG, 2003). The use of 1,2,3,4-tetrahydronaphthalene in shoe and floor polishes (Gaydos, 1981) may also be considered as a solvent use as well as viscosity adjusting.

1,2,3,4-Tetrahydronaphthalene is often mentioned as a hydrogen-carrying solvent in coal liquefaction in addition to elementary hydrogen. When used in this way, 1,2,3,4-tetrahydronaphthalene is converted mainly to naphthalene but also to 1-methylnaphthalene, 1-methylindan, indan, indene, butyl benzene and dimers or C_{9-11} hydrocarbons (Chawla, Keogh and Davis, 1987). This particular use is, however, probably of minor commercial importance in comparison to other uses as solvent. 1,2,3,4-Tetrahydronaphthalene is sometimes also used as a heat transferring fluid (BUA, 1992).

The Swiss Product Register (2003) includes 66 products with 1,2,3,4-tetrahydronaphthalene, 30 of them for professional use and 36 for consumer use. Most of the applications listed (auxiliary material, ceramic colors, cleaning agent, glue, hardener, insecticide, lubricant, metal cleaning agent, paints, surface cleaning, writing material, wood preservative, and similar) may use 1,2,3,4-tetrahydronaphthalene as a solvent, including its use in polishes. The highest concentration ranges in products for professional use are reported for direct solvent use (2 products with > 50 %), followed by two products with 10 – 50 % ("insecticide" and "cleaning agent"). In products for consumer use the highest concentration range for these 36 products is 10 –50 % (2 "solvents", 1 "auxiliary", 1 "lubricant", 1 "teaching / writing material").

According to the database SPIN (2004), the most recent annual consumption volumes in Scandinavia are 17.8 t (Denmark in 2001), 0.6 t (Norway in 2001) and 1.0 t (Sweden in 2000) with a total of 58 preparations; information for Finland is confidential. The focus of the use data is construction (accounts for the highest quantity with 14.0 t in Denmark) as well as cleaning and repair of motor vehicles.

In the Swedish Product Register (2002), among six products containing 1,2,3,4-tetrahydronaphthalene with a total annual quantity of 1 t there are no consumer products. "Paints, varnishes" is given as the main industrial category.

2.2 Environmental Exposure and Fate

2.2.1 Sources of Environmental Exposure

As mentioned above, there are three sources of environmental exposure: Release from anthropogenic production and handling, release from fossil materials and their processing and use, and natural synthesis. In some studies, 1,2,3,4-tetrahydronaphthalene may have been formed by thermal degradation of other substances during the analytical procedures. However, 1,2,3,4-tetrahydronaphthalene findings in studies with careful control of mild thermal conditions indicate that 1,2,3,4-tetrahydronaphthalene is present as such in many materials.

Anthropogenic production

Releases into the environment may occur during production of 1,2,3,4-tetrahydronaphthalene, during solvent use, formulation, and use of formulations as well as from its use as a starting material for organic syntheses. Release from production in the Sponsor country is negligible because a closed system is used, there is no water involved in the process, and solid waste, which

stems from sampling, is incinerated (Degussa AG, 2004 b). Releases into the terrestrial compartment may occur from the use of 1,2,3,4-tetrahydronaphthalene as solvent in herbicides. Further data are not available.

Fossil materials

1,2,3,4-Tetrahydronaphthalene may be released when fossil materials are stored in open containers, burnt incompletely, spilt, or disposed of improperly.

In a sample of German mineral coal the content of 1,2,3,4-tetrahydronaphthalene was 63 mg/kg (Pichler and Hennenberger, 1969). The substance was also identified in coal from Kentucky, U.S.A. (White and Lee, 1980).

1,2,3,4-Tetrahydronaphthalene was identified in petroleum and quantified in the "kerosene fraction" by Mair and Streiff (1941). In four crude oil samples from different locations in Australia, Zadro, Haken and Pinczewski (1985) determined concentrations ranging from 0.077 % to 0.136 % for a common peak of 1,2,3,4-tetrahydronaphthalene plus two other hydrocarbons.

The concentrations of 1,2,3,4-tetrahydronaphthalene found in fuels and heating oil are as follows: gasoline (regular) 0.02 - 0.03 %, gasoline (super and super extra) max. 0.01 %, jet A1 fuel for aircraft 0.25 - 0.41 %, diesel fuel 0.15 - 0.263 %, and heating oil (light) 0.08 - 0.10 % (DGMK, 2003).

Natural synthesis

In the analysis of the aerial parts of four *Sideritis* species (often used as herbal tea and in traditional medicine) from various locations in Greece, 1,2,3,4-tetrahydronaphthalene was found only in *S. raeseri subsp. raeseri*. Its concentration was approximately 5.2 mg/kg (Aligiannis et al., 2001). The concentration of 1,2,3,4-tetrahydronaphthalene in coconut (*Cocos nucifera*) fruit pulp was found to be 86.2 µg/kg (Ghizzoni, 1990). The substance was also identified in peaches from Spain (Hernandez et al., 1999). Further findings in foodstuffs and drinks are reported below (chapter 2.3.2).

Monitoring data (background)

In the analysis of stormwater and sediment samples from 81 locations in 12 urban areas in the Canadian Great Lakes basin, 1,2,3,4-tetrahydronaphthalene was found in less than 10 % of the samples. The estimate of 36 kg 1,2,3,4-tetrahydronaphthalene introduced annually into the Great Lakes basin, about 2/3 thereof into Lake Ontario alone, corresponds to a mean concentration of 16 ng/l (partially adsorbed to the sediment) at a total inflow of $2.23 \cdot 10^9$ m^3. The accuracy of these figures is limited, since the mean concentration is near the detection limit (Marsalek and Schroeter, 1988).

1,2,3,4-Tetrahydronaphthalene was found in 35/93 two-week wet precipitation samples from four remote stations, one on each of the Great Lakes bordering Canada. Concentrations ranged from 4.9 to 181.8 ng/l, average 13.0 ng/l (Chan and Perkins, 1989).

Ahel (1991) analyzed water sampled in 1986-1989 in the area of Zagreb (Croatia / Yugoslavia). He found 1,2,3,4-tetrahydronaphthalene concentrations of 31 ng/l in the Sava River and of 13 ng/l in a nearby sampling well. Information on the frequency of findings and details of the analysis are lacking, which prevents determination of the validity of the published results.

Sea water samples from Terranova Bay, Antarctica were analyzed by Desideri, Lepri and Checchini (1989). 1,2,3,4-Tetrahydronaphthalene was detected at levels ranging from 2 to 33 ng/l (average: 8.9 ng/l) in 9 out of 11 samples. Sea pollution with petroleum or petroleum products as well as local

anthropogenic releases were discussed as sources. In the particulate phase, which was mainly phytoplancton, aromatic hydrocarbons like 1,2,3,4-tetrahydronaphthalene were absent.

In 1/5 samples of suspended sediment from Duluth-Superior harbor (Wisconsin, U.S.A.), 1,2,3,4-tetrahydronaphthalene was detected (not quantified) by Bahnick and Markee (1985) at a detection limit of 0.010 - 0.013 µg/g dry weight. The approximately 200 compounds identified were considered to be primarily plant decomposition products.

In 1988, Almendros, Sanz and Velasco (1996) analyzed soils from 12 monospecific forests of stone pine, evergreen oak, and Spanish juniper in central Spain. Fresh plant material (thin stems with leaves) from the three tree species was also analyzed. 1,2,3,4-Tetrahydronaphthalene was found in 2/12 soil samples (both from below stone pines) and 0/3 plant samples.

Monitoring data (contaminated sites)

In one sample per phase and location of water and suspended solids from three stations plus two final effluents of two bleached kraft pulp and paper mills on the Rainy River (border Ontario, Canada / Minnesota, U.S.A.), Merriman (1988) could not detect 1,2,3,4-tetrahydronaphthalene. Samples were taken at low flow conditions in August 1986. The detection limits were 1.0 ng/l water and 50 µg/kg solids. It should be noted that these values are well below those reported above as background concentrations but in conflict with the results of the following study:

Two years later, i.e. in June and August 1988, 1,2,3,4-tetrahydronaphthalene was found in 11/11 water samples from four stations plus two final effluents of two bleached kraft pulp and paper mills on the same Rainy River. The detection limit had been improved to 0.5 ng/l water and 10 µg/kg solids. Concentrations ranged from 4.6 to 154.3 ng/l in the water phase. Of the suspended solids samples, only 2/12 were positive with 10.0 and 14.0 µg/kg. Maximum water concentrations were found in one mill, maximum solids concentrations in the other mill (Merriman et al., 1991).

In six samples of juvenile fish from the same waters in the same year 1988, the same authors found 1,2,3,4-tetrahydronaphthalene at concentrations of 34.5, 73.2, and 75.3 µg/kg, while three fish were negative at a detection limit of 10 µg/kg (total weight, probably wet).

In groundwater studies near landfills, 1,2,3,4-tetrahydronaphthalene concentrations of 300 and 560 ng/l, respectively, were found in two wells at the edge of Zagreb's (Croatia / Yugoslavia) main landfill (Ahel, 1991; insufficiently documented), while in a plume below a site for disposal of secondary treated sewage effluent operated since 1936 near Falmouth (Massachusetts) the maximum 1,2,3,4-tetrahydronaphthalene concentration was 10 ng/l (Barber et al., 1988). The number of negative findings is not reported in both publications.

In samples of undisturbed snowpack collected near steel works of Sault Ste. Marie (Ontario, Canada) during the winter 1986/1987, Boom and Marsalek (1988) did not detect 1,2,3,4-tetrahydronaphthalene in any of 20 sampling stations at a detection limit of 50 ng/l melt-water.

2.2.2 Photodegradation

In the atmosphere, 1,2,3,4-tetrahydronaphthalene is photodegraded by reaction with hydroxyl radicals with a half-life of 11.2 hours based on an experimental rate constant (Atkinson and Aschmann, 1988) and a tropospheric OH radical concentration of $5 \cdot 10^5$ molecules cm^{-3}.

Photolytical degradation in surface waters would be expected to be of minor importance because the longest wave absorption maximum of 1,2,3,4-tetrahydronaphthalene is at 271.78 nm (Humby, Semeluk and Stevens, 1970). However, Bio/dynamics Inc. / Exxon Biomedical Sciences Inc (1983)

have determined that there is considerable degradation of 1,2,3,4-tetrahydronaphthalene by sunlight in aqueous solution with a half-life as low as approximately 17 hours referring to sunlight time. Considering night time as well as lower light intensities due to shade or location leads to a half-live above 34 hours. Unexpected photodegradation of 1,2,3,4-tetrahydronaphthalene was also observed by Lichtenthaler, Haag and Mill (1989) upon irradiation in hexane solution with a xenon lamp.

EU labelling (Index No. 601-045-00-4) of 1,2,3,4-tetrahydronaphthalene comprises the risk phrase "May form explosive peroxides", indicating that in bulk 1,2,3,4-tetrahydronaphthalene a radical chain reaction may occur in the presence of oxygen, leading to the formation of the hydroperoxide. This suggests that the unexpected photodegradation in water may follow a complex mechanism and not pseudo first-order kinetics. Thus the half-life is probably determined by the concentrations of 1,2,3,4-tetrahydronaphthalene and oxygen and is considerably higher at 1,2,3,4-tetrahydronaphthalene concentrations which may occur in the environment.

2.2.3 Stability in Water

In water, 1,2,3,4-tetrahydronaphthalene is not expected to hydrolyze at a significant rate under environmental conditions due to lack of appropriate functional groups.

2.2.4 Transport between Environmental Compartments

Distribution modeling using Mackay, Level I (V 2.11) and based on the physical-chemical properties listed in Table 1 indicates that the main target compartment for 1,2,3,4-tetrahydronaphthalene will be the atmosphere with 94.7 %, followed by water (2.7 %) (Degussa AG, 2004 a).

Due to its (calculated) K_{oc} of 1,837 l/kg ($\log K_{oc} = 3.264$), it is expected to be highly adsorbed to soil and sediment, i.e. to have a high potential for geoaccumulation (Degussa AG, 2004 a).

The Henry's law constant governing the distribution of 1,2,3,4-tetrahydronaphthalene between aqueous solutions and air was determined by Ashworth et al. (1988). A value of 138 Pa m^3/mol indicates high volatility from aqueous solution according to the criteria of Thomas (1990).

2.2.5 Biodegradation

In a closed bottle test according to Directive 84/449/EEC, C.6 with predominantly domestic sewage as inoculum, 1,2,3,4-tetrahydronaphthalene was not readily biodegradable (5 % after 28 days) (Hüls AG, 1996). In a BODIS (Blok) test (BOD-test for insoluble substances) performed with activated sludge, 81 % biodegradation after 28 days was observed (Hüls AG, 1989 a). Since in the former study the test concentration was much lower than in the latter (2 vs 45.8 mg/l), bacteria toxicity is not a plausible explanation for the difference in results. However, the BODIS test uses a much higher inoculum concentration than the closed-bottle test (30 mg/l activated sludge) and is not regarded as a test on ready biodegradation but can rather be interpreted as a test on inherent biodegradation.

Other studies not performed according to internationally agreed guidelines led to similarly conflicting results. Obviously the ability to biodegrade 1,2,3,4-tetrahydronaphthalene is scarce. Thus among six strains of bacteria isolated from oil-polluted estuarine waters by Dean-Raymond and Bartha (1975), only one was able to metabolize 1,2,3,4-tetrahydronaphthalene. In a study with 32 different strains from hydrocarbon-polluted areas including sludge from industrial WWTPs and mud from the river Rhine, eight strains of bacteria utilizing 1,2,3,4-tetrahydronaphthalene as sole

source of carbon and energy were identified. Growth was not observed after direct addition of the test substance but after well-controlled transfer to the test medium via the gas phase and / or via a hydrophobic solvent (Sikkema and de Bont, 1991).

Schreiber and Winkler (1983) tested the ability of 41 strains isolated from 32 different samples of polluted soils, mud, and waters to grow with 1,2,3,4-tetrahydronaphthalene as the sole carbon source upon addition of the test substance via the gas phase. Growth occurred in several mixed cultures but in none of the 41 strains in pure culture. Transformation and growth rates were low, which according to the authors is probably due to slow transport of 1,2,3,4-tetrahydronaphthalene to the reaction centers.

Anaerobic biodegradation of 1,2,3,4-tetrahydronaphthalene was also observed with a naphthalene-degrading, sulfate-reducing bacterial culture by Annweiler, Michaelis and Meckenstock (2002).

Summarizing the available data on biodegradation, 1,2,3,4-tetrahydronaphthalene is not found readily biodegradable with every inoculum but is expected to be biodegraded well in the environment, though appropriate organisms may not be immediately available.

2.2.6 Bioaccumulation

Valid experimental bioaccumulation data are available only for mussels, the only study being performed with the bivalve mollusc *Macoma balthica* and with a crude oil. . Bioconcentration data are reported for classes of substances contained in crude oil. Data described below are reported for tetralins, i.e. alkylated derivatives of 1,2,3,4-tetrahydronaphthalene, which are more lipophilic and less biodegradable than 1,2,3,4-tetrahydronaphthalene itself. Additionally, results indicate degradation of test substance: The maximum (BCF 23,300) was observed after 120 days of exposure, followed by a decrease to 44 % of the maximum during 60 further days of exposure. 13 % of the maximum were still present after another 60 days of depuration (Clement, Stekoll and Shaw, 1980). Thus in spite of sufficiently good documentation, the results overestimate the bioaccumulation potential of 1,2,3,4-tetrahydronaphthalene.

The log K_{ow} of 3.78 (see Table 1) and QSAR bioconcentration factors of 162.4 (BCFWIN v2.14) to 326 (EU TGD) calculated using this log K_{ow} (Degussa AG, 2004 a) indicate a bioaccumulation potential of 1,2,3,4-tetrahydronaphthalene.

2.2.7 Other Information on Environmental Fate

No information available.

2.3 Human Exposure

The most probable human exposure to 1,2,3,4-tetrahydronaphthalene is through dermal contact or inhalation during manufacture or use.

2.3.1 Occupational Exposure

Please see Section 2.1 / Production Volumes and Use Pattern for information from Product Registers relating to product for professional use. The highest concentration ranges in products for

professional use are reported for direct solvent use (> 50 %), followed by products with 10 – 50 % ("insecticide" and "cleaning agent") (Swiss Product Register, 2003).

In the German production plant, occupational exposure is limited by a closed system to sampling and maintenance. Sampling is a daily activity involving one person for about five minutes, while maintenance activities (like repairing a pump) are rare, e.g. annually, and of variable duration involving usually only one person. For these activities, workers are protected by work clothing, gloves, safety goggles with side shields, and helmet. No recent occupational exposure monitoring data are available (Degussa AG, 2004 b).

In an exposure study performed in the UK thermoplastics processing industry in 1992 - 1994, eleven different thermoplastic-process combinations were evaluated. 1,2,3,4-Tetrahydronaphthalene (isomer uncertain) was found in 2/4 samples from acrylonitrile-butadiene-styrene rubber injection molding at 245 °C melt temperature (operator plus background samples) and in 1/5 samples from Nylon 6 extrusion at 276 °C (background sample). These results indicate that the 1,2,3,4-tetra-hydronaphthalene found probably had a different source (Forrest et al., 1995).

Cocheo, Bellomo and Bombi (1983) investigated occupational exposure in the vulcanization area of a shoe-sole factory, the vulcanization area of a tire retreading factory, the extrusion area of the same tire retreading factory, and the extrusion area of an electrical cables insulation plant in 1983. 1,2,3,4-tetrahydronaphthalene was found only in the vulcanization area of the tire retreading factory. Its concentration was 0 - 1 µg/m^3, and the probable source suggested by the authors was naphthenic oil, which was, however, also used in the other locations studied.

The tentative identification of 1,2,3,4-tetrahydronaphthalene in waste core butts from a core binder system, based on core oil and green sand, from the metal casting industry by Ham et al. (1989) may serve as an indication of occupational exposure in this industry, which is probably due to the use of fossil materials.

2.3.2 Consumer Exposure

Anthropogenic production

The Swiss Product Register (2003) includes 66 products with 1,2,3,4-tetrahydronaphthalene, 36 of them for private use. The highest concentration range for these 36 products is 10 – 50 % (2 "solvents", 1 "auxiliary", 1 "lubricant", 1 "teaching / writing material"). The uses reported may all be special applications of solvent use.

According to the database SPIN (2004), the most recent annual consumption volumes in Scandinavia are 17.8 t (Denmark in 2001), 0.6 t (Norway in 2001) and 1.0 t (Sweden in 2000) with a total of 58 preparations; information for Finland is confidential. Consumer exposure is reported only for Norway, while it was discontinued in Sweden between 1999 and 2000.

Fossil materials

General findings in coal, petroleum, and gasoline are reported above in chapter 2.2.1. Available exposure information is reported here:

In 1996, exposure to hydrocarbons was determined for 13 persons living next to gasoline stations and six control persons in Frankfurt (Germany). 1,2,3,4-Tetrahydronaphthalene was found with 1/13 test persons (2.5 µg/m^3) and 0/6 control persons. Assuming half the detection limit for findings below the detection limit, the geometric mean had decreased from 0.8 µg/m^3 a 1991 survey to 0.6 µg/m^3 in 1996 (Heudorf, Ullrich and Ung, 1998).

In an indoor exposure study in six homes in Northern Italy performed in 1983/1984, 1,2,3,4-tetrahydronaphthalene was found in 2/6 samples at concentrations of 20 µg/m^3 and 10 µg/m^3. Because alkanes, cycloalkanes and alkyl benzenes always occurred as complex mixtures, the authors suggested petroleum distillate fractions, e.g. as solvents for paints, wood impregnants, waxes and polishes, as probable sources (De Bortoli et al., 1985; De Bortoli et al., 1986).

Natural synthesis

Findings in untreated plants, which may be ingested by humans directly or after treatment, are reported above in chapter 2.2.1. 1,2,3,4-Tetrahydronaphthalene was also found in numerous drinks and foodstuffs, which findings are reported here along with exposure resulting from thermal treatment of other biological materials:

In 15 pooled samples of commercial Sen-cha green tea (*Camellia sinensis L. var. Yabukita*), 21 µg /kg 1,2,3,4-tetrahydronaphthalene were found by Shimoda et al. (1995). The substance was also identified in freshly ground (roasted or raw) coffee (Gutmann et al., 1977) and tentatively in cured Rooibos tea (*Aspalathus linearis*) (Habu et al., 1985). Its identification in grapes by Tomasi et al. (2000) also has to be considered to be tentative due to lacking documentation.

In the analysis of seven Australian honeys, 1,2,3,4-tetrahydronaphthalene was found in one honey, which was from *Eucalyptus melliodora* (Graddon, Morrison and Smith, 1979). 1,2,3,4-Tetrahydronaphthalene was also identified in commercially available genuine fermented shoyu (soy sauce) by Nunomura, Sasaki and Yokotsuka (1980) as well as in commercially produced textured soy protein by Ames and Macleod (1984). The latter authors suggested that it was formed by thermal degradation of carotenoids during extrusion. Umano and Shibamoto (1984) found 1,2,3,4-tetrahydronaphthalene among the substances volatilized when heating potato starch. When glycine was added before heating, the concentration of 1,2,3,4-tetrahydronaphthalene in the volatile fraction increased from 1.01 % to 4.44 %.

1,2,3,4-tetrahydronaphthalene was identified tentatively in spiny lobster (*Panulirus argus*) tail meat from the Bahamas (Cadwallader et al., 1995) and in raw ground beef (King et al., 1993). Its concentration in the smoke of commercial non-filter cigarettes was found to be 22 µg/cigarette (Neurath, Gewe and Wichern, 1968).

Exposure to 1,2,3,4-tetrahydronaphthalene may also be due to other, non-food natural materials, from which the substance is released upon thermal treatment. It was identified in thermal reaction products of alder sawdust and poplar chips by Esplin, Fung and Hsu (1986) and in supercritical gas extraction products of spruce wood by Torul and Olcay (1984).

3 HUMAN HEALTH HAZARDS

3.1 Effects on Human Health

3.1.1 Toxicokinetics, Metabolism and Distribution

Studies in Animals

In vitro Studies

Using a homogenate of male Holtzman rat livers, Chen and Lin (1968) found out that both 1,2,3,4-tetrahydronaphthalene and its 1-hydroperoxide were converted to tetrahydronaphthalene-1-ol by rat liver enzymes. Both conversions required NADHP. The authors concluded that hydroxylation of 1,2,3,4-tetrahydronaphthalene probably occurs via the hydroperoxide.

In vivo Studies

The toxicokinetic behavior of 1,2,3,4-tetrahydronaphthalene in rats was studied by Hüls AG (1995 c) using a modified version of the test method described in Directive 84/449/EEC, and part of the results was reported by Meineke et al. (1998). Six groups each comprising five Wistar rats per sex were assigned to the following dose levels: vehicle control (2 groups); 15; 50; 150 mg/kg bw/day; 150 mg/kg bw/day reversal group. 2 ml/kg bw of the vehicle corn oil including the appropriate doses of 1,2,3,4-tetrahydronaphthalene were applied by gavage for 28 consecutive days. Blood was sampled from all animals once (terminal) for serum chemical and hematological investigations plus twice for the toxicokinetics during study (high dose group days 1 and 16; medium and low dose groups days 3 and 18 of treatment); detailed sampling times (approximately) were:

- 0.5; 1.5; 3.0; 6.0; 23.0 hours after treatment on days 1 and 16 from one animal per sex and group each;
- on days 2 and 17 from control groups;
- 0.5; 1.5; 6.0 hours after treatment on days 3 and 18 from 2; 2; 1 animals per sex and group;
- additional sampling from two animals each of the high dose groups at five different times during the 14 day reversal period (first sampling from non-reversal animals before sacrifice); 200 - 500 µl/sample.

The blood concentration maximum for 1,2,3,4-tetrahydronaphthalene was reached approximately 30 minutes after administration of the highest dose. The AUC (area under curve) of the high dose groups was more than proportional higher than that of the lower dose groups indicating that elimination may be saturated at this dose level. An accumulation of test substance after repeated oral administration of up to 150 mg/kg bw/day was, however, not observed. After 23 hours, only traces of test substance were detectable in the blood. In the low and mid dose group, elimination was almost finished after 6 hours. The elimination half life was determined in the range of 30 to 100 minutes. The first order half-life of elimination was approximately 1.5 hours with a one-compartment model and 4.7 hours (for males) with a two-compartment model. The authors concluded that resorption is rapid, but is probably decreased upon repeated dosing. The study was combined with a subacute toxicity study, thus the adverse effects are reported in chapter 3.1.5.

The metabolism of 1,2,3,4-tetrahydronaphthalene in Doe albino rabbits after single doses (210 - approximately 1,000 mg/kg bw) by stomach tube was studied by Elliott and Hanam (1968) using purified unlabeled as well as radioactive test substance. Of the radioactivity, 87 – 90 % was excreted in the urine within two days and 0.5 - 3.7 % on the third day. The feces contained 0.6 - 1.8 %. No radioactivity was found in the breath and negligible amounts were retained in the tissue. The main metabolites in the urine were:

glucuronide of 1,2,3,4-tetrahydro-1-naphthol [1]:	52.4 %
glucuronide of 1,2,3,4-tetrahydro-2-naphthol [2]:	25.3 %
1,2,3,4-tetrahydro-1-oxo-4-naphthol [3] (conjugated):	6.1 %
trans-1,2,3,4-tetrahydronaphthalene-1,2-diol [4] (conjugated):	0.6 %
cis-1,2,3,4-tetrahydronaphthalene-1,2-diol [5] (conjugated):	0.4 %

Previously reported as metabolites, but now identified to be artefacts, were: 1,2,3,4-tetrahydro-2-oxonaphthalene, 1-naphthol, 1,2-dihydronaphthalene, and naphthalene. The substances 1,2,3,4-tetrahydronaphthalene (= test substance itself), 1,2,3,4-tetrahydro-1-oxonaphthalene, 2-naphthol, 5,6,7,8-tetrahydro-1-naphthol, and 5,6,7,8-tetrahydro-2-naphthol also could not be found.

Upon treatment of male and female Fischer 344 rats with 0.5 ml 1,2,3,4-tetrahydronaphthalene/kg bw = 485 mg/kg bw intragastrically on alternate days over a 14 day period, the following metabolites were found (Servé, 1989; Servé et al., 1989):

1,2,3,4-tetrahydro-1-naphthol [1]:	29 %
1,2,3,4-tetrahydro-2-naphthol [2]:	7 %
1,2,3,4-tetrahydro-1-oxo-2-naphthol [6]:	33 %
1,2,3,4-tetrahydro-1-oxo-4-naphthol [3]:	25 %
1,2,3,4-tetrahydronaphthalene-1,4-diol [7]:	1 %
1,2,3,4-tetrahydronaphthalene-1,2-diol [4] and [5]:	traces

The findings of Röckemann (1922) can, due to lacking documentation, only indicate that 1,2,3,4-tetrahydronaphthalene is metabolized in different ways by rabbits on one hand and by dogs and humans on the other hand. The main metabolite in rabbits is 1,2,3,4-tetrahydro-1-naphthol [1], which is excreted as glucuronate. The main metabolite in dogs is 1,2,3,4-tetrahydro-2-naphthol [2], also excreted as glucuronate. Both main metabolites ([1] more rapidly than [2]) are further converted into dihydronaphthalene and subsequently into naphthalene. Considering the conflicting statements of Elliott and Hanam (1968) cited above, who identified 1,2-dihydronaphthalene and naphthalene as artefacts, one may conclude that there are certainly quantitative and maybe also qualitative differences between different mammals in their metabolism of 1,2,3,4-tetrahydro-naphthalene. Considering the purity of the test substances and the analytical tools available in the two studies, the data of Elliott and Hanam (1968) have a much higher reliability than those of Röckemann (1922). However, the studies of Servé (1989) and co-workers confirm that there are at least two metabolic pathways in competition with each other.

Studies in Humans

In vitro Studies

There were no studies available.

In vivo Studies

Pohl and Rawicz (1919) exposed volunteers through the food to doses of 5 or 7 g 1,2,3,4-tetrahydronaphthalene and performed various analyses with the urine collected thereafter. Dark green colored urine was observed, in which an unidentified pigment, naphthalene, and 1,2-dihydronaphthalene were found.

A woman was admitted to a hospital 48 hours after she had drunk about 250 ml (1/2 - 3/4 pint) of Cuprex (1,2,3,4-tetrahydronaphthalene 31.5 %, copper oleate 0.03 %, paraffin oil 52.7 %, acetone 15.7 %) in an episode of self-poisoning. A total of 1900 ml of green-grey urine was collected during the 24 hour period after admission and analyzed for metabolites, which were identified by comparison of GC retention times and mass spectra with reference compounds. The following substances were found in the urine beside unchanged 1,2,3,4-tetrahydronaphthalene:

A = 1,2,3,4-tetrahydro-1-naphthol [1]

B = not identified

C = glucuronide of A

D = glucuronide of 1,2,3,4-tetrahydro-2-naphthol [2]

The predominant metabolite was A. The concentration ratios A:B and C:D were approximately 84:16 and 1:2, respectively (Drayer and Reidenberg, 1973).

As mentioned earlier in this chapter, findings of Röckemann (1922) and others give evidence, however unreliable, that metabolism of 1,2,3,4-tetrahydronaphthalene in humans may be somewhat different from that in rabbits and rodents in quantitative, but possibly also in qualitative terms.

Conclusion

1,2,3,4-Tetrahydronaphthalene is rapidly absorbed when ingested or inhaled. The chemical is metabolized by hydroxylation at the non-aromatic portion of the molecule. The metabolites are excreted mainly (generally > 90 %) as glucuronides with the urine, but elimination with the feces was also observed. Dark green colored urine, which is observed as a typical symptom in humans, indicates metabolization to a pigment.

3.1.2 Acute Toxicity

Studies in Animals

Inhalation

Smyth, Carpenter and Weil (1951) reported that six male rats tolerated exposure to saturated atmospheres of 1,2,3,4-tetrahydronaphthalene for eight hours without deaths. A vapor pressure of 24 Pa (Table 1) corresponds to a concentration of 1300 mg/m^3. Union Carbide Corp. (1992) added the information that 8 hour exposures to mist, which was generated by aerating the compound while it was heated to 170 °C, were also tolerated without mortalities. Thus one may conclude from this limited study that the LC_0 is > 1300 mg/m^3.

Dermal

According to Smyth, Carpenter and Weil (1951) and Union Carbide Corp. (1992), the dermal LD_{50} of 1,2,3,4-tetrahydronaphthalene in male rabbits is approximately 16,800 mg/kg bw within 14 days post observation. After occlusive exposure of 5 animals each to doses of 12.6; 15.8 and 20.0 g/kg

bw for 24 hours, the skin was erythematous, on subsequent examination it was necrotized and ultimately leathery and dry. Autopsy revealed pale livers and kidneys and congestion of the pancreas and intestines.

Oral

In a study with 10 male Sherman rats per dose group, the oral LD_{50} was approximately 2860 mg/kg bw (Smyth, Carpenter and Weil, 1951; Union Carbide Corp., 1992). The doses reported are 2000; 2520; 3160; 3980; 7950 mg/kg bw. Following the doses, the rats exhibited symptoms of sluggishness, prostration, and narcosis. The urine had a brownish coloration. A dose of 7950 mg/kg bw produced severe lung hemorrhage, congestion of the liver, paleness of the kidney with edema in some instances, opacity and adhesions of the intestines. Several of the livers were jaundiced after the administration of a dosage of 3980 mg/kg bw. This effect was not found at the higher level because of rapid death. Lower dosage levels produced similar symptoms of lesser intensity. Since from the other toxicity studies there is no evidence of significant differences in sensitivity between males and females, this study is considered to cover the SIDS endpoint sufficiently.

Studies in Humans

Experience with human exposure to 1,2,3,4-tetrahydronaphthalene was gathered mainly in the years after World War I, when 1,2,3,4-tetrahydronaphthalene was used as a substitute for turpentine. In general, the reliability of the data reported cannot be determined due to lack of documentation.

Inhalation

Koelsch (1926; insufficiently documented) reports that after occupational application of 1,2,3,4-tetrahydronaphthalene or staying in freshly varnished or waxed rooms, workers complained about headache, nausea, vomiting and irritation of mucous membranes and green-colored urine. In two painters who had been painting for three days with 1,2,3,4-tetrahydronaphthalene-containing varnishes in a poorly ventilated area dark green colored urine was observed as the main symptom beside intense irritation of mucous membranes, profuse lacrimation, headache, and stupor. Reversibility was complete within few days (Arnstein, 1922). After approximately 3 kg wax containing about 1.5 kg 1,2,3,4-tetrahydronaphthalene had been applied in a hospital room of approximately 540 m^3 volume, children displayed green colored urine and a marked degree of restlessness. This restlessness was tentatively attributed to a direct effect of 1,2,3,4-tetrahydronaphthalene on the central nervous system without giving further details (Röckemann, 1922; insufficiently documented). Hospital patients on a ward whose floor was recently waxed with a tetralin-based polish and whose windows were closed due to cold weather experienced eye irritation, headache, nausea, diarrhea, and green urine (Badinand, Paufique and Rodier, 1947; insufficiently documented).

Dermal

No data available.

Conclusion

The acute toxicity of 1,2,3,4-tetrahydronaphthalene was found to be relatively low with an oral LD_{50} of 2,860 mg/kg bw (male rats), a dermal LD_{50} of 16,800 mg/kg bw (male rabbits) and no mortalities within 8 hours inhalation of a saturated atmosphere (ca. 1,300 mg/m^3; male rats). In man, the chemical is known to produce headache, nausea, vomiting, lacrimation, green-gray urine, and restlessness at high concentrations.

3.1.3 Irritation

Skin Irritation

Studies in Animals

In a study according to OECD TG 404 with rabbits (Small white Russian), undiluted 1,2,3,4-tetrahydronaphthalene caused moderate irritation with Draize scores of 3.11 for erythema, 1.56 for edema, and 4.55 in total. Effects were not completely reversible within 14 days (Hüls AG, 1984 b). Similar irritation intensity was observed in an early and limited study published by Smyth, Carpenter and Weil (1951) as well as by Union Carbide Corp. (1992). They report an irritation index of 4/10 in rabbits 24 hours after application of 0.01 ml 1,2,3,4-tetrahydronaphthalene to the clipped belly of rabbits (no information on occlusion).

Studies in Humans

A skin condition similar to turpentine-induced dermatitis that was eczematous in nature is reported in five painters (four males, one female) that used 1,2,3,4-tetrahydronaphthalene (1 case) or mixtures containing 1,2,3,4-tetrahydronaphthalene as substitutes for turpentine. From the rare occurrence of the symptoms, the author concluded that the persons probably had a high sensitivity (Galewsky, 1922).

Eye Irritation

Studies in Animals

In a study according to OECD TG 405 with rabbits (Small white Russian), undiluted 1,2,3,4-tetrahydronaphthalene caused no significant irritation with Draize scores of 5.17/110. Effects were completely reversible within 6 days (Hüls AG, 1984 a). Similar irritation intensity was observed in an early study published by Smyth, Carpenter and Weil (1951) as well as by Union Carbide Corp. (1992). They report an irritation index of 1/10 in rabbits 18-24 hours after application of 0.5 ml 1,2,3,4-tetrahydronaphthalene to rabbits (not rinsed).

Studies in Humans

Two painters who had been painting for three days with 1,2,3,4-tetrahydronaphthalene-containing varnishes in a poorly ventilated area complained, among others, about irritation of mucous membranes and profuse lacrimation (Arnstein, 1922).

Respiratory Tract Irritation

Studies in Animals

There were no studies available.

Studies in Humans

There were no studies available.

Conclusion

1,2,3,4-Tetrahydronaphthalene was a moderate irritant to the skin (OECD TG 404) but not to the eye (OECD TG 405). However, high exposure from the gas phase may cause irritation of mucous membranes and profuse lacrimation in humans.

3.1.4 Sensitization

Studies in Animals

Skin

In a guinea pig maximization test according to OECD TG 406 (1981), none of the 20 test animals showed a positive reaction 24 as well as 48 hours after challenge with the pure substance. Positive controls were not used in this study (Hüls AG, 1989 b).

Conclusion

1,2,3,4-Tetrahydronaphthalene was not sensitizing in a guinea pig maximization test, in which no positive controls were used (OECD TG 406, 1981).

3.1.5 Repeated Dose Toxicity

Studies in Animals

Inhalation

In a subchronic inhalation study, 25 male and 20 female Fischer 344 rats per dose level were exposed (whole body) to nominal 1,2,3,4-tetrahydronaphthalene concentrations of 7.5; 15; 30; 60; 120 ppm = 41.2; 82.4; 165; 330; 660 mg/m^3 = exposure levels 1; 2; 3; 4; 5 for 13 weeks on 6 h/day, 5 days/week (NTP, 1997 b). Rats were subdivided into groups of 5 male renal toxicity rats + 10 male and 10 female core study rats + 10 male and 10 female clinical pathology rats. Blood was sampled from 10 animals per dose and sex on days 3 and 23 (after exposures, clinical pathology rats) and at terminal sacrifice (core study rats). Urine was sampled for 16 hours during week 12 on all surviving core study animals. At terminal sacrifice, which was done the day after the last exposure, weights of liver, thymus, right kidney, right testis, heart and lungs were determined, and complete necropsy was performed. In histopathology, target tissues identified at 120 ppm were examined at lower concentrations to no-effect level or lowest exposure concentrations. Gross lesions were examined in all groups. Clinical observations were performed in all animals throughout the in-life study period.

Kidneys were assessed after 2 weeks (5 renal toxicity rats), at 6 weeks (5 male clinical pathology rats), and at terminal sacrifice (5 male core study rats): Histopathology and evaluation of cell proliferation were done in the left kidneys, measurement of α2u-globulin in the right kidneys. In order to determine whether 1,2,3,4-tetrahydronaphthalene may be a reproductive toxicant, vaginal cytology was evaluated for 12 days during the last 2 weeks of the study in all remaining females in the 0-, 30-, 60-, and 120-ppm groups (0, 165, 330, and 660 mg/m^3). Epididymal sperm concentration, spermatid heads/testis, and left caudal, epididymal and testicular weights were evaluated in surviving males from the same groups.

No mortalities and no clinical abnormalities were observed in any group. Body weight gain was lower by 6.1 % (males) and 5.7 % (females), respectively, in the highest dose groups. Clinical chemistry of males of the higher exposure groups was consistent with nephropathy. Hematology revealed a modest regenerative anemia in both sexes, primarily at exposure levels 4 and 5.

In urinalysis, dark-stained urine was observed at exposure levels 3-5. Urine aspartate amino-transferase values were significantly higher in males (ca. 2.5) and females (ca. 17 times control values) at the highest exposure level. The urine lactic dehydrogenase (LDH):creatinine ratio was

significantly, but modestly increased in the two highest dose levels, and LDH activity was increased in high dose females.

There was an increased right kidney : body weight ratio in all groups of exposure levels $\geq$ 2 except level 3 males; the mean absolute right kidney weight was slightly increased in all treated groups. The liver : body weight ratios were increased in males (levels 2 and 5) and females (levels 4 and 5), and the mean absolute liver weight was slightly increased in all groups exposed.

Gross pathology revealed no gross observations in any dose group. Findings in histopathology were olfactory necrosis and regeneration, confirming the irritation potential of 1,2,3,4-tetrahydronaphthalene. The NOAEL for nasal lesions was 15 ppm (82.4 mg/m^3) in males and 7.5 ppm (41.2 mg/m^3) in females. Hyaline droplet accumulation in kidneys of males increased slightly with increased exposure; since effects were observed even at the lowest exposure concentration, a NOAEL could not be determined. Minimal nephropathy was found in males in the higher exposure groups. Concentrations of α2u-globulin generally increased with exposure concentration and time on study. It is noted that α2u-globulin related nephropathy is species- and gender specific and is not considered to be of relevance to humans. Therefore, the α2u-globulin related nephropathy was not used for deciding on the NOAEL.

A similar subchronic inhalation study was performed by NTP (1997 a) in B6C3F1 mice, which were exposed whole-body in groups of 10 per dose and sex to nominal 1,2,3,4-tetrahydronaphthalene concentrations of 7.5; 15; 30; 60; 120 ppm = 41.2; 82.4; 165; 330; 660 mg/m^3 = levels 1; 2; 3; 4; 5 for 13 weeks on 6 h/day, 5 days/week. All animals were bled only at terminal necropsy. Beside complete necropsy, weights of liver, thymus, right kidney, right testis, heart, and lungs were determined. In histopathology, target tissues identified at 120 ppm (660 mg/m^3) were examined at lower concentrations to no-effect level or lowest exposure concentrations. Gross lesions were examined in all groups. Clinical observations were performed in all animals throughout the in-life study period.

Two blood smears were taken from all core study animals at necropsy. One of these slides was subject to micronuclei determination. In order to determine whether 1,2,3,4-tetrahydronaphthalene may be a reproductive toxicant, vaginal cytology was evaluated for 12 days during the last 2 weeks of the study on all females in the 0-, 30-, 60-, and 120-ppm groups (0, 165, 330, and 660 mg/m^3). Epididymal sperm concentration, spermatid heads/testis, and left caudal, epididymal & testicular weights were evaluated in all males from the same groups.

No mortalities and no clinical abnormalities were observed in any group. Body weight gain was lower by 8.9 % (males, significant) and 7.0 % (females, insignificant), respectively, in the highest dose groups. In hematology, total erythrocytes and packed cell volumes were decreased, accompanied by increased mean corpuscular hemoglobin, mean corpuscular volume, and mean corpuscular hemoglobin concentration measurements and reticulocyte concentrations in both sexes at levels 4 and 5. Platelet concentrations were increased in these same groups. Dark-colored urine was observed at level 3 (7/10 each for males and females) and higher (all animals). Relative and absolute weights of right kidneys were reduced in males of levels 2, 4, and 5. Relative liver weights were increased for males (level 5) and females (levels 4 and 5), which may be primarily attributed to lower body weight gain in these groups. The relative (level 5) and absolute (levels 4 and 5) heart weights were decreased in males.

Gross pathology revealed no gross observations in any group. In histopathology, no lesions were observed in the liver, kidney, heart, or testes that correlated with any of the weight changes observed. Atrophy of the olfactory epithelium correlated very well with observations in the previous 14-day study. Ovary and uterus atrophy was observed in high dose females. Incidences at

minimal doses of observation were 2/10 (15 ppm = 82.4 mg/m^3, uterus) and 4/10 (60 ppm = 330 mg/m^3, ovary). Transitional epithelial eosinophilic granules were observed in the urinary bladder of all animals exposed (dose-related), the significance of this finding is unclear. Ignoring transitional epithelial eosinophilic granules of the urinary bladder, the NOAEL was 7.5 ppm = 41.2 mg/m^3 (LOAEL: 15 ppm = 82.4 mg/m^3; uterus atrophy) in females and 15 ppm (82.4 mg/m^3) in males (LOAEL: 30 ppm = 165 mg/m^3; dark-colored urine) (NTP, 1997 a).

Higher test concentrations were used by Cardani (1942), who exposed three guinea pigs (2 males, 1 female) to a single test concentration for 8 hours/day until all animals were dead, i.e. for 22 days. A saturated atmosphere was generated by 3 wash bottles with pure test substance in sequence. The exposure concentration of 1,480 mg/m^3 air was calculated as consumption of test substance divided by volume of air. Animals died on days 17 (male) and 22 (remaining animals). Clinical signs were piloerection, restlessness, apathy, immobility, and trembling. Body weights decreased by 21; 16; and 15 %, respectively. Food consumption was reduced. Hematology revealed slight anemia and leucopenia, and urinalysis showed oliguria, albuminuria, hematuria, increased formation of urine cylinders and dark staining of urine. In histopathology, toxic centrilobular atrophy of the livers, signed by hyperemia, cloudy swelling and fatty degeneration were observed. Kidneys of all animals showed necrotic nephrosis. Lungs showed localized broncho-pneumonia.

Dermal

The reliability of the only dermal repeated dose study with 1,2,3,4-tetrahydronaphthalene published cannot be assessed due to lacking information on doses. The study was performed by Cardani (1942), who treated two guinea pigs of differing sex for 16 days twice daily at an interval of several hours with a cotton swab soaked with 1,2,3,4-tetrahydronaphthalene. The application area had been shaved and treated with barium sulfide for removal of hair. Animals died on days 11 (female) and 16 (male). Clinical signs were piloerection, restlessness, apathy, immobility, and trembling. Body weights decreased by 12 % (male) and 8 % (female), respectively. Food consumption was reduced. Hematology revealed slight anemia and leucopenia, and in urinalysis oliguria, albuminuria, hematuria, increased formation of urine cylinders and dark staining of urine were found. At gross pathology, the skin application area showed squamous and crusted eczema. Histopathology findings were toxic centrilobular atrophy of the livers, signed by hyperemia, cloudy swelling and fatty degeneration. Kidneys of both animals showed necrotic nephrosis. Lungs showed localized broncho-pneumonia.

Oral

The subacute toxicity of 1,2,3,4-tetrahydronaphthalene with gavage application in rats was tested by Hüls AG (1995 a) in accordance with Directive 84/449/EEC, B.7 (1992). The study was combined with toxicokinetic investigations, which are reported above in chapter 3.1.1. Six groups each comprising five Wistar rats per sex were assigned to the following dose levels: vehicle control (2 groups); 15; 50; 150 mg/kg bw/day; 150 mg/kg bw/day reversal group. 2 ml/kg bw of the vehicle corn oil including the appropriate doses of 1,2,3,4-tetrahydronaphthalene were applied by gavage for 28 consecutive days.

No mortalities occurred in any group. Piloerection and alopecia were observed in all groups including controls, the former symptom fading away within a few days of recovery. Squatting position and closed eyes were observed in all treated groups, and reduced activity in high dose males. There was a transient decrease in absolute body weights of all treated males, which was still significant (-11.3 %) in the high dose group on day 28 and compensated during the recovery period. It corresponded to an increased food conversion rate, which decreased during the recovery period, in high dose males. A less pronounced increase in food conversion rate was observed in low and high dose females.

No signs of test substance related effects were detected in ophthalmoscopic examination. Clinical chemistry showed some significant changes, but a dose-response relationship only has to be discussed for sodium, which was significantly increased in all high dose animals and in low dose males but also high (close to historical control maximum) in the control males. Results of hematology included a significant decrease of the red blood cell count in males (insignificant in females of high dose group); improvement with males during recovery still left a significant decrease. Reticulocytes and eosinophiles were significantly increased in high dose females. The recovery group showed a significant increase in hemoglobin and consequently in MCV and MCH of dosed females.

The urine volume was significantly increased in high dose females. The colour of the urine showed a change to yellow-brown and dark, which was not dose dependent. Urine sediment analysis gave a dose-dependent increase in oxalates, which was statistically significant in high dose males with individual values beyond the range of the historical control data also for three intermediate dose males. Recovery left oxalates of two individuals beyond the range of the historical control data. High presence of oxalates in urine was also observed in one or two individuals each of all female control and high dose groups including both recovery groups. Triplephosphates were significantly increased and erythrocytes significantly decreased in high dose males. The urine pH was significantly decreased in high dose females (6.80, control 8.20) and one intermediate dose female. Unusual presence of glucose in urine and high presence of ketone was also observed in the high dose female with the lowest pH of urine.

Changes in organ weights were scarce and focussed on the spleen, the relative weight of which was increased statistically significantly in high dose males and insignificantly, not dose related in intermediate and high dose females. Absolute spleen weights were decreased in low dose females. In the high dose male recovery group, absolute weight of spleen and relative weight of adrenals were increased. Gross pathology revealed no macroscopic lesions considered to be related to treatment. Findings of histopathology consisted of spontaneous lesions in males and females of all groups such as hydrometriosis of the uterus, calcification of Peyer's patches, hyaline casts in the kidney and multifocal lymphocytes in the lung. The NOAEL is 15 mg/kg bw/day, and the LOAEL is 50 mg/kg bw/day (Hüls AG, 1995 a).

The cataract formation reported by Basile (1939) for rabbits after oral application of 1,2,3,4-tetrahydronaphthalene for 30 - 40 days at doses of 0.2 - 1 ml/day supports the assumption that this substance has an adverse effect on eyes. Cataract formation was further studied by Fitzhugh and Buschke (1949) in rats. They found no cataract formation with 1,2,3,4-tetrahydronaphthalene itself but with 1,2,3,4-tetrahydro-2-naphthol, which is a metabolite of 1,2,3,4-tetrahydronaphthalene. It was suggested that the difference in the effects of 1,2,3,4-tetrahydronaphthalene on the eye of the rat and the rabbit might be due to metabolic differences, the cataractogenic metabolite 1,2,3,4-tetrahydro-2-naphthol being predominant in the rabbit and the non-cataractogenic 1,2,3,4-tetrahydro-1-naphthol being predominant in the rat (Basile, 1939). However, the ratio 1,2,3,4-tetrahydro-2-naphthol / 1,2,3,4-tetrahydro-1-naphthol is about 1:2 in rabbits (Elliott and Hanam, 1968) and about 1:4 in rats (Servé, 1989). This means that differences in metabolism cannot account completely for the differences between these species. Anyway, the absence of cataract observations in more recent animal studies indicates that the potential for cataract formation of 1,2,3,4-tetrahydronaphthalene is low.

Studies in Humans

There were no studies available.

Conclusion

In 13-week inhalation studies on rats and mice (performed within the U.S. National Toxicology Program and currently available only as abstracts plus key tables), no mortalities, no clinical abnormalities, and no gross pathological findings were observed at exposure concentrations up to and including 660 mg/m^3. In mice, transitional epithelial eosinophilic granules were observed in the urinary bladder of all exposed groups (dose-related), the toxicological significance of this finding is however unclear. In female mice, uterus atrophy was found at 82.4 mg/m^3, and atrophy of the ovary at 330 mg/m^3. In rats, a NOAEL could also not be established due to increased liver weight down to the lowest tested concentration (41.2 mg/m^3). The NOAEL for nasal lesions in rats was 82.4 mg/m^3 in males and 41.2 mg/m^3 in females, and 164.8 mg/m^3 in mice.

In a 28 day toxicity study in rats with gavage application of up to 150 mg 1,2,3,4-tetrahydronaphthalene/kg bw/day, no mortalities occurred in any group. Squatting position and closed eyes were observed in all treated groups. There was a transient decrease in absolute body weights of all treated males. Results of hematology were indicative of a hemolytic anemia in males and females of the high dose group, which was still present, though to a lesser degree, at the end of the recovery period. As a secondary reaction to the anemia, the reticulocyte counts for high dose females were increased and the extramedullary hematopoesis in the spleen of both high dose genders was enhanced. Based on the adverse effects on blood and spleen (significant at 150 mg/kg bw/day but already beginning at 50 mg/kg bw/day), the NOAEL in this study was at 15 mg/kg bw /day.

3.1.6 Mutagenicity

In vitro Studies

In an Ames test performed according to the original publication by B. Ames (1975) with *Salmonella typhimurium* TA 1535, TA 1537, TA 1538, TA 98, and TA 100, test substance concentrations of 10; 50; 100; 250; 500; 1000; 5000 µg/plate were employed in the presence and absence of Aroclor induced rat liver S9 mix. Cytotoxicity was observed at $\geq$ 50 µg/plate (-S9) and $\geq$ 500 µg/plate (+S9), respectively. At non-toxic test substance concentrations, a significant increase in mutant frequency was not observed (Hüls AG, 1988). A negative result in the Ames test (+/- Aroclor 1254 induced rat liver S9 mix) was also obtained by Florin et al. (1980) using the same strains except TA 1538 and doses of 0.03; 0.3; 3; 30 µmol/plate (ca. 4; 40; 400; 4,000 µg/plate). These authors observed cytotoxicity at >= 3 µmol/plate (ca. 400 µg/plate). The chemical was also tested negative in an Ames test performed within the frame of the U.S. National Toxicology Program (NTP, 2004 a) and in a further, poorly documented Ames test (National Cancer Institute, undated). In a mouse lymphoma test, a negative result was obtained in the absence of a metabolic activation system (dose range 35-47.5 µg/ml), while with the addition of S-9 mix the test was equivocal (dose range 10-20 µg/ml): The only cultures exhibiting a significant increase in mutant frequency had less than 10 % total growth (National Cancer Institute / Microbiological Associates, 1992).

In vivo Studies

In a micronucleus assay in NMRI mice according to OECD TG 474 (1983) performed by Hüls AG (1993), five mice per sex and test duration received one single application with 2,000 mg 1,2,3,4-tetrahydronaphthalene/kg bw in corn oil (10 ml/kg bw) by gavage. The selected dose was the maximum dose without mortalities within 48 hours. Sampling times were 24 and 48 hours after test substance administration. 1,2,3,4-Tetrahydronaphthalene treatment did not result in an increase in

the frequency of micronucleated polychromatic erythrocytes (PCE), but it significantly reduced the PCE/NCE ratio in male and female animals at both sampling times. This clearly indicates that the target organ (the bone marrow) had been reached in this test.

1,2,3,4-Tetrahydronaphthalene did not induce micronuclei in peripheral erythrocytes taken from B6C3F1 mice (10 per dose and sex) which were exposed for 13 weeks on 6 h/day, 5 days/week to concentrations of 7.5; 15; 30; 60; 120 ppm = 41.2; 82.4; 165; 330; 660 mg/m^3 (NTP, 1997 a; NTP, 2004 b).

Studies in Humans

There were no studies available.

Conclusion

1,2,3,4-Tetrahydronaphthalene was not genotoxic in bacterial systems *in vitro* (Ames test). In a Mouse Lymphoma test, results were negative and equivocal, without and with metabolic activation, respectively. *In vivo*, no mutagenic activity was detectable in two micronucleus assays on mice according to OECD TG 474 using the oral and inhalation routes of administration.

3.1.7 Carcinogenicity

1,2,3,4-Tetrahydronaphthalene is being tested in a 2 year inhalation study on B6C3F1 mice and F344 rats at concentration levels of 0, 30, 60, or 120 ppm (NTP, 2004 c).

3.1.8 Toxicity for Reproduction

Studies in Animals

Effects on Fertility

In a subchronic inhalation study, 25 male and 20 female Fischer 344 rats per dose level were exposed (whole body) to nominal 1,2,3,4-tetrahydronaphthalene concentrations of 7.5; 15; 30; 60; 120 ppm = 41.2; 82.4; 165; 330; 660 mg/m^3 = exposure levels 1; 2; 3; 4; 5 for 13 weeks on 6 h/day, 5 days/week. Rats were subdivided into groups of 5 male renal toxicity rats + 10 male and 10 female core study rats + 10 male and 10 female clinical pathology rats. General test conditions and observations are reported above in chapter 3.1.5.

In order to determine whether 1,2,3,4-tetrahydronaphthalene may be a reproductive toxicant, vaginal cytology was evaluated for 12 days during the last 2 weeks of the study in all females in the 0-, 30-, 60-, and 120-ppm groups. Epididymal sperm concentration, spermatid heads/testis, and left caudal, epididymal and testicular weights were evaluated in all males from the same groups. No indications of reproductive toxicity were reported (NTP, 1997 b).

A similar subchronic inhalation study was performed by NTP (1997 a) in B6C3F1 mice, which were exposed whole-body in groups of 10 per dose and sex to nominal 1,2,3,4-tetrahydronaphthalene concentrations of 7.5; 15; 30; 60; 120 ppm = 41.2; 82.4; 165; 330; 660 mg/m^3 = levels 1; 2; 3; 4; 5 for 13 weeks on 6 h/day, 5 days/week. General test conditions and observations are reported above in chapter 3.1.5.

In order to determine whether 1,2,3,4-tetrahydronaphthalene may be a reproductive toxicant, vaginal cytology was evaluated for 12 days during the last 2 weeks of the study on all females in

the 0-, 30-, 60-, and 120-ppm groups. Epididymal sperm concentration, spermatid heads/testis, and left caudal, epididymal & testicular weights were evaluated in all males from the same groups.

In histopathology, ovary and uterus atrophy was observed in high dose females. Incidences of ovary atrophy at minimal doses of observation and above were 4/10 (330 mg/m^3), and 8/10 (660 mg/m^3). Incidences of uterus atrophy at minimal doses of observation and above were 2/10 (82.4 mg/m^3), 2/10 (165 mg/m^3), 6/10 (330 mg/m^3), and 8/10 (660 mg/m^3). Information on severity is not reported. No other indications of reproductive toxicity were reported.

As uterus atrophy and atrophy of the ovary were found in the absence of systemic toxicity in mice an effect of the chemical on reproduction cannot be excluded, although no such effect was evident in the studies on rats. Further clarification with respect to the reproducibility and significance of these results may be expected from the ongoing carcinogenicity studies.

Developmental Toxicity

Based on the results of the 28-day study in rats (Hüls AG, 1995 a), four groups of 24 mated female Sprague-Dawley rats received 1,2,3,4-tetrahydronaphthalene by daily oral administration (gavage) at 0 (sesame oil = control), 15, 45 and 135 mg/kg bw/day from day 6 to day 19 post-coitum inclusive. On day 20 post-coitum, the dams were sacrificed and subjected to macroscopic examination. The study was designed according to OECD TG 414 (2001) (Aventis Pharma ProTox, 2004).There was no treatment-related death in any of the dams. Clinical signs were not observed. Mean absolute and relative food consumption was distinctly to slightly decreased in high dose animals as compared to the controls, attaining statistical significance on study days 6 - 18 (absolute 6 - 9: 33 %: 9 - 13: -12 %; 13 - 16: -10 %; 16 - 18: -12 %; relative 6 - 9: -32 %; 9 - 13: -10 %; 13 - 16: -7 %; 16 - 18: -9 %). In mid dose females, mean absolute and relative food consumption was slightly to marginally lower (statistically significant) during study days 6 - 9 (absolute: -15 %; relative: -16 %) and 13 - 16 (absolute and relative: -6 %) only. The terminal body weight (gestation day 20) was decreased in a statistically significant way (-5 %) for high dose females as compared to controls. A significantly lower body weight gain was recorded for the whole treatment period (0 - 20: -15 %).

Abortions, premature delivery or total resorptions were not observed in any of the test groups, nor were there any macroscopic findings that were ascribed to treatment with the test item. No treatment related effects were observed on pre- or post-implantation loss, fetal weight or sex-ratio. There was no statistically significant difference in the mean crown-rump length for either male or female fetuses in any group. However, evaluation of both genders together revealed a slight but statistically significant decrease of the mean crown-rump length for all high dose fetuses against the control. In addition, the mean placenta weight was slightly but statistically significant decreased in the high dose group. These findings were marginal and considered to be within the physiological range for this rat strain and age. However, a treatment-related influence on these endpoints could not be excluded.

With respect to the fetuses, no test item related external or soft tissue malformations or variations were detected.

Evaluation of skeletal defects revealed isolated findings of statistical significance for high-dose fetuses at the thoracic vertebra centra and in the rib (here also for low-dose fetuses): There was one tail aplasia in a fetus of a high dose female (1 fetus out of 152 examined, i.e. 0.7 %). This fetus also showed a large variety of other skeletal minor defects on the vertebra and skeletal retardations which were all associated with spina bifida occulta as the major defect diagnosis for this fetus. This complex finding was associated with insufficient oxygen supply of this fetus, which is known to occur incidentally during embryonal development within relatively large litters (14 fetuses in total

in this litter). In the absence of correlating findings either in other fetuses or other litters of this group, these findings were considered to be incidental.

Minor skeletal defects of statistical significance included aplasia/fused/fragmented thoracic vertrebra centra in 0 % (control), 0.6 % (low dose), 0 % (mid dose), and 2.0 % (high dose) animals. As the incidences were only slightly above inhouse control data (0 - 1.5 %) and did not follow a dose response relationship, they were considered to be incidental. Another minor defect of statistical significance was uni- or bilateral knoddy ribs in 0 % (control), 3.2 % (low dose), 0 % (mid dose), and 7.9 % (high dose) animals. As historical control data were not yet available for this endpoint and the occurrence of this effect did not follow a dose response relationship, it was considered to be incidental.

The NOAEL for maternotoxicity was 45 mg/kg bw/day and 135 mg/kg bw/day for embryonic development (Aventis Pharma ProTox, 2004).

Studies in Humans

There were no studies available.

Conclusion

No specific studies have been performed on the toxicity of 1,2,3,4-tetrahydronaphthalene to fertility. There were no indications of an adverse effect on vaginal cytology, sperm and on reproductive organs from the 13-week inhalation study on rats. In mice, no effects on vaginal cytology and sperm were noted in the 13-week inhalation study, but uterus atrophy and atrophy of the ovary were found in the absence of systemic toxicity (*cf.* repeated dose section). Therefore, an effect of the chemical on reproduction cannot fully be excluded.

1,2,3,4-tetrahydronaphthalene did not show any developmental effects in a gavage study with rats performed in accordance with OECD TG 414 (2001) up to and including the highest tested dose level of 135 mg/kg bw/day. The NOAEL for maternal toxicity was 45 mg/kg bw/day, effects at 135 mg/kg bw/day were reduced food consumption and reduced body weight gain. The NOAEL for developmental toxicity is 135 mg/kg bw/day.

3.2 Initial Assessment for Human Health

1,2,3,4-Tetrahydronaphthalene is rapidly absorbed when ingested or inhaled. The chemical is metabolized by hydroxylation at the non-aromatic portion of the molecule. The metabolites are excreted mainly as glucuronides with the urine, but elimination with the feces was also observed. Dark green colored urine, which is observed as a typical symptom in humans, indicates metabolization to a pigment.

The acute toxicity of 1,2,3,4-tetrahydronaphthalene was found to be relatively low with an oral LD_{50} of 2860 mg/kg bw (male rats), a dermal LD_{50} of 16,800 mg/kg bw (male rabbits) and no mortalities within 8 hours inhalation of a saturated atmosphere (ca. 1300 mg/m^3; male rats). In man, the chemical is known to produce headache, nausea, vomiting, lacrimation, green-gray urine, and restlessness at high concentrations.

1,2,3,4-Tetrahydronaphthalene was a moderate irritant to the skin (OECD TG 404), but not to the eye (OECD TG 405). High exposure from the gas phase may cause irritation of mucous membranes and profuse lacrimation in humans.

1,2,3,4-Tetrahydronaphthalene was not sensitizing in a guinea pig maximization test (OECD TG 406, 1981).

Repeated dose, inhalation studies:

In 13-week inhalation studies on rats and mice (performed within the U.S. National Toxicology Program and currently available only as abstracts plus key tables), no mortalities, no clinical abnormalities, and no gross pathological findings were observed at exposure concentrations up to and including 660 mg/m^3. In mice, transitional epithelial eosinophilic granules were observed in the urinary bladder of all exposed groups (dose-related), the toxicological significance of this finding is however unclear. In female mice, uterus atrophy was found at 82.4 mg/m^3, and atrophy of the ovary at 330 mg/m^3. In rats, a NOAEL could also not be established due to increased liver weight down to the lowest tested concentration (41.2 mg/m^3). The NOAEL for nasal lesions in rats was 82.4 mg/m^3 in males and 41.2 mg/m^3 in females, and 164.8 mg/m^3 in mice.

Repeated dose, oral studies:

In a 28 day toxicity study in rats with gavage application of up to 150 mg 1,2,3,4-tetrahydronaphthalene/kg bw/day, no mortalities occurred in any group. Squatting position and closed eyes were observed in all treated groups. There was a transient decrease in absolute body weights of all treated males. Results of hematology were indicative of a hemolytic anemia in males and females of the high dose group, which was still present, though to a lesser degree, at the end of the recovery period. As a secondary reaction to the anemia, the reticulocyte counts for high dose females were increased and the extramedullary hematopoesis in the spleen of both high dose genders was enhanced. Based on the adverse effects on blood and spleen (significant at 150 mg/kg bw/day, but already beginning at 50 mg/kg bw/day), the NOAEL in this study was at 15 mg/kg bw/day.

1,2,3,4-Tetrahydronaphthalene was not genotoxic in bacterial systems *in vitro* (Ames test). In a Mouse Lymphoma test, results were negative and equivocal, without and with metabolic activation, respectively. *In vivo*, no mutagenic activity was detectable in two micronucleus assays on mice according to OECD TG 474 using the oral and inhalation routes of administration.

No specific studies have been performed on the toxicity of 1,2,3,4-tetrahydronaphthalene to reproduction. There were no indications of an adverse effect on vaginal cytology, sperm and on reproductive organs from the 13-week inhalation study on rats. In mice, no effects on vaginal cytology and sperm were noted in the 13-week inhalation study, but uterus atrophy and atrophy of the ovary were found in the absence of systemic toxicity (*cf.* repeated dose section). Therefore, an effect of the chemical on reproduction cannot fully be excluded.

1,2,3,4-tetrahydronaphthalene did not show any developmental effects in a gavage study with rats performed in accordance with OECD TG 414 (2001) up to and including the highest tested dose level of 135 mg/kg bw/day. The NOAEL for maternal toxicity was 45 mg/kg bw/day, effects at 135 mg/kg bw/day were reduced food consumption and reduced body weight gain. The NOAEL for developmental toxicity was 135 mg/kg bw/day.

4 HAZARDS TO THE ENVIRONMENT

4.1 Aquatic Effects

Acute Toxicity Test Results

In a semistatic test with *Danio rerio* performed according to Directive 92/69/EEC, C.1 (1992 version), fish were exposed for 96 hours to analytical concentrations of 1.5; 2.4; 3.7; 9.1; 7.9 mg/l 1,2,3,4-tetrahydronaphthalene (geometric mean of two analyses after 0 and 24 hours; nominal: 3.5; 5.0; 7.0; 10; 14 mg/l). The LC_{50} (96 h) was determined to be 3.2 mg/l (Hüls AG, 1995 b).

The acute toxicity of 1,2,3,4-tetrahydronaphthalene to *Daphnia magna* was determined in a static test conducted according to Directive 92/69/EEC, C.2. Since the geometric mean of the analytical concentrations after 0 and 48 hours deviated by less than 20 % from the nominal concentrations, the latter were used for the evaluation. After 48 h of exposure, the EC_{50} was calculated to 9.5 mg/l (Hüls AG, 1994 a). With *Daphnia pulex*, Smith, Savino and Blouin (1988) determined a 48 hour-EC_{50} of 2.4 mg/l in a static test based on U.S. national guidelines. At least 10 individuals per replicate were exposed in a series of 5 concentrations at 20 °C without feeding during the test. The crucial parameters alkalinity (120 - 125 mg/l as $CaCO_3$), hardness (160 - 180 mg/l as $CaCO_3$) and dissolved oxygen (8 - 9 mg/l) were reported. In the brine shrimp *Artemia salina*, Price, Waggy and Conway (1974) observed a static 24 hour-EC_{50} of 78 mg/l. In the absence of a broadly agreed test protocol for marine organisms, they used a previously published method and exposed 30 - 50 individuals per test concentration at 24.5 °C in synthetic seawater to test concentrations of 10, 18, 32, 56, or 100 mg/l. As in the 2 latter tests no analytical monitoring was performed, it cannot be excluded that the test substance concentration has significantly decreased during the exposure period due to volatilization.

The growth inhibition of 1,2,3,4-tetrahydronaphthalene on the freshwater alga *Desmodesmus subspicatus* (ex: *Scenedesmus subspicatus)* was tested by Hüls AG (1994 b) according to a test procedure similar to OECD Guideline 201. The algae were exposed to 6 concentrations between 1.2 and 17 mg/l and one control. Since the analytical concentrations after 0 hours deviated by less than 20 % from the nominal concentrations and the values at 72 hours indicate stability, nominal concentrations were used for the evaluation. Based on growth rate an E_rC_{50} of 11.0 mg/l and a 72 h-E_rC_{10} of 5.3 mg/l (NOEC 3.6 mg/l) were determined. Based on biomass development an E_bC_{50} of 7.0 mg/l and a 72h-E_bC_{10} of 3.8 mg/l were determined.

All acute aquatic effects data are below the water solubility of 45 mg/l (see Table 1) except for the data for the marine invertebrate *Artemia salina*. However, for the synthetic seawater used in this test, the authors report a water solubility of 350 mg/l, the validity of which cannot be assigned due to insufficient documentation (Price, Waggy and Conway, 1974).

Chronic Toxicity Test Results

No information available.

Toxicity to Microorganisms

In a bacterial toxicity test using *Pseudomonas putida* (Hüls AG, 1994 c) a 5 h-EC_{10} of 16 mg/l was obtained. Using nominal test concentrations of 50; 75; 100 and 150 mg/l, a flat dose-response relationship was observed, and the EC_{10} as well as the EC_{50} of 402 mg/l were obtained by extrapolation. It has to be noted that all test concentrations were above the water solubility of

45 mg/l (see Table 1), but nonylphenol ethoxylated (10 EO) and propoxylated (5 PO) was added as a solubilizer. The observations of Sikkema and de Bont (1991) confirm the order of magnitude of the onset of bacteria toxicity. In their search among 32 different strains for organisms that can biodegrade 1,2,3,4-tetrahydronaphthalene, they observed that the test substance was toxic at concentrations of 14.6 mg/l and higher for all strains.

4.2 Terrestrial Effects

Several publications report effects of 1,2,3,4-tetrahydronaphthalene on various non-aquatic organisms. Though none of these studies follows an internationally recognized guideline and the validity of some studies cannot be stated due to poor documentation, these effects are considered to be noteworthy.

Acute Toxicity Test Results

The potential of 1,2,3,4-tetrahydronaphthalene to cause leaf damage in bean, citrus, cotton, maize, rape, soybeans, and tomato was investigated but insufficiently documented by Krenek, Reed and King (1987). One to two months post emergent, i.e. at the three to five leaf stage, 10; 20; 40; or 80 l/ha single doses were applied with a hand-held spinning disc applicator. Upon visual inspection by three assessors at various time intervals up to 2 months, 1,2,3,4-tetrahydronaphthalene was assigned a rating of 6.0 - 8.0 on a relative scale from 1 (least phytotoxic) to 10 (most phytotoxic).

In 3 day old female *Musca domestica* L (K1 strain), single doses of 0.0002 ml/individual applied to the ventral abdomen caused 100 % knockdown within 24 hours in at least 10 x 10 individuals (Kocher and Ascher, 1954). Downs, Stafford and Coles (2000) identified 1,2,3,4-tetrahydronaphthalene as a substance which might be useful in the treatment of head lice. Cellulose filter papers of 5 cm diameter were dipped into solutions (see below) of the test substance in isopropanol and dried. Ten live adult head lice were put on each filter paper for two hours. Mortalities were 0/80 in the control, 26/101 with 1 % 1,2,3,4-tetrahydronaphthalene solution, and 50/50 with 10 % solution. Though lack of documentation and reference substances limits the value of the latter publication, these studies may indicate that the “insecticide” use in the Swiss product register cited above is not a simple solvent use.

4.3 Other Environmental Effects

No data available.

4.4 Initial Assessment for the Environment

According to Mackay Level I model calculation, the main target compartment for 1,2,3,4-tetrahydronaphthalene will be the atmosphere (94.7 %), followed by water (2.7 %). The experimental Henry’s law constant of 138 Pa m^3/mol indicates high volatility from surface waters. With a calculated K_{oc} of 1,837 l/kg, the sorption potential to soil or sediment organic matter is expected to be high.

In the atmosphere, 1,2,3,4-tetrahydronaphthalene is removed by reaction with hydroxyl radicals with a calculated half-life of 11.2 hours based on an experimental rate constant. In water, it is not expected to hydrolyze at a significant rate under environmental conditions. Photolytic degradation in surface waters is an additional removal process of unclear significance with a half-life at least above 34 hours. 1,2,3,4-Tetrahydronaphthalene is not readily biodegradable by every inoculum, but

is degraded well by several rare microorganisms. Anaerobic degradation was also observed. A calculated bioconcentration factor of 162.4 resp. 326 indicates a bioaccumulation potential of 1,2,3,4-tetrahydronaphthalene.

The lowest valid acute test results of aquatic testing determined for fish, invertebrates, and algae were as follows:

Danio rerio:	96-h-LC_{50} = 3.2 mg/l
Daphnia magna:	48-h-EC_{50} = 9.5 mg/l
Daphnia pulex:	48-h-EC_{50} = 2.4 mg/l
Desmodesmus subspicatus:	72-h-E_rC_{50} = 11.0 mg/l; 72-h-E_bC_{50} = 7.0 mg/l

Long term aquatic toxicity data are available for one trophic level:

Desmodesmus subspicatus: 72-h E_rC_{10} = 5.3 mg/l; 72-h E_bC_{10} = 3.8 mg/l

From the lowest value among the acute values, an aquatic PNEC of 2.4 µg/l is calculated using an assessment factor of 1000 according to the EU Technical Guidance Document.

5 RECOMMENDATIONS

Environment:

The chemical is a candidate for further work.

The chemical possesses properties indicating a hazard for the environment. Based on data presented by the Sponsor company, exposure from production is low. However, environmental exposure may result from the use of 1,2,3,4-tetrahydronaphthalene as industrial solvent and from the formulation and use of products containing the substance. Therefore, an exposure assessment and, if then indicated, an environmental risk assessment is recommended.

Human Health:

The chemical is a candidate for further work.

The chemical possesses properties indicating a hazard for human health (irritant to skin and mucous membranes, repeated dose toxicity, potential effect on reproduction). Based on data presented by the Sponsor country, adequate risk management measures are being applied for occupational settings. A high potential for consumer exposure exists as a result of the use as solvent in e.g. paints, waxes, and polishes. It is therefore recommended to perform an exposure assessment and, if then indicated, a risk assessement. It is further noted that the chemical is being tested in a 2 year inhalation carcinogenicity study on mice and rats under the US National Toxicology Program.

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I U C L I D

Data Set

Existing Chemical	:	ID: 119-64-2
CAS No.	:	119-64-2
EINECS Name	:	1,2,3,4-tetrahydronaphthalene
EC No.	:	204-340-2
TSCA Name	:	Naphthalene, 1,2,3,4-tetrahydro-
Molecular Formula	:	C10H12

Producer related part

Company	:	Degussa AG
Creation date	:	14.03.2001

Substance related part

Company	:	Degussa AG
Creation date	:	14.03.2001
Status	:	
Memo	:	Submission under ICCA Initiative in 2004
Printing date	:	13.10.2004
Revision date	:	31.05.2003
Date of last update	:	20.09.2004
Number of pages	:	132
Chapter (profile)	:	Chapter: 1, 2, 3, 4, 5, 6, 7, 8, 10
Reliability (profile)	:	Reliability: without reliability, 1, 2, 3, 4
Flags (profile)	:	Flags: without flag, non confidential, SIDS

1.0.1 APPLICANT AND COMPANY INFORMATION

Type	:	cooperating company
Name	:	Degussa AG
Contact person	:	Dr. Michael Weiss, Marl
Date	:	01.03.2001
Street	:	Bennigsenplatz 1
Town	:	40474 Duesseldorf
Country	:	Germany
Phone	:	+49 2365 49-4607
Telefax	:	+49 2365 49-7275
Telex	:	
Cedex	:	
Email	:	michael.weiss@degussa.com
Homepage	:	www.degussa.com

Remark : Contact point for any correspondence relating to the submission of this data set:

Degussa AG
CF-CO-PM-Environment, Health & Safety
Dr. Michael Weiss
Bau 1137, PB 16
D-45764 Marl

Reporting History

Year	Activity	Company
1994	Reporting	Huels AG
1997	Update	Huels AG
1998	None	Creanova Spezialchemie GmbH
2000	Update	Degussa-Huels AG
2003	Update	Degussa AG

21.01.2004

1.0.2 LOCATION OF PRODUCTION SITE, IMPORTER OR FORMULATOR

Type	:	Manufacturer
Name of plant	:	Degussa AG, Herne
Street	:	Herzogstrasse 28
Town	:	44651 Herne
Country	:	Germany
Phone	:	+49 2325 68-3541
Telefax	:	+49 2325 68-3555
Telex	:	
Cedex	:	
Email	:	
Homepage	:	www.degussa.com

29.01.2004

1.0.3 IDENTITY OF RECIPIENTS

1.0.4 DETAILS ON CATEGORY/TEMPLATE

1.1.0 SUBSTANCE IDENTIFICATION

1.1.1 GENERAL SUBSTANCE INFORMATION

Purity type : typical for marketed substance
Substance type : Organic
Physical status : Liquid
Purity : = 98 - 100 % w/w
Colour : Clear
Odour : like naphthalene

Remark : Company (site): Degussa AG, Herne (Germany)
Result : Typical purity: 98.9 % (Reference BUA)
14.05.2004 (17) (40)

1.1.2 SPECTRA

Type of spectra : UV

Result : Transition lambda(max) (nm) epsilon (max)

Transition	lambda(max) (nm)	epsilon (max)
A <- X (0 - 0)	271.78	588
A <- X (max.)	264.87	597
B <- X (1st band)	214.20	4,170
C <- X	188.05	20,800
D <- X	130.66	8,970

Test condition : - Spectrometer: Jarrell-Ash one meter 15° Robin Vacuum Ultraviolet dual beam spectrophotometer
- Cell: 1 m cell; for the range 230 - 300 nm, the vapor was measured in a 10 cm heated cell of own design.
- Range: 1200 - 3000 A = 120-300 nm
- Sample preparation: outgassing of liquid sample, vaporization.

Test substance : Standard sample from A.P.I., purity 99.86 % (mole)
Reliability : (1) valid without restriction
Test procedure in accordance with generally accepted scientific standards and described in sufficient detail
14.05.2004 (66)

1.2 SYNONYMS AND TRADENAMES

1,2,3,4-Tetrahydronaphthalin (German)

5,6,7,8-Tetrahydronaphthalene

5,6,7,8-Tetrahydronaphthalin (German)

Benzocyclohexane

Tetrahydronaphthalene

14.01.2004

Tetrahydronaphthalin

Tetralin (R)

Tetranap

THN

1.3 IMPURITIES

Purity : typical for marketed substance
CAS-No : 91-17-8
EC-No : 202-046-9
EINECS-Name : Decahydronaphthalene
Molecular formula :
Value : ca. .35 % w/w

Result : Maximum content: 1.5 %
21.01.2004 (17)

Purity : typical for marketed substance
CAS-No : 91-20-3
EC-No : 202-049-5
EINECS-Name : Naphthalene
Molecular formula :
Value : ca. .36 % w/w

Result : Maximum content: 0.7 %
17.05.2004 (17)

Purity : typical for marketed substance
CAS-No : 100-41-4
EC-No : 202-849-4
EINECS-Name : Ethylbenzene
Molecular formula :
Value : ca. .06 % w/w

21.01.2004 (17)

Purity : typical for marketed substance
CAS-No : 108-88-3
EC-No : 203-625-9
EINECS-Name : Toluene
Molecular formula :
Value : ca. .02 % w/w

21.01.2004 (17)

Purity : typical for marketed substance
CAS-No : 71-43-2
EC-No : 200-753-7
EINECS-Name : benzene, pure
Molecular formula :
Value : ca. .01 % w/w

21.01.2004 (17)

Purity : typical for marketed substance
CAS-No : 7732-18-5
EC-No : 231-791-2
EINECS-Name : Water
Molecular formula :
Value : < .01 % w/w

Result : Maximum content: <0.02 %
17.05.2004 (17)

Purity : typical for marketed substance
CAS-No : 771-29-9
EC-No : 212-230-0
EINECS-Name : 1,2,3,4-tetrahydro-1-naphthyl hydroperoxide
Molecular formula :
Value : ca. .005 % w/w

Result : specification: 0.005 - 0.01 % w/w
17.05.2004 (17)

1.4 ADDITIVES

Purity type : typical for marketed substance
CAS-No :
EC-No :
EINECS-Name :
Molecular formula :
Value :
Function of additive :

Result : Normally, no additives are used.
17.05.2004 (17)

1.5 TOTAL QUANTITY

Quantity : ca. 10000 - tonnes produced in 2003

Result : Worldwide production volume.

Worldwide production capacities:
Czech Republic < 1,000 t/year (estimate)
Germany 9,000 t/year
Japan < 1,000 t/year (estimate)
U.S.A. 12,000 t/year
Production rates are known or assumed to be well below capacities. The annual quantity on the market is estimated to be below 10,000 t/year.

Flag : Critical study for SIDS endpoint

25.06.2004 (40)

Quantity : ca. 50000 - tonnes produced in 1991

Result : Worldwide production capacities:
Germany 9,000 t/year
Japan unknown
U.S.A. 45,000 t/year

25.05.2004 (17)

1.6.1 LABELLING

Labelling : as in Directive 67/548/EEC
Specific limits : No
Symbols : N, Xi, ,
Nota : , ,
R-Phrases : (19) May form explosive peroxides
(36/38) Irritating to eyes and skin
(51/53) Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment
S-Phrases : (2) Keep out of reach of children
(26) In case of contact with eyes, rinse immediately with plenty of water and seek medical advice
(28) After contact with skin, wash immediately with plenty of water
(61) Avoid release to the environment. Refer to special instructions/Safety data sets

Remark : Index No. 601-045-00-4
21.01.2004

1.6.2 CLASSIFICATION

Classified : as in Directive 67/548/EEC
Class of danger : dangerous for the environment
R-Phrases : (51/53) Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment
Specific limits : No

Classified : as in Directive 67/548/EEC
Class of danger : Irritating
R-Phrases : (36/38) Irritating to eyes and skin
Specific limits : No

Classified : as in Directive 67/548/EEC
Class of danger :
R-Phrases : (19) May form explosive peroxides
Specific limits : No

1.6.3 PACKAGING

1.7 USE PATTERN

Type of use : Type
Category : Non dispersive use

16.01.2004 (17) (130) (132) (133)

Type of use : Type
Category : Use in closed system

29.01.2004 (17) (40)

Type of use : Type
Category : Wide dispersive use

29.01.2004 (17) (40) (130) (133)

Type of use : Industrial
Category : Basic industry: basic chemicals

Result : Tetrahydronaphthalene is a component of petroleum and coal. These materials are predominantly used as fuel.
29.01.2004 (17) (40)

Type of use : Industrial
Category : Chemical industry: used in synthesis

29.01.2004 (17) (40)

Type of use : Industrial
Category : Paints, lacquers and varnishes industry

29.01.2004 (17) (40) (130) (132) (133)

Type of use : Industrial
Category : Personal and domestic use

16.01.2004 (17) (130) (133)

Type of use : Industrial
Category : other: Construction

21.01.2004 (130)

Type of use : Use
Category : Cleaning/washing agents and disinfectants

16.01.2004 (32) (130) (133)

Type of use : Use
Category : Heat transferring agents

21.01.2004 (17)

Type of use : Use
Category : Intermediates

Result : Mainly production of Carbaryl (R) via 1-naphthol and production of decahydronaphthalene
29.01.2004 (17) (40)

Type of use : Use
Category : Solvents

Result : Reference Chawla: Tetrahydronaphthalene is often mentioned as a hydrogen-carrying solvent in coal liquefaction in addition to elementary hydrogen. When used in this way, tetrahydronaphthalane is converted mainly to naphthalene but also to 1-methylnaphthalene, 1-methylindan, indan, indene, butyl benzene and dimers or C9-11 hydrocarbons. This particular use is, however, probably of minor commercial importance in comparison to other uses as solvent.

Reference Degussa: Tetrahydronaphthalene dissolves fats, oils, linoxyn, rubber, waxes, asphalt, bitumen, pitch, phenol, naphthalene, iodine, sulphur, and other materials. Because it dissolves colophony, congo copals, oil glyptals, coumarone resins and modified formaldehyde resins, it is widely used in the production of high-grade lacquers, as it imparts a good flow to the lacquers and gives high gloss, smoooth film surfaces. The very high dissolving power for organic substances of all types promotes the adhesion of the individual paint layers to one another. The substance is also used as a solvent for herbicides.

Reference Switzerland: The uses auxiliary material, ceramic colours, cleaning agent, glue, hardener, insecticide, lubricant, metal cleaning agent, paints, surface cleaning writing material, wood preservative, and similar entries may all refer to solvent use.
19.02.2004 (17) (27) (32) (39) (40) (132) (133) (136)

Type of use : Use
Category : Viscosity adjustors

Result : used in the manufacture of shoe creams and floor waxes
17.05.2004 (54)

1.7.1 DETAILED USE PATTERN

1.7.2 METHODS OF MANUFACTURE

Origin of substance : Synthesis
Type : Production

Result : Technical grade 1,2,3,4-tetrahydronaphthalene is manufactured exclusively by catalytic hydrogenation of naphthalene.
(1) Desulfurisation of crude naphthalene with a sodium suspension at 160-180°C for approximately 2 hours;
(2) Distillation in vacuo, treatment of distillation residue with water to convert excess sodium;
(3) Batchwise hydrogenation in loop reactors at about 200°C and 15-20 bar with admixture of a finely powdered nickel catalyst activated by manganese and copper;
(4) Filtration and recycling of catalyst; distillation of product not required.

21.01.2004 (17)

1.8 REGULATORY MEASURES

1.8.1 OCCUPATIONAL EXPOSURE LIMIT VALUES

Type of limit : TLV (US)
Limit value : 135 mg/m3

Remark : This TLV was proposed in the literature.
135 mg/m3 = 25 ppm.
11.08.2003 (91) (95)

Type of limit : Other
Limit value : 100 mg/m3

Country : U.S.S.R.
Result : 18 ppm = 100 mg/m3
11.08.2003 (95)

1.8.2 ACCEPTABLE RESIDUES LEVELS

1.8.3 WATER POLLUTION

Classified by : KBwS (DE)
Labelled by : KBwS (DE)
Class of danger : 2 (water polluting)

Country : Germany
Remark : No. 1194 in catalogue
21.01.2004 (18)

1.8.4 MAJOR ACCIDENT HAZARDS

Legislation : Stoerfallverordnung (DE)
Substance listed : Yes
No. in Seveso directive :

Country : Germany
Remark : Störfallverordnung 2000, Anhang I
21.01.2004 (38)

1.8.5 AIR POLLUTION

Classified by : other: Degussa AG
Labelled by : other: Degussa AG
Number : 3.1.7 (organic substances)
Class of danger : III

Country : Germany

Remark : Technische Anleitung zur Reinhaltung der Luft (TA Luft)
17.05.2004 (38)

1.8.6 LISTINGS E.G. CHEMICAL INVENTORIES

1.9.1 DEGRADATION/TRANSFORMATION PRODUCTS

1.9.2 COMPONENTS

1.10 SOURCE OF EXPOSURE

Source of exposure : Environment: exposure from production
Exposure to the : Substance

Remark : Company (site): Degussa AG, Herne (Germany)
Result : - Release to air: negligible (closed system)
- Release to water: none (no water involved in process)
- Solid wastes and treatment: Adsorption material (used during sampling), approximately 2 m3/year; incineration
17.05.2004 (40)

Source of exposure : Human: exposure by production
Exposure to the : Substance

Remark : Company (site): Degussa AG, Herne (Germany)
Result : - Activities with possible exposure: Sampling, maintenance
- Frequency and duration: Sampling daily, 5 minutes; Maintenance rare, e.g. annually, duration depends on occasion, e.g. repairing a pump
- Number of persons involved: Sampling 1; maintenance normally 1
- Protective measures (engineering): Closed system
- Protective measures (personal): Not required regularly; sampling, maintenance: gloves, safety goggles with side shields, helmet, work clothing
- Monitoring data: No recent monitoring data are available.
19.02.2004 (40)

Source of exposure : Human: indirect exposure
Exposure to the : Substance

Result : - Identification of tetrahydronaphthalene in 2 out of 6 samples, detection limit not reported
- Concentrations: 20 µg/m3; 10 µg/m3
- Additional observations: Alkanes, cycloalkanes and alykl benzenes always occurred as complex mixtures.
- Probable sources suggested by authors: Petroleum distillate fractions, e.g. as solvents for paints, wood impregnants, waxes and polishes
Test condition : - Location: Living rooms of six homes in Northern Italy
- Year (performance): 1983 and beginning of 1984
- Sampling: intermittent pumping of air through adsorption tubes filed with Tenax
- Cleanup: Thermodesorption, cryofocussing
- Analysis: GC/FID, GC/MS; identification based on retention indices and mass spectra; quantification with internal standards and reference mixtures
Reliability : (2) valid with restrictions

Study well documented, meets generally accepted scientific principles, acceptable for assessment

14.01.2004 (34) (35)

Source of exposure : Human: indirect exposure
Exposure to the : Substance

Method : Based on German VDI methods 3482, leaf 4, and 3864, leaf 1
Result : 1,2,3,4-tetrahydronaphthalene was found with 1/13 test persons (2.5 µg/m3) and 0/6 control persons. Assuming half the detection limit for findings below the detection limit, the geometric mean had decreased from 0.8 µg/m3 in the 1991 survey to 0.6 µg/m3 in 1996.
Test condition : - Location: Frankfurt/Main (Germany)
- Year (performance): 1996
- Sampling:
13 persons living next to gasoline stations plus
6 control persons
7 days continuous passive sampling
- Clean-up: elution with CS2
- Analysis: GC-FID with internal standards
- Quality control: limit of detection 1 µg/m3 for hydrocarbons
- Additional data: Comparison with results from 1991 survey
Reliability : (1) valid without restriction
Test procedure in accordance with national standard methods

17.05.2004 (63)

Source of exposure : Human: exposure of the consumer/bystander
Exposure to the : Substance

Result : Emission rates for tetrahydronaphthalene: 100 - 240 ng/kJ, approximately ca. 0.7 - 1.68 mg/h or 4.35 - 10.44 mg/kg kerosene (heat content 43.5 kJ/g)
Test condition : - Year (performance): ca. 1990
- Sampling: Unvented kerosene space heaters were operated in 27 m3 chambers with an air exchange rate of 1.1 exchanges per hour in an intermittent mode (1 hour on and 1 hour off) in order to avoid unrealistic high temperatures. Fuel consumption was about 7000 kJ/h. Five test were made with a radiant heater and two tests with a maltuned convective heater. Air samples were collected on XAD/filter samplers.
- Clean-up: Soxhlet extraction of filters and XAD resin with methylene chloride
- Analysis: GC-MS and GC-FID, calibration with internal standards (precision ca. 20 %), identification via mass spectra library
- Quality control: Two 8-hour control tests, i.e. without a heater in operation
- Additional data: From the concentrations, the air exchange and the chamber volume, the mass flow of pollutants in relation to the energy of the fuel consumed can be calculated. The analysis is called semiquantitative with an accuracy within a factor of 3-4 and a precision on the order of 30 %.
Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

21.07.2004 (139)

Source of exposure : other: Occurrence in petroleum
Exposure to the : Substance

Result : 1,2,3,4-Tetrahydronaphthalene was isolated and identified by comparison with a synthetic sample (Eastman). Its concentration in the "kerosene fraction" was 0.27 +/- 0.03 %.
Test condition : (1) From a petroleum sample, the fraction boiling between 114 and 144 degree C at 56.8 Torr (75.7 hPa) was isolated ("kerosene fraction").

(2) This fraction was further separated by distillation, azeotropic distillation, and crystallization, to obtain pure substances.

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

21.01.2004 (97)

Source of exposure : other: Occurrence in petroleum
Exposure to the : Substance

Result : 1,2,3,4-Tetrahydronaphthalene gave a common peak together with an isoalkane and methyldecahydronaphthalene. The percentage of this peak in the four samples was:
(1) 0.136 %; (2) 0.113 %; (3) 0.082 %; (4) 0.077 %.

Test condition : Crude oil samples were analyzed directly (i.e. without fractionation) by GC/MS and GC/FID.

Test substance : Australian crude oil samples:
(1) Alton A, Bowen-Surat Basin, Queensland
(2) Alton B, Bowen-Surat Basin, Queensland
(3) Tirrawarra, Cooper Basin, South Australia
(4) Moorari, Cooper Basin, South australia

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

06.10.2003 (144)

Source of exposure : other: Occurrence in gasoline
Exposure to the : Substance

Method : Gas chromatography, effluent split:
(1) FID
(2) FID with mercuric perchlorate adsorption for removal of olefins and aromatics
(3) Time-of-flight-mass spectrometry; spiking with hydrocarbon standards where available

Result : Concentration of 1,2,3,4-tetrahydronaphthalene in
(1) Premium-grade gasoline: 0.02 %
(2) Regular-grade gasoline: 0.14 %
(3) Representative 1965 U.S. gasoline blend: 0.01 %

Test substance : Three gasoline samples were analyzed.

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

15.08.2003 (118)

Source of exposure : other: Occurrence in liquid fuels and in heating oil
Exposure to the : Substance

Method : Analyses in three different laboratories were performed:
Lab 1. Two-dimensional GC coupled to a FID-detector
Lab 2. One-dimensional GC coupled to a MS-detector
Lab 3. Column-chromatographic separation into fractions followed by GC-MS.

Result : Gasoline, regular: 0.2 - 0.3 g/kg
Gasoline, super: < 0.1 - 0.1 g/kg
Gasoline, super plus: < 0.1 g/kg
Diesel fuel: 1.5 - 2.63 g/kg
Jet A1 fuel: 2.5 - 4.1 g/kg
Heating oil, light: 0.8 - 1.0 g/kg

Test substance : Representative mixtures for each type of product from different refineries in Germany.

The proportions corresponded to the market shares of the refineries. Samples of winter time product (December 2001) and transition time product (February 2002) were combined, leading to a total of 12 samples: 6 types of products x 2 seasons.

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment. Restriction: only short description of the analytical methods employed

28.05.2004 (44)

Source of exposure : other: Occurrence in products of coal coking
Exposure to the : Substance

Result : - Fractions obtained:
15.6 g water
95 l gas
180 g tar
1508.8 g coke
- Concentration of 1,2,3,4-Tetrahydronaphthalene:
0.07 % (700 mg/kg) in the tar fraction
700 mg/kg tar x 180 g tar / 2000 g coal = 63 mg/kg coal
- Consideration of possible chemical reactions
1,2,3,4-Tetrahydronaphthalene may be formed but not significantly decomposed under the test conditions. Thus 63 mg/kg coal may be considered as a maximum.

Test condition : - Test substance: 2000 g German mineral coal (1800 g water- and ashfree)
- Processing: Low-temperature carbonization (200-500 degree C; heating rates: up to 200 degree C: 5 degree/min, 200-500 degree C: 0.5 degree/min) leading to fractionation
- Analysis: Gas chromatography; no details on identification

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

17.05.2004 (113)

Source of exposure : other: Occurrence in coal
Exposure to the : Substance

Result : 1,2,3,4-Tetrahydronaphthalene was identified, not quantified.

Test condition : - Test Substance: Coal from Homestead (Kentucky, USA)
- Processing: Grinding, Soxhlet extraction with benzene, removal of solvent by vacuum stripping, refluxing with cyclohexane, phase separation, fractionation by clay-gel percolation
- Analysis: GC/FID under various conditions; GC-MS; identification by comparison of MS and retention indices

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

06.10.2003 (143)

Source of exposure : other: Occupational exposure from processing of thermoplastics
Exposure to the : Substance

Result : Tetrahydronaphthalene was found in two processes:
- An unidentified isomer in 2/4 samples from process 1) at 245 °C melt temperature; adsorbent: Tenax; concentrations: below 0.01 mg/m3. Background and operator samples were positive, nearby and purging samples were negative, indicating that the origin of the finding may have had a different source.
- 1,2,3,4-isomer in 1/5 samples from process 7) at 276 °C melt temperature; adsorbend: Tenax; concentration: 0.13 mg/m3. The positive

sample was a background sample, indicating that the origin of the finding may have had a different source.

Test condition : - Location: UK Thermoplastics processing industry
- Year (performance): probably about 1992-1994
- Sampling: 11 different thermoplastic-process combinations were evaluated:
1) Acrylonitrile-butadiene-styrene, injection moulding
2) High impact polystyrene, injection moulding
3) High impact polystyrene, sheet extrusion
4) High density polyethylene, blow moulding
5) Low density polyethylene, blown film
6) Low density polyethylene, blend with linear low density polyethylene, blown film
7) Nylon 6, extrusion
8) Polypropylene, tape extrusion
9) PVC (rigid), injection moulding
10) PVC (plasticised), cable extrusion
11) SAN, injection moulding
Adsorption tubes with Tenax, Chromosorb, Poropak, or charcoal, static (height 1.5 m) or operator-worn; sample size 10-15 l
- Clean-up: Thermodesorption (250 °C) / cryofocussing (liquid CO2); for charcoal: elution with CS2
- Analysis: GC-MS with MS library search; decane as standard for quantification
- Quality control: no data;
detection limit: approximately 0.1 µg/m3

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

17.05.2004 (51)

Source of exposure : other: Occupational exposure from processing of rubber products
Exposure to the : Substance

Result : - Detection of tetrahydronaphthalene: Only in location (B1), i.e. in the vulcanization area of a tire retreading factory.
- Concentration range: 0-1 µg/m3
- Probable source: Naphthenic oil (which was also used in the other locations)

Test condition : - Location:
(A) Vulcanization area of a shoe-sole factory
(B1) Vulcanization area of a tire retreading factory
(B2) Extrusion area of the same tire retreading factory
(C) Extrusion area of an electrical cables insulation plant
- Year (performance): 1982
- Sampling: Personal samplers with activated charcoal tubes;
sampling time 30 minutes;
4 parallel sampling tubes with 1 l/min each per sample
No. of samples: (A) 13; (B1) 6; (B2) 6; (C) 10
- Cleanup: elution with trichlorofluoromethane, concentration
- Analysis: GC/MS, quantification with internal standard
- Quality control: standard mixture control

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

17.05.2004 (31)

Source of exposure : other: Occurrence in plants, natural source
Exposure to the : Substance

Result : 1,2,3,4-tetrahydronaphthalene was found only in S. raeseri subsp. raeseri.

Its concentration was 0.43%. The yield of essential oil from S. raeseri subsp. raeseri was 0.12% v/w. Thus the total concentration is approximately 5.2 mg/kg.

Test condition : - Location: Various places in Greece
- Year (performance): 1999
- Sampling: Aerial parts (herba in flowering stage) of Sideritis species (often used as herbal tea and in traditional medicine) were collected in July:
S. clandestina subsp. clandestina from Mt. Parnon
S. raeseri subsp. raeseri from Mt. Agrafa
S. raeseri subsp. attica from Mt. Parnis
S. sipylea from Lesvos island
S. syriaca subsp. syriaca from Mt. Idi (Crete)
- Clean-up: Steam distillation for 3 hours, drying (Na2SO4)
- Analysis: GC-MS, comparison with spectra libraries
- Quality control: comparison with published retention indices

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

19.12.2003 (2)

Source of exposure : other: Occurrence in plants, natural source
Exposure to the : Substance

Result : 1,2,3,4-Tetrahydronaphthalene was identified in the intermediate ripeness class. The peak area of 3.1% cannot be converted into a value for the concentration in the fruit.

Test condition : - Location: Moncada (Valencia, spain)
- Year (performance): 1992
- Sampling: Collection of peaches during June and July; classification according to ripeness (green / intermediate / ripe)
- Clean-up: Circulation of air through: glass bottle with sample followed by 20% potassium permanganate, charcoal, and Porapak Q; elution with dichloromethane followed by pentane (soxhlet, 12 hours)
- Analysis: GC/FID; GC/MS
- Quality control: Comparison of Kovats index with that of standard compounds
- Additional data: Electroantennogram studies see chapter 4.9

Reliability : (1) valid without restriction
Test procedure in accordance with generally accepted scientific standards and described in sufficient detail

05.01.2004 (62)

Source of exposure : other: Occurrence in plants, natural source
Exposure to the : Substance

Result : The total yield (92.9 vs 11.9 mg/kg) and the degree of thermal degradation were higher with method (2). The concentration of tetrahydronaphthalene was 21 µg/kg with method (1) and < 5 µg/kg with method (2).

Test condition : - Sampling: 15 commercial samples of Sen-cha green tea (Camellia sinensis L. var. Yabukita)
- Clean-up: Two different methods were used:
(1) Adsorptive Column Method: 15 batches of 50 g each were treated as follows: Addition of 1.0 l deionized water of 80 °C, standing for 3 minutes, filtration through coarse filter paper, immediate cooling to about 40 °C, passage through a column packed with Porapak Q. Elution with 80 ml of 1:1 (v/v) diethyl ether / isopentane, drying with sodium sulfate, addition of internal standard, concentration, pooling of the 15 concentrates, further concentration.
(2) Simultaneous Distillation and Extraction (SDE) Method: 200 g of a mixture of the 15 samples, 1.0 l of deionized water and 70 ml of diethyl

ether were united in a 2 l round-bottom flask. Volatiles were separated under 150 mm Hg (200 hPa) pressure at 70 °C for 50 minutes and condensed at -5 °C. Addition of internal standard, drying with sodium sulfate, and concentration followed.
- Analysis: GC-FID for quantification; GC-MS with spectra search for identification
- Quality control: comparison of retention indices

Reliability : (2) valid with restrictions
Test procedure in accordance with generally accepted scientific standards and described in sufficient detail

17.05.2004 (123)

Source of exposure : other: Occurrence in food, natural source
Exposure to the : Substance

Result : Concentration of tetrahydronaphthalene (unit not reported)
Year: 1995 / 1997
Upper part: 6.0 / 5.5
Lower part: 1.6 / 4.5

Test condition : - Location: Berici Hills, Italy
- Year (performance): 1995 / 1997
- Sampling: Two separate masses of grapes were micro-vinified. They originated from the upper and lower parts of a vineyard, respectively, with a difference in level of about 35 meters.
- Analysis: No data

Reliability : (4) not assignable
Documentation insufficient for assessment

23.12.2003 (137)

Source of exposure : other: Occurrence in food, natural source
Exposure to the : Substance

Result : 86.2 ppb (ug/kg) 1,2,3,4-tetrahydronaphthalene were found (identification by mass spectrometry) by soxhlet extraction under reduced pressure.

Test condition : - Sample: Coconut (Cocos nucifera) fruit pulp
- Cleanup:
Mixing with water;
purging with inert gas (helium) at 50 degree C for 8 hours
(direct or preceded by water steam distillation)
or alternatively reduced pressure Soxhlet extraction;
sorption to Tenax TA;
thermodesorption and cryofocussing (280 / -130 degree C)
- Analysis: GC / MS or FTIR, calibration curve, internal standard; detection limit: 0.1 ppb
- Identification: Gas chromatography / mass spectrometry plus gas chromatography / Fourier transform IR spectrometry

Reliability : (1) valid without restriction
Test procedure in accordance with generally accepted scientific standards and described in sufficient detail

17.05.2004 (55)

Source of exposure : other: Occurrence in food, natural source
Exposure to the : Substance

Result : 93 components were identified. 1,2,3,4-Tetrahydronaphthalene was among the 36 compounds identified in shoyu for the first time. Its concentration is not reported.

Test condition : - Sampling: Commercially available genuine fermented shoyu (soy sauce), pH 4.8
- Clean-up:
Four fractions by distillation under reduced pressure followed by

extraction with CH2Cl2 at pH 11.7, then pH 5.3, then pH 3.2; drying over Na2SO4; concentration
Ten fractions by direct extraction with CH2Cl2 followed by complex sequence of further extractions and re-extractions at pH values between 2.0 and 12.5; drying over Na2SO4; concentration
Further enrichment of minor components by GC / thermal conductivity detection (removal of major components)
- Analysis: GC-MS
- Quality control: comparison of retention times and mass spectra with those of authentic samples

Reliability : (1) valid without restriction
Test procedure in accordance with generally accepted scientific standards and described in sufficient detail

12.08.2003 (112)

Source of exposure : other: Occurrence in food, natural source
Exposure to the : Substance

Result : - Identification: Detected in soy products the first time.
- Quantification: The relative peak area was 0.20 %.
- Origin: Probably from thermal degradation of carotenoids during extrusion (= texturisation).

Test condition : - Sample: Commercially produced textured soy protein (TSP)
- Blank control: Distilled water
- Cleanup: Mixing with water, extraction, concentration in vacuo
- Analysis: Gas chromatography / flame ionization detection
- Identification: Gas chromatography / mass spectrometry plus gas chromatography / microwave plasma detection

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

24.07.2003 (4)

Source of exposure : other: Occurrence in food, natural source
Exposure to the : Substance

Result : 1,2,3,4-tetrahydronaphthalene was identified as a trace component in honey from Eucalyptus melliodora. Hydrocarbon concentrations in all of the other 6 honey samples were generally much lower, the hydrocarbon composition being similar.

Test condition : - Sample: 7 commercial unifloral Australian honeys
- Blank control: Solvent
- Cleanup: Extraction with methylene chloride, concentration
- Analysis: GC / MS / Computer, internal standard
- Identification: Computer MS library search / compilations of MS data / retention data (where available)

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles; restriction: identification of hydrocarbons not confirmed by retention data.

24.07.2003 (56)

Source of exposure : other: Occurrence in food, natural source
Exposure to the : Substance

Result : 1,2,3,4-tetrahydronaphthtalene was tentatively identified. Its concentration in the headspace sample was 0.04 %.

Test condition : - Sample: cured Rooibos tea (Aspalathus linearis) from producer
- Cleanup:
(1) steam distillation / continuous extraction with heptane at 40 Torr for 3 x 3 hours; drying, filtration, solvent removal in vacuo
(2) transport from headspace tube to Tenax cartridge with helium stream;

cryofocussing (210 degree C / liquid nitrogen)
- Analysis: Gas chromatography / flame ionization detection
- Identification: Gas chromatography / mass spectrometry / comparison with data of authentic samples

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

17.05.2004 (59)

Source of exposure : other: Occurrence in food, natural source
Exposure to the : Substance

Result : 1,2,3,4-tetrahydronaphthtalene was one among 80 substances identified for the first time in raw coffee.

Test condition : - Sample: freshly ground coffee (roasted or raw)
- Cleanup: Transport with helium flow to Tenax cartridge, cryofocussing (150 / -60 degree C)
- Analysis: Gas chromatography / flame ionization detection or sulfur compound detector
- Identification: Gas chromatography / mass spectrometry

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

24.07.2003 (58)

Source of exposure : other: Occurrence in food, natural source
Exposure to the : Substance

Result : 1,2,3,4-tetrahydronaphthalene was identified (not quantified) tentatively by mass spectra match only. Its odor is characterised as "pine oil and bug-like".

Test condition : - Sampling: Spiny lobster (Panulirus argus) tail meat from the Bahamas Department of Fisheries, Nassau, frozen within several hours following collection until analysis
- Clean-up: thawing at 4 °C; steaming to 80 °C; cooling on ice; cutting into small pieces of ca. 0.5 ml;
further (1): addition of 1.5 l water plus internal standard to 1 kg sample; extraction with 75 ml dichloromethane for 4 hours at 52-53 °C; concentration of extract; drying
further (2): purge & trap of 130 g sample plus internal standard at 60 °C with helium to tenax trap; elution with diethyl ether; drying and concentration
- Analysis: GC-MS / GC-olfactometry / GC-Fourier transform IR
- Quality control: Tentative identification by either match of mass spectra or match of retention index plus odor properties with authentic standards

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

19.12.2003 (22)

Source of exposure : other: Occurrence in food, natural source
Exposure to the : Substance

Result : 1,2,3,4-tetrahydronaphthalene was found in the volatiles fraction at a concentration of 0.45% FID area = 13.5 µg/kg raw beef. Tentative identification is based on mass spectra match on two spectrometers. The probability of formation by thermal degradation of other substances is low in view of the mild temperature conditions with the volatiles fraction.

Test condition : - Sampling: 15 g of raw ground beef, addition of 10 mg/kg phenylheptane as internal standard
- Clean-up: Continuous supercritical carbon dioxide extraction at 35 °C and

41.4 MPa with approximately 150 g of CO2; flow through valve at 50 °C with short contact time; collection of volatiles (35 °C) on Tenax TA adsorbent at normal pressure (i.e. reduction to 1 atm = 0.101 MPa).
- Analysis:
Volatile fraction: Thermodesorption in injector port of gas chromatograph at 200 °C; GC-MS / GC-FID analysis
Condensed fraction (primarily fat): Dissolved in chloroform; transferred to headspace vials; evaporation of chloroform; heating at 150 °C for 2 h; GC-MS / GC-FID analysis of headspace
Identification: Comparison of retention times and / or mass spectra with those of standards compounds
- Quality control: analysis of clean Tenax as control; duplicate analyses

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

17.05.2004 (86)

Source of exposure : other: Occurrence in tobacco smoke
Exposure to the : Substance

Result : 1,2,3,4-Tetrahydronaphthtalene was identified in cigarette smoke for the first time.
Its content in the 11 g condensate was approximately 600 ppm (= 6.6 mg in 300 cigarettes = 22 µg/cigarette = 18.5 µg/g tobacco).

Test condition : - Sampling: 300 commercial non-filter cigarettes (1.19 g tobacco/cigarette) were smoked by a machine under standard conditions (1 breath of 2 sec duration and 35 ml volume/min, down to 23 mm length, 65 % relative air humidity). Breath was condensed at -78 degree C.
- Clean-up: solution in equal volume of hexane, fractionation on silica gel column with solvents of increasing polarity
- Analysis: GC-FID/MS
- Quality control: no data

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

17.05.2004 (105)

Source of exposure : other: Formation in heating of wood
Exposure to the : Substance

Result : 1,2,3,4-tetrahydronaphthalene was found in the tar fraction. Results of two individual analyses are reported:
- 0.36 mg/g tar = 28 µg/g wood; tar yield = 7.7 % w/w (fluidized-bed gasifier, alder sawdust)
- 0.88 mg/g tar = 28 µg/g wood; tar yield = 3.2 % w/w (downdraft gasifier, poplar chips)
1,2,3,4-tetrahydronaphthalene and tar yields are based on dry wood weight.

Test condition : The performance of biomass gasifiers was tested.
A) Downdraft gasifier:
- Feed type: poplar chips (Populus tremuloides)
- Feed moisture: 10.5 % wet
- Temperatures: 680 °C above grate, 550 °C below grate
B) Fluidized-bed gasifier:
- Feed type: alder sawdust (Alnus rubra)
- Feed moisture: 27.67 % wet
- Temperatures: 785 °C (bed), 601 °C (sample location)
Analyses:
- The following fractions obtained were analysed:
producer gas, particulates, bottom char, cyclone rejects, condensate, tar.

Conclusion : 1,2,3,4-tetrahydronaphthalene is either a component or, more

probably, a thermal decomposition product of wood.

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

17.05.2004 (48)

Source of exposure : other: Formation in heating of wood
Exposure to the : Substance

Result : SOXHLET EXTRACTION:
- Yield of acetone extract: 1.59 % (spruce), 2.54 % (beech) (based on dry weight)
- 1,2,3,4-tetrahydronaphthalene: not detected
SUPERCRITICAL GAS EXTRACTION:
- Stability: Yields (based on dry weight) of 21.45 % (spruce) and 34.52 % (beech) gaseous compounds indicated significant decomposition during extraction.
- Yield of acetone extract: 6.78 % (spruce), 9.55 % (beech) (based on dry weight)
- 1,2,3,4-tetrahydronaphthalene: constituted 56.92 % of the volatile fraction from spruce wood; 0.0545 % yield of volatiles based on dry wood corresponds to 0.031 % 1,2,3,4-tetrahydronaphthalene; results for beech are not reported.

Test condition : - Sampling: Samples of wood were taken from trees 35-55 years old in Turkey: Oriental spruce (Picea orientalis) and Oriental beech (Fagus orientalis)
- Clean-up: Directly after sampling, discs were cut, chipped, dried with a stream of cold air and ground to a size of 40-60 mesh. Further steps were
(a) soxhlet extraction with acetone for 18 hours and fractionation including water steam distillation and elution on a neutral alumina column
(b) supercritical-gas extraction by actone for 30 minutes at 240 degree C and 5-6.5 MPa followed by fractionation as above
- Analysis: GC/MS and GC/FID with two different columns
- Quality control: no data

Conclusion : 1,2,3,4-tetrahydronaphthalene is formed by thermal decomposition of wood during supercritical gas extraction.

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

22.06.2004 (138)

Source of exposure : other: Formation in heating of potato starch
Exposure to the : Substance

Result : Concentration of 1,2,3,4-tetrahydronaphthalene:
- 1.01 % in volatiles from starch alone
- 4.44 % in volatiles from starch with glycine
- not detected in solid residues from both experiments

Test condition : - Sampling: 15 g potato starch alone or mixed with 7.5 g glycine in an Erlenmeyer flask, heating with a Bunsen burner at 290 degree C for 40 minutes, transport of volatile substances in a nitrogen stream to a glass tube trap packed with Porapak Q.
- Clean-up: Removal of water from the Porapak Q trap, heating the trap at 100 degree C for 10 min, cryofocussing of volatiles at -78 degree C
- Analysis: GC/MS, GC/FID
- Quality control: Comparison of mass spectra and Kovats retention indices to those of authentic compounds
- Additional data: The solid residue in the flask was also extracted and analyzed.

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles,

acceptable for assessment. Restriction: Resulting concentrations are not related to raw material but only to a fraction.

18.05.2004 (140)

Source of exposure : other: Occurrence in foundry wastes
Exposure to the : Substance

Result : 1,2,3,4-tetrahydronaphthtalene was tentatively identified in waste core butts from a core binder system based on core oil and green sand. It was found in the volatile fraction as well as among the semi-volatile substances (base/neutral). Its concentration in the sample was approximately 40 ug/kg. It was not detected in samples from the eight other core binder systems investigated.

Test condition : - Sample: samples of nine core binder systems from the metalcasting industry
- Cleanup:
(a) for volatiles: leaching with water, concentration by purge and trap, or
(B) for semi-volatiles: leaching with water, filtration, extraction with methylene chloride,
- Analysis: Gas chromatography / mass spectrometry with internal standards
- Identification: Head space gas chromatography / mass spectrometry / spectra library; GC/FID with authentic standard where available

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

24.07.2003 (60)

1.11 ADDITIONAL REMARKS

1.12 LAST LITERATURE SEARCH

Type of search : External
Chapters covered : 3, 4, 5
Date of search : 17.02.2004

18.05.2004

1.13 REVIEWS

2.1 MELTING POINT

Value : = -35.8 °C
Decomposition : no, at °C
Sublimation : No
Method : other: experimental determination using published method followed by extrapolation to zero impurity
Year : 1941
GLP : No
Test substance : other TS: 1,2,3,4-tetrahydronaphthalene of Eastman's or isolated from petroleum, further purified by five crystallizations followed by distillation under reduced pressure

Result : -36.22 +/- 0.01 °C (isolated from petroleum and purified)
-35.79 +/- 0.03 °C (same material extrapolated to zero impurity)
-35.97 +/- 0.01 °C (commercial and purified)
-35.80 +/- 0.02 °C (same material extrapolated to zero impurity)
Second value cited by Thiessen
Fourth value = key study
Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment
Flag : Critical study for SIDS endpoint
16.09.2004 (97) (136)

Value : = -35.7 - -35.8 °C
Decomposition : no, at °C
Sublimation : no
Method : other: no data
Year : 1978
GLP : no
Test substance : no data

Result : -35.749 +/- 0.01 degree C
Reliability : (2) valid with restrictions
Data from handbook or collection of data
16.09.2004 (54) (91)

Value : = -35 °C
Decomposition : no, at °C
Sublimation : no
Method : other: no data
Year :
GLP : no
Test substance : no data

Reliability : (2) valid with restrictions
Data from handbook or collection of data
16.09.2004 (32) (116) (131)

2.2 BOILING POINT

Value : = 207.6 °C at 1013.25 hPa
Decomposition : no
Method : other: determination with the apparatus of C.B. Willingham and F.D. Rossini followed by extrapolation to zero impurity
Year : 1941

GLP : no
Test substance : other TS: 1,2,3,4-tetrahydronaphthalene of Eastman's, further purified by five crystallizations followed by distillation under reduced pressure

Result : 207.57 +/- 0.10 degree C
Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment
Flag : Critical study for SIDS endpoint
16.09.2004 (97) (136)

Value : = 207.6 °C at 1013.25 hPa
Decomposition : no
Method : other: no data
Year : 1978
GLP : no
Test substance : no data

Result : 207.62 +/- 0.02 degree C
Reliability : (2) valid with restrictions
Data from handbook or collection of data
16.09.2004 (54) (91)

Value : = 207.3 °C at 1013 hPa
Decomposition : no
Method : other: no data
Year :
GLP : no
Test substance : no data

Reliability : (2) valid with restrictions
Data from handbook or collection of data
16.09.2004 (32)

Value : = 207.2 °C at 1013 hPa
Decomposition :
Method : other: no data
Year :
GLP : no data
Test substance : no data

Reliability : (2) valid with restrictions
Data from handbook or collection of data
16.09.2004 (100) (131)

2.3 DENSITY

Type : density
Value : = .9702 g/cm³ at 20 °C
Method : other: Capacity and Density Section of the U.S. National Bureau of Standards (1941), followed by extrapolation to zero impurity
Year : 1941
GLP : no
Test substance : other TS: 1,2,3,4-tetrahydronaphthalene of Eastman's, further purified by five crystallizations followed by distillation under reduced pressure

Result : 0.9702 +/- 0.0001 g/cm3 (experimental)
0.9702 +/- 0.0002 g/cm3 (zero impurity)

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment
Flag : Critical study for SIDS endpoint
16.09.2004 (97) (136)

Type : density
Value : = .9696 g/cm³ at 20 °C
Method : other: no data
Year :
GLP : no
Test substance : no data

Result : 0.9729 g/cm3 reported for 15.56°C (60°F)
Reliability : (2) valid with restrictions
Data from handbook or collection of data
16.09.2004 (91)

Type : density
Value : = .9702 - .9729 g/cm³ at 20 °C
Method : other: no data
Year :
GLP : no
Test substance : no data

Reliability : (2) valid with restrictions
Data from handbook or collection of data
11.08.2003 (32) (100)

Type : density
Value : = .971 g/cm³ at 20 °C
Method : other: no data
Year :
GLP : no
Test substance : no data

Reliability : (2) valid with restrictions
Data from handbook or collection of data
02.10.2003 (131)

Type : density
Value : = .9659 g/cm³ at 25 °C
Method : other: no data
Year : 1978
GLP : no
Test substance : no data

Reliability : (2) valid with restrictions
Data from handbook or collection of data
11.08.2003 (54) (91)

Type : density
Value : = .9662 g/cm³ at 25 °C
Method : other: Capacity and Density Section of the U.S. National Bureau of Standards (1941), followed by extrapolation to zero impurity
Year : 1941
GLP : no
Test substance : other TS: 1,2,3,4-tetrahydronaphthalene of Eastman's, further purified by five crystallizations followed by distillation under reduced pressure

Result : 0.9662 +/- 0.0001 g/cm3 (experimental)
0.9662 +/- 0.0002 g/cm3 (zero impurity)
Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment
16.09.2004 (97)

2.3.1 GRANULOMETRY

2.4 VAPOUR PRESSURE

Value : = .34 hPa at 20 °C
Decomposition :
Method : other (measured): no data
Year :
GLP : no
Test substance : no data

Result : reported as 3.4 x 10-4 bar.
Some other vapor pressures reported (also converted from bar):
0.062 hPa at 0°C
0.15 hPa at 10°C
0.50 hPa at 25°C
0.72 hPa at 30°C
2.7 hPa at 50°C
8.3 hPa at 70°C
34.2 hPa at 100°C
289.7 hPa at 160°C
846.2 hPa at 200°C
Reliability : (2) valid with restrictions
Data from handbook or collection of data
Flag : Critical study for SIDS endpoint
18.05.2004 (91)

Value : = .2 hPa at 20 °C
Decomposition : no
Method : other (measured): static
Year : 1985
GLP : no
Test substance : other TS: Aldrich Chemical, purity 99 %

Remark : Details reported only by Burris and MacIntyre
Result : 0.15 Torr = 19.99 Pa
Test condition : Temperature: 20.00 +/- 0.03 degree C
Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment
(19) (131)

Value : = .24 hPa at 20 °C
Decomposition : no
Method : other (measured): no data
Year :
GLP : no
Test substance : no data

Result : Reported as 0.18 mm Hg. Further data:

1 mm Hg (1.33 hPa) at 38°C,
2 mm Hg (2.67 hPa) at 50°C,
25 mm Hg (33.3 hPa) at 100°C

Reliability : (2) valid with restrictions
Data from handbook or collection of data

14.08.2003 (116)

Value : = .266 hPa at 20 °C
Decomposition : no
Method : other (calculated): Extrapolation from measured data
Year : 1937
GLP : no
Test substance : other TS: 1,2,3,4-Tetrahydronaphthalene, no further data

Result : 39.3 degree C: 0.067 kPa
40.1 degree C: 0.080 kPa
40.8 degree C: 0.093 kPa
41.8 degree C: 0.093 kPa
46.6 degree C: 0.227 kPa
48.9 degree C: 0.253 kPa
49.4 degree C: 0.253 kPa
54.0 degree C: 0.293 kPa
74.4 degree C: 0.933 kPa
75.1 degree C: 0.947 kPa
75.5 degree C: 0.960 kPa
101.1 degree C: 3.040 kPa
126.6 degree C: 9.039 kPa
148.6 degree C: 19.625 kPa
Fitted Antoine equation (T in degree C, VP in kPa):
log (VP) = 6.61761 - 1956.133 / (T + 218.774)
extrapolated value at 20 degree C = 0.0266 kPa

Reliability : (2) valid with restrictions
Data from handbook or collection of data

21.07.2004 (53)

Value : = .46 hPa at 20 °C
Decomposition : no
Method : other (calculated): Extrapolation from measured data
Year : 1983
GLP : no
Test substance : other TS: 1,2,3,4-Tetrahydronaphthalene, no further data

Result : Extrapolated from the experimentally determined vapour pressure curve in the source referenced:
207.2 degree C: 1013.25 hPa (760 Torr)
181.8 degree C: 533.3 hPa (400 Torr)
157.2 degree C: 266.6 hPa (200 Torr)
135.3 degree C: 133.3 hPa (100 Torr)
121.3 degree C: 80.0 hPa (60 Torr)
110.4 degree C: 53.3 hPa (40 Torr)
93.8 degree C: 26.7 hPa (20 Torr)
79.0 degree C: 13.3 hPa (10 Torr)
65.3 degree C: 6.67 hPa (5 Torr)
38.0 degree C: 1.33 hPa (1 Torr)
log (VP) = -2538 * (1/T) + 8.3227 (T in K, VP in hPa)
correlation coefficient: -0.9997

Reliability : (2) valid with restrictions
Data from handbook or collection of data

18.05.2004 (100)

Value : = .583 hPa at 25 °C

Decomposition	:	no
Method	:	other (measured): gas saturation technique
Year	:	1983
GLP	:	no
Test substance	:	other TS: tetrahydronaphthalene obtained from Fluka AG, purity > 97%
Result	:	49.7 Pa at 20 cm3/min flow rate 67.7 Pa at 100 cm3/min flow rate 57.6 Pa at 180 cm3/min flow rate Mean = 58.3 +/- 9.0 Pa
Test condition	:	(1) A well controlled quanity of nitrogen was passed through a saturator column with the test substance and then through granular charcoal; (2) Desorption with carbon disulfide (100 % desorption efficiency), GC-FID analysis; (3) Analysis of standards sorbed to carbon disulfide; (4) Determination at three flow rates in order to detect non-saturation
Reliability	:	(2) valid with restrictions Study well documented, meets generally accepted scientific principles, acceptable for assessment

26.01.2004 (15)

2.5 PARTITION COEFFICIENT

Partition coefficient	:	octanol-water
Log pow	:	= 3.78 at 23 °C
pH value	:	
Method	:	OECD Guide-line 107 "Partition Coefficient (n-octanol/water), Flask-shaking Method"
Year	:	1988
GLP	:	no
Test substance	:	other TS: Hüls AG. Purity >= 98.0 %
Reliability	:	(2) valid with restrictions Guideline study without detailed documentation
Flag	:	Critical study for SIDS endpoint

15.09.2004 (73)

Partition coefficient	:	octanol-water
Log pow	:	= 3.45 at °C
pH value	:	
Method	:	other (measured): no data
Year	:	
GLP	:	no data
Test substance	:	no data
Reliability	:	(2) valid with restrictions Data from handbook or collection of data

11.08.2003 (93)

Partition coefficient	:	octanol-water
Log pow	:	= 3.49 at °C
pH value	:	
Method	:	other (measured): Hansch C et al. (1995), cited in SRC Kowwin v1.66 Computer Program, integrated in U.S. EPA's EPI program Vers. 3.10
Year	:	1995
GLP	:	no data
Test substance	:	no data

Reliability : (2) valid with restrictions
Data from handbook or collection of data
18.05.2004 (41)

Partition coefficient : octanol-water
Log pow : = 3.96 at °C
pH value :
Method : other (calculated): SRC Kowwin v1.66 Computer Program, integrated in U.S. EPA's EPI program Vers. 3.10
Year : 2004
GLP :
Test substance :

Reliability : (2) valid with restrictions
Accepted calculation method
06.10.2003 (41)

Partition coefficient : octanol-water
Log pow : = 4 at 25 °C
pH value :
Method : other (measured): see Test Conditions
Year : 1983
GLP : no
Test substance : other TS: tetrahydronaphthalene obtained from Fluka AG, purity > 97%

Test condition : (1) Dissolution in water-saturated octanol at 0.01 mol/l
(2) Triplicate aliquots mixed with octanol-saturated reagent grade water
(3) Agitation for 1 hour at 25 °C
(4) Centrifugation followed by HPLC analysis
Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment
26.01.2004 (15)

Partition coefficient : octanol-water
Log pow : = 4.014 at °C
pH value :
Method : other (calculated): CLOGP3 Computer Program, MedChem Project, Pomona College
Year : 1989
GLP :
Test substance :

Reliability : (2) valid with restrictions
Accepted calculation method
06.10.2003 (73)

2.6.1 SOLUBILITY IN DIFFERENT MEDIA

Solubility in : Water
Value : = 45 mg/l at 20 °C
pH value :
concentration : at °C
Temperature effects :
Examine different pol. :
pKa : at 25 °C
Description : of very low solubility
Stable : yes
Deg. product :

Method : other
Year : 1985
GLP : no
Test substance : other TS: Aldrich Chemical, purity 99 %

Result : 45.0 +/- 0.4 mg/l
Test condition : - Temperature: 20 +/- 0.2 degree C
- Equilibration for a minimum of 48 hours
- Solvent extraction of water phase with pentane
- Gas chromatography
- 2 vessels x 3 analyses = 6 determinations
Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment
Flag : Critical study for SIDS endpoint
18.05.2004 (21)

Solubility in : Water
Value : = 42.7 mg/l at 20 °C
pH value :
concentration : at °C
Temperature effects :
Examine different pol. :
pKa : at 25 °C
Description : of very low solubility
Stable : yes
Deg. product :
Method : other
Year : 1985
GLP : no
Test substance : other TS: Aldrich Chemical, purity 99 %

Result : 42.7 +/- 0.4 mg/l
Test condition : - Temperature: 20 +/- 0.2 degree C
- Equilibration with magnetic stirring for a minimum of 48 hours
- Solvent extraction of water phase
- Gas chromatography
Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment
(19)

Solubility in : Water
Value : = 46.7 mg/l at 28 °C
pH value :
concentration : at °C
Temperature effects :
Examine different pol. :
pKa : at 25 °C
Description : of very low solubility
Stable : yes
Deg. product :
Method : other
Year : 1985
GLP : no
Test substance : other TS: Aldrich Chemical, purity 99 %

Result : 46.7 +/- 0.4 mg/l
Test condition : - Temperature: 28 +/- 1 degree C
- Equilibration for a minimum of 48 hours

- Solvent extraction of water phase with pentane
- Gas chromatography / FID

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

(20)

Solubility in : other: synthetic seawater
Value : = 350 mg/l at 25 °C
pH value :
concentration : at °C
Temperature effects :
Examine different pol. :
pKa : at 25 °C
Description : moderately soluble (100-1000 mg/L)
Stable : yes
Deg. product :
Method : other: no data
Year : 1974
GLP : no
Test substance : no data

Test condition : - Composition of medium: Synthetic seawater obtained by dissolution in the following order in 20 l of distilled water of: 557.37 g NaCl, 27.20 g CaSO4, 63.36 g MgCl2.7H2O, 168.30 g MgCl2, 15.84 g KCl, 3.14 g MgBr2.6H2O
Reliability : (4) not assignable
Documentation insufficient for assessment

26.01.2004 (115)

Solubility in : Water
Value : = 46.4 mg/l at 25 °C
pH value :
concentration : at °C
Temperature effects :
Examine different pol. :
pKa : at 25 °C
Description : of very low solubility
Stable : yes
Deg. product :
Method : other: Approach to equilibrium from two directions followed by substance specific analysis
Year : 1996
GLP : no
Test substance : other TS: 1,2,3,4-Tetrahydronaphthalene from Aldrich; no data on purity

Result : 0.351 +/- 0.048 mmol/kg = 46.4 +/- 6.3 mg/l
Test condition : (1) Equilibration in two 50 ml Erlenmeyer flasks sealed with ground glass stoppers of each 40 g water and 1.5 g test substance at 15 °C and at 35 °C, respectively, for 2-3 days with shaking at ca. 50 rpm;
(2) Further equilibration of both flasks in a single temperature bath at 25 °C for another 2 to 3 days;
(3) Sampling 5 ml from aqueous phase, addition of 0.5 g NaCl, 2 g hexane and internal standard naphthalene, separation of phases (centrifugation) and analysis with GC-FID;
(4) Average of results from both flasks.
Reliability : (2) valid with restrictions
Test procedure in accordance with generally accepted scientific standards and described in sufficient detail; restriction: Possible impurity naphthalene may interfere with internal standard

08.01.2004 (57)

Solubility in : Water
Value : = 35.8 mg/l at 21 °C
pH value :
concentration : at °C
Temperature effects :
Examine different pol. :
pKa : at 25 °C
Description : of very low solubility
Stable : yes
Deg. product :
Method : other: see Test Conditions
Year : 1983
GLP : no
Test substance : other TS: tetrahydronaphthalene obtained from Fluka AG, purity > 97%

Result : 20 hours equilibration: 35.6 +/- 1.3 mg/l
96 hours equilibration: 30.9 +/- 1.0 mg/l
120 hours equilibration: 40.2 +/- 2.5 mg/l
144 hours equilibration: 36.3 +/- 3.8 mg/l
Mean: 35.8 +/- 4.2 mg/
Test condition : (1) 2-5 g test substance plus 500 ml reagent grade water in glass stoppered 1 l Erlenmeyer flask;
(2) Vigorous shaking at 21 °C;
(3) Removal of aliquots, centrifugation at 21 °C in covered stainless steel tubes;
(4) Extraction with pentane, HPLC analysis;
(5) Triplicate analyses
Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

26.01.2004 (15)

2.6.2 SURFACE TENSION

2.7 FLASH POINT

Value : ca. 71 °C
Type : closed cup
Method : other: no data
Year : 1978
GLP : no
Test substance : no data

Reliability : (2) valid with restrictions
Data from handbook or collection of data

23.07.2003 (54)

Value : = 77 °C
Type : open cup
Method : other: no data
Year :
GLP : no data
Test substance : no data

Reliability : (2) valid with restrictions
Data from handbook or collection of data

12.08.2003 (100)

Value : = 77 °C
Type : closed cup
Method : other: Pensky-Martens
Year :
GLP : no
Test substance : no data

Reliability : (2) valid with restrictions
Data from handbook or collection of data

14.08.2003 (116)

Value : = 78 °C
Type : other: no data
Method : other: no data
Year :
GLP : no
Test substance : no data

Reliability : (2) valid with restrictions
Data from handbook or collection of data

02.10.2003 (131) (136)

Value : = 82 °C
Type : closed cup
Method : other: no data
Year :
GLP : no data
Test substance : no data

Reliability : (2) valid with restrictions
Data from handbook or collection of data

12.08.2003 (100)

2.8 AUTO FLAMMABILITY

Value : = 385 °C at
Method : other: no data
Year : 1978
GLP : no
Test substance : no data

Reliability : (2) valid with restrictions
Data from handbook or collection of data

23.07.2003 (54)

2.9 FLAMMABILITY

2.10 EXPLOSIVE PROPERTIES

2.11 OXIDIZING PROPERTIES

2.12 DISSOCIATION CONSTANT

2.13 VISCOSITY

2.14 ADDITIONAL REMARKS

Memo	:	Critical properties
Method	:	A glass ampoule is loaded with the substance and alternately heated and cooled in an electrical furnace through its vapor-liquid critical transition temperature. The temperature and position of the meniscus dissappearances and reappearances with time are recorded. From these results, the critical temperature and density are retrieved. The full details of the method were published in earlier papers cited in this publication.
Result	:	Critical temperature: 719.9 +/- 1.0 K (= 446.75 +/- 1°C) Critical density: 0.324 +/- 0.005 g/ml A decrease of critical temperature with time, indicating thermal decomposition, was observed but compensated using an extrapolation method.
Test substance	:	Source: Aldrich; purity: 99 %
Reliability	:	(1) valid without restriction Test procedure in accordance with generally accepted scientific standards and described in sufficient detail
02.10.2003		(134)
Memo	:	Flammable limits
Result	:	Flammable limits: Lower limit 0.8 % v/v (100 deg C) Upper limit 5.0 % v/v (150 deg C)
Reliability	:	(2) valid with restrictions Data from handbook or collection of data
23.07.2003		(54)

3.1.1 PHOTODEGRADATION

Type	:	air
Light source	:	other: blacklight irradiation
Light spectrum	:	nm
Relative intensity	:	based on intensity of sunlight
INDIRECT PHOTOLYSIS		
Sensitizer	:	OH
Conc. of sensitizer	:	500000 molecule/cm³
Rate constant	:	ca. .0000000000343 cm³/(molecule*sec)
Degradation	:	= 50 % after 11.2 hour(s)
Deg. product	:	not measured
Method	:	other (measured): Relative rate method, see Reference
Year	:	1988
GLP	:	no data
Test substance	:	other TS: Alfa Products, purity 99 %
Result	:	- Rate constant: (3.43 +- 0.06) x 1E-11 cm3/(molec. x s)
Test condition	:	TEST TYPE: - Test medium: Dry pure air - Test system: 6400 l all-teflon chamber - Concentration of test substance: (5-24) x 1E+12 molec./ml - Concentration of sensitizer: 2.4E+14 molec. CH3ONO/ml - Generation of sensitizer: Photolysis of methyl nitrite - Pressure or pressure range: 740 torr = 987 hPa - Temperature: 296 +- 2 K - Analysis: Sorption of air samples to Tenax GC, thermal desorption, gas chromatography / flame ionization detection DURATION: 1-8 minutes REFERENCE SUBSTANCE: propene OTHER: addition of nitric oxide to avoid ozone formation
Reliability	:	(1) valid without restriction Test procedure in accordance with generally accepted scientific standards and described in sufficient detail
Flag	:	Critical study for SIDS endpoint

12.07.2004 (9)

Type	:	air
Light source	:	other: Sylvania 40-watt BL blacklamps
Light spectrum	:	nm
Relative intensity	:	based on intensity of sunlight
INDIRECT PHOTOLYSIS		
Sensitizer	:	OH
Conc. of sensitizer	:	500000 molecule/cm³
Rate constant	:	ca. .000000000038 cm³/(molecule*sec)
Degradation	:	= 50 % after 10.1 hour(s)
Deg. product	:	not measured
Method	:	other (measured)
Year	:	1984
GLP	:	no data
Test substance	:	
Result	:	- Rate constant: (3.8 +- 1.1) x 1E-11 cm3/(molec. x s)
Test condition	:	TEST TYPE: - Test medium: purified and humidified air - Test system: 6400 l indoor teflon chamber REFERENCE SUBSTANCE: 1,3,5-trimethylbenzene
Reliability	:	(2) valid with restrictions

Study well documented, meets generally accepted scientific principles, acceptable for assessment

12.07.2004 (24)

Type	:	air
Light source	:	other: blacklight irradiation
Light spectrum	:	nm
Relative intensity	:	based on intensity of sunlight
INDIRECT PHOTOLYSIS		
Sensitizer	:	NO3
Conc. of sensitizer	:	
Rate constant	:	ca. .0000000000000086 cm³/(molecule*sec)
Degradation	:	% after
Deg. product	:	not measured
Method	:	other (measured): Relative rate method, see Reference
Year	:	1988
GLP	:	no data
Test substance	:	other TS: Alfa Products, purity 99 %
Result	:	- Rate constant: (8.6 +- 1.3) x 1E-15 cm3/(molec. x s)
Test condition	:	TEST TYPE: - Test medium: Dry pure air - Test system: 6400 l all-teflon chamber - Concentration of sensitizer: (24 or 6.0) x 1E+13 molec./cm3 (2 experiments) - Generation of sensitizer: N2O5 - Pressure or pressure range: 740 torr = 987 hPa - Temperature: 296 +- 2 K - Analysis: Sorption of air equivalents to Tenax GC, thermal desorption, gas chromatography / flame ionization detection REFERENCE SUBSTANCE: propene
Reliability	:	(1) valid without restriction Test procedure in accordance with generally accepted scientific standards and described in sufficient detail

12.07.2004 (9)

Type	:	water
Light source	:	Sun light
Light spectrum	:	nm
Relative intensity	:	= 1 based on intensity of sunlight
Conc. of substance	:	45 mg/l at °C
DIRECT PHOTOLYSIS		
Halflife t1/2	:	ca. 17 hour(s)
Degradation	:	= 82.9 % after 43.7 hour(s)
Quantum yield	:	
Deg. product	:	
Method	:	other (measured): see Test Conditions
Year	:	1983
GLP	:	no
Test substance	:	other TS: tetrahydronaphthalene obtained from Fluka AG, purity > 97%
Result	:	No absorbance peaks above 190 nm; test substance concentration after exposure time = 7.7 mg/l
Test condition	:	(1) Dissolution of test substance in water (2) Determination of UV/VIS absorption 280 - 600 nm (3) Dilution to < 0.1 absorbance (for all wavelengths > 290 nm) if necessary (not necessary for tetrahydronaphthalene) (4) Exposure to sunlight in glass stoppered, 32 x 200 mm quartz test tubes (autoclaved prior to test to avoid biodegradation); sunlight time: 43.7 hours; sunny weather, area free from shade

(5) Daily analysis by HPLC
(6) negative control: identical solutions in glass tubes wrapped in aluminum foil; concentration: 45.0 mg/l

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

26.01.2004 (15)

Type : other: solution in hexane
Light source : Xenon lamp
Light spectrum : nm
Relative intensity : ca. 3 - 5 based on intensity of sunlight
Conc. of substance : .5 mmol/l at 28 °C
DIRECT PHOTOLYSIS
Halflife t1/2 : ca. 44.6 hour(s)
Degradation : % after
Quantum yield :
Deg. product :
Method : other (measured)
Year : 1989
GLP : no data
Test substance : other TS: commercial, reagent grade or better

Result : Rate constant = 0.43 x 10-5 s-1
Rate constant in solvent benzene = 0.40 x 10-5 s-1

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

12.07.2004 (94)

3.1.2 STABILITY IN WATER

Type : abiotic
t1/2 pH4 : at °C
t1/2 pH7 : at °C
t1/2 pH9 : at °C

Result : In water, 1,2,3,4-tetrahydronaphthalene is not expected to hydrolyze at a significant rate under environmental conditions due to lack of appropriate functional groups. There are no conflicting observations from studies of water solubility or ecotoxicity.

Reliability : (2) valid with restrictions
Expert judgment

Flag : Critical study for SIDS endpoint

16.09.2004 (41)

3.1.3 STABILITY IN SOIL

3.2.1 MONITORING DATA

Type of measurement : background concentration
Media : surface water
Concentration : = .00017 - .00155 µg/l
Method : See Test Conditions

Country : Canada, boundary to USA

Result : Detection frequencies and concentration ranges for 1,2,3,4-tetrahydronaphthalene
- Point Edward
detected in 11 water samples = 28 %
mean concentration 0.64 +/- 0.32 ng/l
range 0.37 - 1.55 ng/l
detected in 7 suspended sediment samples = 21 %
mean concentration 880.4 +/- 767.8 ng/g
range 20.84 - 1900 ng/g
Port Lambton
detected in 3 water samples = 5 %
mean concentration 0.43 +/- 0.20 ng/l
range 0.17 - 0.66 ng/l
detected in 14 suspended sediment samples = 25 %
mean concentration 674.9 +/- 1318 ng/g
range 7.08 - 5366 ng/g

Test condition : - Location: Two monitoring stations near head (Point Edward) and mouth (Port Lambton) of the St. Clair river, which carries water from Lake Huron to Lake St. Clair (further to Lake Erie).
- Year (performance): 1987-1989
- Sampling: Sampling of water and suspended sediment samples through a 12-mm polyethylene tube with a submersible pump at bi-weekly intervals. Separation of suspended sediment by centrifugation of 6 l/min for 24 hour periods (efficiency 90 % for particles > 0.6 µm). Volume of sampled centrifugate water: 40 l.
Number of water samples
1987: 9 (Jun-Dec) at Edward, 11 (Jun-Dec) at Lambton
1988: 15 (Apr-Dec) at Edward, 20 (Jan-Dec) at Lambton
1989: 9 (Jan-May) at Edward, 24 (Jan-Dec) at Lambton
Number of suspended sediment samples
1987: 10 (Jun-Dec) at Edward, 14 (May-Dec) at Lambton
1988: 15 (Apr-Dec) at Edward, 20 (Jan-Dec) at Lambton
1989: 9 (Jan-May) at Edward, 24 (Jan-Dec) at Lambton
- Clean-up: Continuous-flow countercurrent extraction of water samples
- Analysis: According to Analytical Methods Manual (Environment Canada, 1978) and Niagara River Analytical Sampling Protocol (1988)
- Quality control: Normal inhouse QA/QC procedures by National Water Quality Laboratory; GC scan of methylene chloride rinse of sample cans
- Additional data: Non-detected data points were excluded from computation. Concentration data are reported only for the period May 1987 - May 1989.

Reliability : (4) not assignable
Documentation insufficient for assessment

20.07.2004 (25)

Type of measurement : background concentration
Media : surface water
Concentration : ca. .016 µg/l
Method : See Test Conditions

Country : Canada
Result : 1,2,3,4-Tetrahydronaphthalene was found in < 10 % of the samples. The estimate of 36 kg tetrahydronaphthalene introduced annually into the Great Lakes basin, about 2/3 thereof into Lake Ontario alone, corresponds to a mean concentration of 16 ng/l (partially adsorbed to the sediment) at a total inflow of 2.23 x 10e9 m3. The accuracy of these figures is limited, since the mean concentration is near the detection limit.

Test condition : - Location: 81 locations from 12 urban areas in the Canadian Great Lakes basin
- Year (performance): 1979-1983
- Sampling:

Stormwater samples: sewer inlet samplers and automatic wastewater samplers; 4 l filtered (5 um) water per sample
Sediment samples: From filtration of stormwater samples or direct collection from street sediment
- Clean-up: Extraction with CH2Cl2, for sediments supported by ultrasonic treatment and followed by gel permeation chromatography
- Analysis: gas chromatography / flame ionization detection
- Quality control: Internal quality assurance procedures including verifications of selected high-level detections;
Detection limit 20-50 ng/l water, 50 ug/kg sediment for polycyclic aromatic hydrocarbons;
Consideration of results below detection limit: Concentration assumed to be half the (mean) detection limit.
Recovery: Typically 60 - 110 %
Precision: Range from 12 to 83 %
- Additional data: annual precipitation data

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

12.07.2004 (98)

Type of measurement : background concentration
Media : surface water
Concentration : = .031 µg/l
Method : See Test Conditions

Country : Croatia / Yugoslavia
Result : 31 ng/l in Sava River
13 ng/l in nearby sampling well
Test condition : - Location: Near Zagreb
- Year (performance): 1986-1989
- Sampling: From Sava River or from sampling wells at the depth of maximum groundwater flow (14 m);
- Cleanup: Fractionation and enrichment procedures, no details reported
- Analysis: Combination of HPLC, GC, MS; no details reported;

Reliability : (4) not assignable
Documentation insufficient for assessment

12.07.2004 (1)

Type of measurement : background concentration
Media : other: snow
Concentration : = .005 - .021 µg/l
Method : See Test Conditions

Country : Antarctica
Result : 1,2,3,4-Tetrahydronaphthalene was detected in 5 out of 8 surface snow samples. It was not detected (i.e. < 5 ng/l) in the additional 6 samples from various depths:
1987/88: 3 sites: 21 +/- 4; 5; 7 +/- 2 ng/l
1988/89: 2 sites: 9 +/- 2 ng/l; not detected
1990/91: 3 sites: 7 +/- 2 ng/l; not detected; not detected
Test condition : - Location: Terranova Bay, Antarctica
- Year (performance): 1987/88, 1988/89, 1990/91
- Sampling: Collection of snow from 5-10 cm depth in steel containers (8 samples); 1990/91 two additional samples each from surface, 1 m depth and 2 m depth
- Cleanup: melting of snow at room temperature, extraction with hexane, drying, concentration.
- Analysis: GC with FID or MS detection; identification by both retention time and MS spectra library
- Quality control: all apparatus cleaned with solvents before use; recovery

80 +/- 7 % determined with standard mixture. Limit of detection: 5 ng/l.

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

21.07.2004 (43)

Type of measurement : background concentration
Media : other: rain / snow
Concentration : = .0049 - .1818 µg/l
Method : See Test Conditions

Country : Canada
Result : Tetrahydronaphthalene ("tetrahydronaphtha", identity not quite certain) could be determined in 35 of 93 samples at concentrations ranging from 4.9 to 181.8 ng/l; the average amounted to 13.0 ng/l.
Test condition : - Location: Four stations, one on each of the Great Lakes bordering Canada, in remote areas
- Year (performance): 1986
- Sampling: 2-week wet precipitation samples were taken with a stainless steel funnel equipped with a movable lid which was controlled by an electronic moisture sensor. Precipitation was collected in an amber glass bottle which contained about 200 ml of methylene chloride. 93 samples of average volume 3.3 l were analyzed.
- Cleanup: Repeated extraction with methylene chloride, drying, concentration, elution through deactivated silica
- Analysis: GC/ECD
- Quality control: Blanks (clean bottles)
Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

12.07.2004 (26)

Type of measurement : background concentration
Media : other: sea water, aqueous and particulate phases
Concentration : = .002 - .033 µg/l
Method : See Test Conditions

Country : Antarctica
Result : Tetrahydronaphthalene was detected at levels ranging from 2 to 33 ng/l (average: 8.9 ng/l) in 9 out of 11 sea water samples.
Sea pollution with petroleum or petroleum products as well as local anthropogenic releases were discussed as sources. In the particulate phase, which was mainly phytoplancton, aromatic hydrocarbons like tetrahydronaphthalene were absent.
Test condition : - Location: Terranova Bay, Antarctica
- Year: 1989
- Sampling: 25 l sea water samples were taken from a boat >= 1 km away from the route of the ship at 0.5 m depth.
- Cleanup: filtration, separate extraction of liquid and particulate fractions with n-hexane, drying, concentration; fractionation on silica gel microcolumn
- Analysis: GC with FID, ECD, or MS/computer detection
- Quality control: all apparatus cleaned with solvents before use; recovery 70 +/- 10 % (aqueous phase; particulate phase 70 +/- 5 % for benzenic hydrocarbons) determined with standard mixture; blank controls
Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

12.07.2004 (42)

Type of measurement : background concentration

Media : sediment
Concentration :
Method : See Test Conditions

Country : USA
Result : Tetrahydronaphthalene was detected (not quantified) in 1 out of 5 (suspended) sediment samples.
About 200 compounds were identified and considered to be primarily plant decomposition products.
Test condition : - Location: Duluth-Superior harbor (Wisconsin)
- Year (performance): 1982/1983
- Sampling: Centrifugation of 100-150 l of water, filtration
- Cleanup: drying in ventilation hood or vacuum desiccator; Soxhlet extraction (twice); washing; florisil fractionation
- Analysis: capillary GC/FID
- Quality control: Recovery 94-100%; blank samples; detection limit 0.010-0.013 µg/g dw
Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

12.07.2004 (12)

Type of measurement : background concentration
Media : soil
Concentration :
Method : See Test Conditions

Country : Spain
Result : 1,2,3,4-tetrahydronaphthalene was found in 2/12 soil samples (both from below stone pines) and 0/3 plant samples. Concentrations were 0.8% and 1.1% of the total chromatographic area. Information is insufficient for calculation of mg/kg soil.
Test condition : - Location: Soil of 12 monospecific forests in central Spain
- Year (performance): 1988 (April - June)
- Sampling:
4 locations each with forests of stone pine, evergreen oak, and Spanish juniper; samples from 10 cm depth; mixing of subsamples from an area each of 10 m2;
additional samples of approximately 200 g of fresh plant material (thin stems with leaves)
- Clean-up:
Soil samples: air-drying and sieving to 2 mm; Soxhlet extraction for 3 days with petroleum ether (40-70 °C) with exchange of liquid each 12 hours; drying; concentration; methylation with diazomethane.
Plant samples: air-drying, crushing, and homogeneization to 3 mm; plantwise mixing; further treatment probably like soil samples (Soxhlet extraction, etc.)
- Analysis: GC-MS with MS library search for identification; GC-FID for quantitation
- Quality control: Comparison with GC and MS data of authentic samples for commercially available substances
Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

12.07.2004 (3)

Type of measurement : concentration at contaminated site
Media : surface water
Concentration : < .001 µg/l
Method : See Test Conditions

Country : Canada / U.S.A. border
Result : 1,2,3,4-Tetrahydronaphthalene was not detected in any of the water or suspended solids samples.
Test condition : - Location: Rainy River, border Ontario (Canada) / Minnesota (U.S.A.), three stations plus two final effluents of two bleached kraft pulp and paper mills
- Year (performance): 1986 (August)
- Sampling: One sample per phase and location
Water in pre-cleaned 19 l stainless steel containers after centrifugation
Suspended solids: From centrifugation (see water sampling); pressure filtration
- Clean-up:
Water: Continuous-flow extraction with CH2Cl2; drying and concentration; chromatography on silica gel column
Suspended solids: Extraction with 1:1 hexane/acetone; additional extraction with benzene; drying; concentration; gel permeation chromatography; chromatography on silica gel column
- Analysis: GC-FID
- Quality control: yes, no details published
Detection limit 1.0 ng/l water; 50 ng/g solids
- Additional data: Low flow conditions (138-199 m3/s = well below usual mean of 306 m3/s) in the Rainy River
Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

12.07.2004 (101)

Type of measurement : concentration at contaminated site
Media : surface water
Concentration : = .0013 - .1543 µg/l
Method : See Test Conditions

Country : Canada / U.S.A. border
Result : Identification and concentration of tetrahydronaphthalene
- Water samples:
11/11 samples positive; concentration range 1.3 to 154.3 ng/l
Two maximum concentrations were found in the effluent samples from one and the same mill.
- Suspended solids samples:
2/12 samples positive, concentrations 10.0 and 14.0 ng/g
Both positive samples were from not the mill that emitted the maximum concentrations in the effluent.
Test condition : - Location: Rainy River, border Ontario (Canada) / Minnesota (U.S.A.), four stations plus two final effluents of two bleached kraft pulp and paper mills
- Year (performance): 1988 (June and August)
- Sampling: 1 sample per location and month (minus 1 sample)
Water: 38 l samples after centrifugation
Suspended solids: From centrifugation (see water sampling); pressure filtration
- Clean-up:
Water: Continuous-flow extraction with CH2Cl2; drying and concentration; chromatography on silica gel column
Suspended solids: Extraction with 1:1 hexane/acetone; additional extraction with benzene; drying; concentration; gel permeation chromatography; chromatography on silica gel column
- Analysis: GC-MS
- Quality control: yes, no details published
Detection limit 0.5 ng/l water; 10 ng/g solids
- Additional data: Low flow conditions (248 m3/s; usual mean 306 m3/s) in the Rainy River

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment
12.07.2004 (102)

Type of measurement : concentration at contaminated site
Media : ground water
Concentration : = 0 - .56 µg/l
Method : See Test Conditions

Country : Croatia / Yugoslavia
Result : 300 and 560 ng/l, respectively, in two wells at the edge of Zagreb's main landfill (depth: 11 m); not detected in untreated wastewater and in two wells near the sewage canal of a parmaceutical and a yeast-producing plant (depth: 10.5 m)
Test condition : - Location: Near Zagreb
- Year (performance): 1986-1989
- Sampling: From waste water flow or from sampling wells at the depth of maximum groundwater flow;
- Cleanup: Fractionation and enrichment procedures, no details reported
- Analysis: Combination of HPLC, GC, MS; no details reported;
Reliability : (4) not assignable
Documentation insufficient for assessment
12.07.2004 (1)

Type of measurement : concentration at contaminated site
Media : ground water
Concentration : <= .01 µg/l
Method : See Test Conditions

Country : USA
Result : The maximum concentration of tetrahydronaphthalene found was 10 ng/l (number of samples not reported).
Test condition : - Location: Plume below a site for disposal of secondary treated sewage effluent operated since 1936, near Falmouth (Massachusetts)
- Year (performance): 1984
- Sampling: water from PVC sampling wells
- Cleanup: Purge & Trap / Closed Loop Stripping
- Analysis: GC/MS, MS library match
- Quality control: initially discarding at least three well volumes of sample; addition of surrogate standards to samples; confirmation of identity with authentic standards
Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment
12.07.2004 (13)

Type of measurement : concentration at contaminated site
Media : other: snow
Concentration : < .05 µg/l
Method : See Test Conditions

Country : Canada
Result : Tetrahydronaphthalene was not detected in any of 20 sampling stations at a detection limit of 0.050 µg/l melt-water.
Test condition : - Location: Near steel works, Sault Ste. Marie (Ontario)
- Year (performance): Winter 1986/1987
- Sampling: Collection of undisturbed snowpack (from almost 11 weeks) in stainless steel core samplers, slow melting.
- Cleanup: Extraction with methylene chloride, drying, concentration, gel

permeation chromatography.
- Analysis: GC/FID

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

12.07.2004 (16)

Type of measurement : concentration at contaminated site
Media : other: waste water
Concentration : = .0551 - .063 µg/l
Method : See Test Conditions

Country : Spain
Result : The lower concentration (55.1 ng/l) was measured when the wastewater treatment plant worked normally. The higher concentration (63 ng/l) was measured after a breakdown in the biological system of the wastewater treatment plant. 1,2,3,4-tetrahydronaphthalene was not identified in the 5 drinking water samples.
Test condition : - Location: Cordoba (Andalusia, Spain)
- Year (performance): ca. 1997
- Sampling: 1 l samples of
drinking water from the "Villa Azul" water treatment plant (1 sample each from 5 different stages)
waste water from "La Golondrina" purification plant (1 sample each from periods of regular and poor working state)
- Clean-up: 1.5 hours closed loop stripping analysis (CLSA) of diluted (1:10) wastewater samples at 45 degree C water temperature, adsorption on charcoal, extraction with carbon disulfide or dichloromethane
- Analysis: GC-FID/MS (FID for quantification, MS for identification); quantification with internal standards
- Quality control: analysis of blank control; studies on influence of purge time and extraction solvent

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

21.07.2004 (6)

Type of measurement : concentration at contaminated site
Media : biota
Concentration : <= 34.5 - 75.3
Method : See Test Conditions

Country : Canada / U.S.A. border
Result : Identification and concentration of tetrahydronaphthalene
Perca flavescens I: 73.2 ng/g
Perca flavescens II: 34.5 ng/g
Perca flavescens III: < 10 ng/g
Percina caprodes: < 10 ng/g
Micropterus dolomieui I: 75.3 ng/g
Micropterus dolomieui II: < 10 ng/g
Test condition : - Location: Rainy River, border Ontario (Canada) / Minnesota (U.S.A.)
- Year (performance): 1988 (August)
- Sampling: 6 juvenile fish, using a beach seine
- Clean-up:
Drying with Na2SO4, extraction with CH2Cl2; drying; concentration; gel permeation chromatography; chromatography on silica gel column
- Analysis: GC-MS
- Quality control: yes, no details published
Detection limit 10 ng/g (total weight, probably wet)
- Additional data: Low flow conditions (248 m3/s; usual mean 306 m3/s) in the Rainy River

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment
12.07.2004 (102)

3.2.2 FIELD STUDIES

3.3.1 TRANSPORT BETWEEN ENVIRONMENTAL COMPARTMENTS

3.3.2 DISTRIBUTION

Media : air - biota - sediment(s) - soil - water
Method : Calculation according Mackay, Level I
Year :

Result : Air: 94.7112 %
Water: 2.6960 %
Soil: 1.2845 %
Sediment: 1.2988 %
Susp. Sediment 0.0083 %
Fish: 8.12E-4 %
Aerosol: 3.34E-4 %

Test condition : Data used:
Molecular weight: 132.21 g/mol
log Kow: 3.78
Vapour pressure: 34 Pa
Water solubility: 0.045 g/l
Melting point: -35.8 degree C
Temperature: 20 degree C

Volumes, densities, and organic carbon / fat concentration:
Air: 6 000 000 000 m3, 1.206 kg/m3
Water: 7 000 000 m3, 1000 kg/m3
Soil: 45 000 m3, 1500 kg/m3, 2 % OC
Sediment: 21 000 m3, 1300 kg/m3, 5 % OC
Susp. sediment: 35 m3, 1500 kg/m3, 16.7 % OC
Fish: 7 m3, 1000 kg/m3, 5 % fat
Aerosol: 0.12 m3, 1500 kg/m3

Reliability : (2) valid with restrictions
Accepted calculation method

Flag : Critical study for SIDS endpoint
10.02.2004 (41)

Media : water - air
Method : other (measurement): Henry's Law Constant
Year : 1984

Method : Equilibrium partitioning in closed systems (EPICS);
Control: Batch air stripping technique

Result : Henry's Law Constant:
0.00075 atm m3/mol = 76 Pa m3/mol at 10 degree C
0.00105 atm m3/mol = 106 Pa m3/mol at 15 degree C
0.00136 atm m3/mol = 138 Pa m3/mol at 20 degree C
0.00187 atm m3/mol = 189 Pa m3/mol at 25 degree C
0.00268 atm m3/mol = 272 Pa m3/mol at 30 degree C

Temperature dependence (regression equation):
H = exp(11.83-5392/T) (H in atm m3/mol, T in K)

Reliability : (1) valid without restriction
Test procedure in accordance with generally accepted scientific standards and described in sufficient detail

Flag : Critical study for SIDS endpoint

06.10.2003 (8)

Media : water - soil

Method : other (calculation): PCKocWin Version 1.66 as integrated in EpiWin Version 3.10 (first-order molecular connectivity index (1-MCI) method), Syracuse Research Center / U.S. EPA

Year :

Result : Koc = 1837; log Koc = 3.264
"high" potential for geoaccumulation (Blume scale)

Reliability : (2) valid with restrictions
Accepted calculation method

Flag : Critical study for SIDS endpoint

12.07.2004 (41)

3.4 MODE OF DEGRADATION IN ACTUAL USE

3.5 BIODEGRADATION

Type : aerobic

Inoculum : predominantly domestic sewage

Concentration : 2 mg/l related to Test substance
related to

Contact time :

Degradation : = 5 (±) % after 28 day(s)

Result : other: not readily biodegradable

Kinetic of testsubst. : 5 day(s) = 3 %
15 day(s) = 3 %
%
%
%

Control substance : Benzoic acid, sodium salt

Kinetic : 28 day(s) = 86 %
%

Deg. product :

Method : other: OECD Guide-line 301 D and Directive 84/449/EEC, C.6 (Biotic degradation - closed bottle test)

Year : 1988

GLP : no

Test substance : other TS: produced by Hüls AG, Sample ID 429/870827

Test condition : INOCULUM/TEST ORGANISM
- Sampling site: predominantly domestic WWTP Marl-Ost, sampled 23 November 1988
- Preparation of inoculum: filtration (aerobic), the first 200 ml of the filtrate were discarded
- Initial cell concentration: 0.5 ml/l; cells not counted
TEST SYSTEM
- Culturing apparatus: 300 ml precision glass bottles
- Number of culture flasks per concentration: 2 per sampling time (0, 5, 15, and 28 days)

- Measuring equipment: oxygen electrode WTW
- Closed vessels used: yes
DURATION OF THE TEST: 0, 5, 15, or 28 days (parallel)
ANALYTICAL PARAMETER: dissolved oxygen
TEST CONDITIONS
- Test temperature: 20 degree C

Reliability : (2) valid with restrictions
Guideline study with acceptable restrictions
Flag : Critical study for SIDS endpoint
12.07.2004 (81)

Type : aerobic
Inoculum : activated sludge
Concentration : 45.8 mg/l related to Test substance
related to
Contact time :
Degradation : = 81 (±) % after 28 day(s)
Result :
Kinetic of testsubst. : 7 day(s) = 0 - 0 %
14 day(s) = 42 - 54 %
21 day(s) = 66 - 72 %
28 day(s) = 78 - 84 %
%
Control substance : Diethylene glycol
Kinetic : 7 day(s) = 2 - 5 %
28 day(s) = 76 - 94 %
Deg. product :
Method : other: BODIS (Blok) Test (BOD-test for insoluble substances)
Year : 1989
GLP : no
Test substance : as prescribed by 1.1 - 1.4

Test condition : INOCULUM/TEST ORGANISM
- Sampling site: predominantly domestic WWTP Marl-Ost
TEST SYSTEM
- Culturing apparatus: 300 ml precision glass bottles
- Number of culture flasks per concentration: 3
- Closed vessels used: yes
DURATION OF THE TEST: 28 days
ANALYTICAL PARAMETER: dissolved oxygen

Reliability : (2) valid with restrictions
Comparable to guideline study with acceptable restrictions
Flag : Critical study for SIDS endpoint
12.07.2004 (71)

Type : aerobic
Inoculum : other: sea water
Concentration : 9.215 mg/l related to Test substance
related to
Contact time :
Degradation : = 3 (±) % after 20 day(s)
Result : other
Kinetic of testsubst. : 5 day(s) = 3 %
%
%
%
%
Control substance : other: glucose
Kinetic : %
%

Deg. product	:	not measured
Method	:	other: Standard method for the examination of water and wastewater, Am. Publ. Health Assoc. (1971)
Year	:	1974
GLP	:	no
Test substance	:	no data
Test condition	:	INOCULUM/TEST ORGANISM - Sampling site: Lavaca Bay, Texas - Feeding: addition of small amounts of settled raw wastewater about every 3 to 4 days TEST SYSTEM - Culturing apparatus: 300 ml BOD bottle - Number of culture flasks per concentration: 1 or 2 replicates each for 4 sampling times - Aeration device: Sparging of dilution water with pure oxygen before test, no further aeration - Measuring equipment: oxygen meter permitting correction for high salinity water - Closed vessels used: yes INITIAL TEST SUBSTANCE CONCENTRATION: 3 ul/0.3 l x 0.9215 mg/ul = 9.215 mg/l METHOD OF PREPARATION OF TEST SOLUTION: Addition of seed to test vessel, filling completely with highly oxygenated dilution water, addition of 3.0 ul pure test substance with syringe DURATION OF THE TEST: 20 days ANALYTICAL PARAMETER: Dissolved oxygen SAMPLING: five times during test period TEST CONDITIONS - Composition of medium: Synthetic seawater obtained by dissolution in the following order in 20 l of distilled water of: 557.37 g NaCl, 27.20 g CaSO4, 63.36 g MgCl2.7H2O, 168.30 g MgCl2, 15.84 g KCl, 3.14 g MgBr2.6H2O - Additional substrate: Nutrient salts and buffers as recommended in test method NITRATE/NITRITE MEASUREMENT: colorimetrically, assumed to be principally nitrite CONTROLS: inoculum blank
Reliability	:	(2) valid with restrictions Study well documented, meets generally accepted scientific principles, acceptable for assessment

06.10.2003 (115)

Type	:	aerobic
Inoculum	:	other: sea water
Concentration	:	12.4 µg/l related to Test substance related to
Contact time	:	
Degradation	:	> 99.2 (±) % after 10 day(s)
Result	:	other
Deg. product	:	
Method	:	other: see Test Conditions
Year	:	1978
GLP	:	no
Test substance	:	other TS: gas oil
Result	:	- Evaporation control (room temperature) 66 % loss in 2 hours, 99 % loss in 24 hours - Concentration of 1,2,3,4-tetrahydronaphthalene (total oil): Start solution: 12.4 (1162) µg/l Inhibited control: 14.3 (1285) µg/l Test solution (end of test): < 0.1 (11.2 µg/l)

- Classification of biodegradation rate: "moderate"

Test condition : INOCULUM/TEST ORGANISM
- Type of sludge: sea water
- Source: North Sea coast
- Sampling site: not reported
TEST SYSTEM
- Aeration device: none
INITIAL TEST SUBSTANCE CONCENTRATION: 1.2 mg/l (total oil content)
METHOD OF PREPARATION OF TEST SOLUTION: 10 litres phosphorus- and nitrogen-free artificial sea water was contacted with 100 ml gas oil at 20 degree C for 3 days while being stirred very slowly. The water layer was subsequently sampled in four portions
DURATION OF THE TEST: 10 days
ANALYTICAL PARAMETER: Test substance concentration (Pentane extraction, purification, GC)
TEST CONDITIONS
- Composition of medium: not reported
- Additional substrate: nitrogen and phosphorus salts for biodegradation phase
- Test temperature: 25 degree C
CONTROLS: evaporation control, negative control inhibited with copper sulphate
ADDITIONAL EXPERIMENTS: Similar tests at 20 degree C with durations of 2, 4, 7, and 14 days were performed but evaluated only quantitatively, leading to a classification of the biodegradation rate.

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment;
Restrictions:
- identification by Kovats's index may be erroneous;
- disappearance of peak indicates primary, not ultimate degradation

12.07.2004 (142)

Type : aerobic
Inoculum : other: natural microbial flora of groundwater
Concentration : 2 mg/l related to Test substance
µg/l related to
Contact time :
Degradation : = 100 (±) % after 12 day(s)
Result : other: complete biodegradation in non-standard test
Deg. product :
Method : other: batch biodegradation assay
Year : 1978
GLP : no
Test substance : other TS: gas oil (BP Company), as much as soluble in ground water by shaking for 10 minutes

Result : Percent degradation

Days	Total	1,2,3,4-Tetrahydronaphthalene
1	:= 0	:= 0
2	-1	-1
3	0	-17
4	3	-6
5	3	-13
6	8	-14
7	46	1
8	66	26
9	80	53
10	90	100

11 98 100
12 100 100
After a lag phase of 5-7 days, degradation is rapid and complete.
Additional observation: At concentrations >= 2.0-2.1 mg/l, degradation ceased after 10 days but continued after the addition of NH4Cl, indicating that assimilable nitrogen is a growth-limiting substrate.

Test condition : INOCULUM/TEST ORGANISM
- Source: local groundwater, not further identified
- Initial cell concentration: ca. 130 cells/ml
TEST SYSTEM
- Culturing apparatus: 2.8 l sealed flasks with 2 l test solution
INITIAL TEST SUBSTANCE CONCENTRATION:
1851 nl total hydrocarbons/l
7.8 nl 1,2,3,4-tetrahydronaphthalene/l
METHOD OF PREPARATION OF TEST SOLUTION: see test substance characterization
DURATION OF THE TEST: 288 hours = 12 days
TEST CONDITIONS
- Test temperature: 10 degree C
- pH value: initial 7.9, final 7.3
SAMPLING: Extraction with CH2Cl2
ANALYTICAL PARAMETER: test substance concentration (GC / peak area, internal standard)
CONTROLS: addition of HgCl2 to identical solution

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

13.07.2004 (85)

Type : aerobic
Inoculum : other: river or sea water
Concentration : 50 mg/l related to Test substance
related to
Contact time :
Degradation : = 8 - 15 (±) % after 3 day(s)
Result : other: hard to moderate biodegradability
Control substance : other: no data
Kinetic : %
%
Deg. product : not measured
Method : other: cultivation method
Year : 1987
GLP : no data
Test substance : no data

Result : 8 % degradation in sea water (Akashi Beach)
15 % degradation in river water (Mino River)
Test condition : Biodegradation in river or sea water tested by Osaka University institute
Reliability : (4) not assignable
Publication in Japanese; documentation insufficient for assessment (at least in English)

13.07.2004 (89)

Type : aerobic
Inoculum : other: adapted sewage/soil
Concentration : 3.58 mg/l related to Test substance
related to
Contact time :
Degradation : = 9.99 (±) % after 24 day(s)
Result :

Kinetic of testsubst.	:	2 day(s) = 2.87 % 6 day(s) = 3.3 % 9 day(s) = 5.24 % 13 day(s) = 8.9 % 17 day(s) = 9.33 %
Deg. product	:	
Method	:	other: Mineralization test
Year	:	1983
GLP	:	no
Test substance	:	other TS: tetrahydronaphthalene obtained from Fluka AG, purity > 97%
Result	:	No further biodegradation between days 24 and 29. Degradation was incomplete in the positive control which, according to the authors, may be due to toxic effects of the test substance on the inoculum during the adaptation phase.
Test condition	:	INOCULUM/TEST ORGANISM - Preparation of inoculum: 14 days adaption period with addition of test material on days 0, 7, and 11 - Initial cell concentration: 100 ml seed in 1 l test solution TEST SYSTEM - Culturing apparatus: 2 l flask, special design - Number of culture flasks per concentration: 3 - Aeration device: no aeration; head space filled with oxygen - Measuring equipment: trapping of CO2 with barium hydroxide, titration with HCl - Closed vessels used: yes (rubber septa) TEST CONDITIONS - Test temperature: room temperature - Other relevant factors: dark INITIAL TEST SUBSTANCE CONCENTRATION: water extract dilute 1:10 = ca. 3.58 mg/l according to water solubility determined in the same study; measured TOC not reported ANALYTICAL PARAMETER: CO2 evolution. Biodegradability was given as percentage of total test material carbon evolved as CO2. CONTROLS: blank
Reliability	:	(3) invalid Significant methodological deficiencies: The limits of bacteria toxicity were not determined.
13.07.2004		(15)

Type	:	aerobic
Inoculum	:	Nocardia sp. (Bacteria)
Contact time	:	
Degradation	:	(±) % after
Result	:	other: degradation observed but not quantified
Deg. product	:	yes
Method	:	other: hydrocarbon co-oxidation test
Year	:	1970
GLP	:	no
Test substance	:	other TS: Aldrich Chemical Co., technical grade, passed through silica gel column before use
Result	:	- Identified degradation product: 4-(2-hydroxyphenyl)butanoic acid
Test condition	:	INOCULUM/TEST ORGANISM - Species/strain: Nocardia corallina strain V-49 - Source: isolated from soil TEST SYSTEM - Culturing apparatus: agar-resin plate or 40-liter stirred fermentor TEST CONDITIONS - Additional substrate: n-hexadecane or Cerelose

Reliability : (4) not assignable
Documentation insufficient for assessment

14.08.2003 (82)

Type : aerobic
Inoculum : other fungi: Penicillium simplicissimum
Concentration : 1000 mg/l related to Test substance
100 mg/l related to Test substance
Contact time :
Degradation : (±) % after 1 month
Result : under test conditions no biodegradation observed
Deg. product :
Method : other
Year : 1990
GLP : no data
Test substance : other TS: Commercial grade, used without further purification

Test condition : INOCULUM/TEST ORGANISM
- Species/strain: Penicillium simplicissimum
- Source: Isolated from activated sludge from a paper-mill's waste water treatment plant
- Feeding: Addition of 24 ml/h of a solution of 2 g/l veratryl alcohol (CAS RN 93-03-8) in mineral salts medium
- Method of cultivation: Stirring (600 rpm) ca. 1150 ml of solution at 30 degree C in flat-bottomed round flask (2 l), withdrawing half of the culture (24 h x 24 ml/h = 576 ml) daily.
TEST SYSTEM
- Culturing apparatus: 100 ml serum bottles with screw caps
- Number of culture flasks per concentration: 1
- Closed vessels used: yes
ANALYTICAL PARAMETER: CO2 production (determined by GC)
SAMPLING: Only at the end of the test period
TEST CONDITIONS
- Composition of medium: added per liter of deionized water:
1.8 g KH2PO4; 1.0 g Na2HPO4; 2.0 g NH4Cl, 0.1 g (NH4)2SO4;
0.075 g MgCl2 x 6 H2O; 0.2 ml of trace elements solution
- Test temperature: 30 degree C
- pH value: 5.0
- Other relevant factors: Whenever the CO2 concentration in a bottle was more than five times the concentration in the blank it was concluded that gowth had occurred (< 5 times: no growth).
CONTROLS: blank (i.e. no carbon source)
Conclusion : Penicillium simplicissimum does not grow on tetrahydonaphthalene as sole carbon source.
Reliability : (3) invalid
Bacteria toxicity is expected at the test concentration.

15.01.2004 (36)

Type : aerobic
Inoculum : other bacteria: gram-negative rods
Contact time :
Degradation : (±) % after
Result : other
Deg. product : yes
Method : other
Year : 1974
GLP : no data
Test substance : other TS: Aldrich Chemical Company, purity 97 % or higher

Result : Among the six strains, only one grown on naphthalene was able to metabolize tetrahydronaphthalene, converting it into a ketone

tetrahydronaphthalone. The position of keto group could not be determined.

Test condition : INOCULUM/TEST ORGANISM
- Species/strain: Six strains of bacteria
- Source: Oil-polluted estuarine waters
- Sampling site: Arthur Kill (New Jersey)
- Method of cultivation: Isolation by addition of 0.05 to 0.1 % sterile naphthalene (3 strains), 1-methyl naphthalene (1 strain) and 2-methyl naphthalene (2 strains) as sole sources of carbon and energy in Bushnell-Haas broth (Difco) supplemented with 3% NaCl

TEST SYSTEM
- Culturing apparatus: Fernbach flasks with 1 l of test solution
- Number of culture flasks per concentration: 1
- Aeration device: shaking (200 rpm)

INITIAL TEST SUBSTANCE CONCENTRATION: 0.05-0.1 % v/v
DURATION OF THE TEST: 18-24 hours
SAMPLING: End of study: (1) Centrifugation (2), acidification of supernatant, (3) extraction with diethyl ether, (4) GC / FID / MS
TEST CONDITIONS
- Composition of medium: potassium phosphate buffer (0.05M)
- Test temperature: 27 degree C
- pH value: 6.8

Conclusion : The typical route of biodegradation of naphthalene is not followed with tetrahydronaphthalene, where initial attack by naphthalene-grown bacteria occurs on the saturated ring.

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles

12.08.2003 (37)

3.6 BOD5, COD OR BOD5/COD RATIO

BOD5
Method : other: see Test Conditions
Year : 1983
Concentration : related to
BOD5 : = 0 mg/l
GLP : no
COD
Method : other: Standard method of dichromate sulfuric acid reflux followed by ferrous ammonium sulfate titration, ferroin indicator (COD determination)
Year : 1983
COD : mg/g substance
GLP : no
RATIO BOD5 / COD
BOD5/COD : = 0

Remark : BOD and COD results are reported in units of mg O2/l of original water extract. This water extract was prepared by equilibration of tetrahydronaphthalene with water and subsequent separation. For conversion into units of mg O2/g tetrahydronaphthalene, the reported values were divided by the water solubility (0.0358 g tetrahydronaphthalene / l solution) as reported in the same study.

Result : COD = 419 mg O2/l tetrahydronaphthalene solution = 11,704 mg O2/g tetrahydronaphthalene. This result is higher than expected, which according to the authors is probably due to excess suspended test substance.
BOD5 = BOD20 = 0 mg O2/l tetrahydronaphthalene solution = 0 mg O2/g tetrahydronaphthalene.
- A single spurious replicate value of 1300 mg O2/g tetrahydronaphthalene

= 36,313 mg O2/g tetrahydronaphthalene at the lowest test concentration was omitted.
- Indications of toxicity to the sewage organisms were observed at the higher test concentrations.

Test condition : - Test solution: Equilibration of test substance with water for a number of hours followed by phase separation in a separatory funnel
- COD: Refluxing with silver sulfate catalyst for about 2 hours
- BOD: Test solution
(1) diluted (6 concentrations) with phosphate buffered distilled water with added inorganic nutrients in BOD bottles, two replicates,
(2) seeded with 3% seed of sewage effluent,
(3) incubated at 20 °C in the dark,
(4) dissolved oxygen determined with DO electrode;
(5) results corrected for oxygen consumption of water blanks;
(6) positive controls glucose/glutamic acid

Test substance : other TS: tetrahydronaphthalene obtained from Fluka AG, purity > 97%

Reliability : (3) invalid
Significant methodological deficiencies: The limits of bacteria toxicity were not determined. Explanations for conflicting results (COD > expected; BOD positive outlier) are merely assumptions, indicating lack of experimental precision.

26.01.2004 (15)

3.7 BIOACCUMULATION

Species : other: QSAR estimate
Exposure period : at °C
Concentration :
BCF : = 162.4 - 1514
Elimination :
Method : other: calculation with BCFWIN v2.14 as integrated in EPIWIN v3.10, Syracuse Research Center / U.S. EPA
Year :
GLP :
Test substance :

Result : - Calculation with BCFWIN v2.14 as integrated in EPIWIN v3.10, Syracuse Research Center / U.S. EPA:
BCF = 162.4
- Calculation according to EU Technical Guidance Document on Risk Assessment of Chemical Substances following European Regulations and Directives, 2nd Edition (2003), chapter 4.5.2:
BCF (Pimephales promelas) = 326
BCF (Lumbricus terrestris) = 1514

Test condition : log Kow used: 3.78
Reliability : (2) valid with restrictions
Accepted calculation method
Flag : Critical study for SIDS endpoint
28.05.2004 (41)

Species : other: Macoma balthica (bivalve mollusc)
Exposure period : 180 day(s) at 8 °C
Concentration : .043 µg/l
BCF : ca. 10200 - 23300
Elimination : yes
Method : other
Year : 1977
GLP : no data

Test substance : other TS: Crude oil from Prudhoe Bay.
Bioconcentration data are reported in the study for classes of substances, e.g. biphenyls or fluorenes.
The data cited here refer to tetralins, i.e. alkylated derivatives of tetrahydronaphthalene

Remark : The study is not fully acceptable for the assessment of tetrahydronaphthalene for the following reasons:
- Bioconcentration data refer to a mixture.
- Data refer to alkylated derivatives, which are less soluble and more liphophilic than the unsubstituted homologs.
- Unsubstituted substances are usually more susceptible to biodegradation and metabolism, which was also observed in the present study.
- Test substance was detected in control organisms (initial background contamination).
Thus the data presented overestimate the bioconcentration potential of 1,2,3,4-tetrahydronaphthalene.

Result : Concentrations and concentration factors of "tetralins" on a wet weight basis:
60 days: 640 µg/kg / 43 ng/l = 14,900 l/kg
120 days: 1000 µg/kg / 43 ng/l = 23,300 l/kg
180 days: 440 µg/kg / 43 ng/l = 10,200 l/kg
day 240: 130 µg/kg (end of depuration)
control, day 0: 5.5 µg/kg
control, day 180: 0 µg/kg
The mean number of aliphatic non-ring carbons in the "tetralins" was 3.4 in the aqueous phase and 4.8 (day 60) or higher in the molluscs, increasing continuously up to 5.7 (day 240).
In general, i.e. for all classes of substances, the results indicate degradation of test substance after an initial phase of adaptation.
Substances with higher substitution levels were preferably accumulated.

Test condition : Exposure:
- Duration: 180 days
- Depuration: 60 days
- Concentration of test substance (i.e. crude oil): 30 µg/l; results for 300 µg/l and 3,000 µg/l reported in lesser detail
- Control: seawater
- Analysis: after 60, 120, 180 days and 60 day depuration; additional analyses at 30 day intervals reported in lesser detail

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles

28.05.2004 (30)

Species : other: Mytilus edulis (marine mussel)
Exposure period : at °C
Concentration :
Elimination : yes
Method : other: see Test Conditions
Year : 1972
GLP : no
Test substance : no data

Remark : More detailed information is reported for studies with radiolabelled other test substances.

Result : High toxicity at 100 ppm = 100 mg/l
Paralysis at lower test concentrations
Uptake per mussel approximately 20 ug (mg?)
80 % thereof discharged within 24 hours in fresh seawater

Test condition : TEST ORGANISMS
- Wild caught: collected off the local pier
- Age/size/weight/loading: average 0.30 g dry weight excluding shell

STOCK AND TEST SOLUTION AND THEIR PREPARATION
- Other procedures: sonication in the presence of < 50 mg Celite/l
DILUTION WATER
- Source: sea water
- Aeration: continuous bubbling of air through test solution
TEST SYSTEM
- Concentrations: 10-100 ug/l or mg/l
- Renewal of test solution: for depuration phase
- Exposure vessel type: 2 l beaker with 1 l sea water
- Number of replicates and individuals: 1 mussel per replicate
DURATION OF THE TEST: no data
SAMPLING: analysis of mussels
MONITORING OF TEST SUBSTANCE CONCENTRATION: no data

Reliability : (3) invalid
Documentation insufficient for assessment

15.01.2004 (92)

3.8 ADDITIONAL REMARKS

Memo : Oxidation by Pseudomonas sp.

Result : Isolated degradation products:
1,2-dihydronaphthalene (CAS No. 447-53-0)
1,2,3,4-tetrahydro-1-naphthol (CAS No. 529-33-9)
The authors assumed dehydrogenation followed by hydroxylation

Test condition : INOCULUM/TEST ORGANISM
- Species/strain: Pseudomonas sp.
- Source: isolated from local groundwater
- Initial cell concentration: ca. 130 cells/ml
TEST SYSTEM
- Culturing apparatus: 200 ml test solution
INITIAL TEST SUBSTANCE CONCENTRATION: 10 mg/l
DURATION OF THE TEST: 3 days
TEST CONDITIONS
- Additional substrate: 10 mg/l nutrient broth
- Test temperature: 20 degree C
SAMPLING: Extraction with CH2Cl2
ANALYTICAL PARAMETER: degradation products (GC / MS / retention time)

Test substance : Origin: Fluka Chem. Samples Co.

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

19.08.2003 (85)

Memo : Oxidation by bacteria (pure culture), attack on aromatic moiety

Result : - Corynebacterium sp. strain C125 is able to use (among others) 1,2,3,4-tetrahydronaphthalene as the sole source of carbon and energy. The growth rate is moderate for the title compound.
- Succinate-grown cells were not adapted to the aromatic compounds tested.
- The proposed pathway for the degradation of 1,2,3,4-tetrahydronaphthalene is:
(1) 1,2,5,6,7,8-hexahydro-cis-1,2-naphthalene diol, i.e. hydroxylation of the aromatic nucleus;
(2) 5,6,7,8-tetrahydro-1,2-naphthalene diol, i.e. dehydrogenation leading back to aromaticity;
(3) 4-(2'-oxocyclohexane)-2-hydroxy-2,4-butadienoic acid, i.e. ring fission

next to saturated ring and terminal oxidation in previously aromatic structure

Test condition : INOCULUM/TEST ORGANISM
- Species/strain: Corynebacterium sp. strain C125
- Source: Isolated by authors on o-xylene (CAS No. 95-47-6) in previous study
- Method of cultivation: In solution with
15 g of Oxoid no. 3 agar/l
and the following mineral medium:
K2HPO4 1.55 g/l
NaH2PO4 x 2 H2O 0.85 g/l
(NH4)2SO4 2.0 g/l
MgCl2 x 6 H2O 0.1 g/l
ZnSO4 x 7 H2O 2 mg/l
CaCl2 x 2 H2O 1 mg/l
FeSO4 x 7 H2O 5 mg/l
Na2MoO4 x 2 H2O 0.2 mg/l
CuSO4 x 5 H2O 0.2 mg/l
CoCl2 x 6 H2O 0.4 mg/l
MnCl2 x 2 H2O 1 mg/l
+ EDTA 10 mg/l;
Addition of
o-xylene (CAS No. 95-47-6) by the vapor phase or
1,2,3,4-tetrahydronaphthalene with a micropump or
succinate directly to the medium
- Initial cell concentration: 1 g total protein/l in incubation experiments; not reported for growth experiments
TEST SYSTEM
- Culturing apparatus:
100 ml serum bottles with 10 ml of test solution
- Measuring equipment: GC for CO2 evolution (headspace samples) and incubation extracts; MS for compound identification
- Closed vessels used: yes
INITIAL TEST SUBSTANCE CONCENTRATION: 7.5 mmol/l = 992 mg/l in incubation experiments; 0 in growth experiments
ANALYTICAL PARAMETER:
(1) turbidity and (2) CO2 evolution for growth monitoring
TEST CONDITIONS
- Composition of medium: 50 mM potassium phosphate buffer for incubation experiments; see above for growth experiments
- Test temperature: 30 degree C
- pH value: potassium phosphate buffer (7.0) for incubation experiments
- Other relevant factors:
Under specific conditions, the activities of selected enzymes could be inhibited in order to stop metabolism at certain steps.

Test substance : Source: Janssen Chimica (Beerse, Belgium); no further data

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

13.07.2004 (125)

Memo : Oxidation by bacteria (pure cultures), identification of eight strains

Result : - Direct addition of test substance: None of the 28 strains (i.e. excluding those identified in the present study) utilized 1,2,3,4-tetrahydronaphthalene.
- Addition of test substance via gas phase and via hydrophobic solvent:
Arthrobacter A177 positive with both
Corynebacterium C125 positive with both
Nocardia S3 positive with both
Pseudomonas A2 positive with gas phase addition

other strains negative.
- Isolation of additional strains
Acinetobacter T5 (gas phase method);
Arthrobacter T2 (gas phase method);
Arthrobacter T6 (solvent phase method);
Moraxella T7 (solvent phase method);
Thus eight strains of bacteria utilizing 1,2,3,4-tetrahydronaphthalene as sole source of carbon and energy have been obtained.

Test condition : INOCULUM/TEST ORGANISM
- Species/strain:
Acinetobacter T5 (isolated on tetrahydronaphthalene, present study);
Alcanigenes OBB65 (isolated on 1,3-dichlorobenzene);
Arthrobacter A177 (on o-xylene);
Arthrobacter T2 (on tetrahydronaphthtalene, present study);
Arthrobacter T6 (on tetrahydronaphthtalene, present study);
Aspergillus nidulans strain;
Corynebacterium C125 (on o-xylene);
Moraxella T7 (on tetrahydronaphthtalene, present study);
Mycobacterium E3 (on ethene);
Nocardia corallina (Rhodococcus sp.) V49;
Nocardia S3 (on styrene);
Pseudomonas A2 (on 1,3,5-trimethylbenzene);
Pseudomonas P47 (on D-phenylglycine);
Pseudomonas P53 (on o-cresol);
Pseudomonas putida C60 (on phenol);
Pseudomonas putida LW4 (on D-phenylglycine);
Pseudomonas strain 50 (isolated on benzene);
Rhodococcus S5 (on styrene);
Unidentified strain 102 (on lindane);
Unidentified strain C2 (on cyclohexane);
Unidentified strains EB1, EB2 (on ethylbenzene);
Unidentified strains EM1, EM3, EM4, EM6 (on benzene);
Unidentified strains KZ4, RA15 (on toluene);
Unidentified strains N1, N3 (on naphthalene);
Xanthobacter 124X (on styrene);
Yeast: Trichosporon cutaneum (on phenol).
- Source: inhouse and other culture collections;
Samples from hydrocarbon-polluted areas including sludge from industrial WWTPs and mud from the river Rhine
- Method of cultivation: On slants of 5 g glucose/l and 3.5 g yeast extract medium/l with 15 g Oxoid no. 3 agar/l
- Initial cell concentration: 1 g of soil inoculum in search for additional strains studies
TEST SYSTEM
- Culturing apparatus:
300 ml Erlenmeyer flasks with 50 ml test solution
- Measuring equipment: GC for CO2 evolution (headspace samples); UV-Vis (274 nm) for 1,2,3,4-tetrahydronaphthalene determination
- Closed vessels used: yes
INITIAL TEST SUBSTANCE CONCENTRATION:
(1) Direct addition: 5 ul/10 ml = 485 mg/l
(2) Via gas phase: ca. 16 ul/l = 15.5 mg/l
(3) Via partitioning from FC40 solution: ca. 15 ul/l = 14.6 mg/l
ANALYTICAL PARAMETER:
(1) turbidity and (2) CO2 evolution for growth monitoring
SAMPLING: daily
TEST CONDITIONS
- Composition of medium:
K2HPO4 1.55 g/l
NaH2PO4 x 2 H2O 0.85 g/l
NH4Cl 2.0 g

(NH4)2SO4 0.1 g/l
MgCl2 x 6 H2O 0.1 g/l
0.2 ml of trace elements solution (Vishniac & Santer 1957)
- Test temperature: 30 degree C
CONTROLS: yes (without 1,2,3,4-tetrahydronaphthalene)

Test substance : Source: Janssen Chimica (Beerse, Belgium); no further data

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

Flag : Critical study for SIDS endpoint

19.08.2003 (124)

Memo : Oxidation by bacteria from polluted soil, sludge, and water

Result : - Growth with 1,2,3,4-tetrahydonaphthalene as the sole carbon source occurred in several mixed cultures but in none of the 41 strains in pure culture.
- Pseudomonas stutzeri AS39 grew with 1,2,3,4-tetrahydronaphthalene vapour only in liquid culture. Salicylate-grown cells but not acetate-grown cells oxidized 1,2,3,4-tetrahydronaphthalene.
- Products of 1,2,3,4-tetrahydronaphthalene conversion by Pseudomonas stutzeri AS39 and by the other strains were:
1,2,3,4-tetrahydro-1-naphthol (CAS No. 529-33-9) and
1,2,3,4-tetrahydro-1-oxonaphthalene (CAS No. 529-34-0)
- Transformation and growth rates were low, which according to the authors is probably due to slow transport of 1,2,3,4-tetrahydonaphthalene to the reaction centers.

Test condition : INOCULUM/TEST ORGANISM
- Species/strain: Pseudomonas stutzeri AS39; 41 other strains
- Sampling site: 41 strains isolated from 32 different samples of polluted soils, mud, and waters from West Germany;
Pseudomonas stutzeri AS39 isolated from a coal dump overlayed by partly recultivated soil near Herten, Germany
- Method of cultivation:
Liquid cultures: Mineral salts medium (Dorn et al. 1974);
Solid media: 1.5 % Bacto agar added to liquid medium;
Supplementation: 0.05 % Yeast extract or vitamins solution
TEST SYSTEM
- Culturing apparatus:
<= 100 ml: shaking flasks
<= 200 ml: cylindrical bubbling columns
<= 750 ml: 1 l-fermentors
- Aeration device: Depending on apparatus, supported by magnetic stirring
- Closed vessels used: yes (teflon lined screwcaps)
INITIAL TEST SUBSTANCE CONCENTRATION: 0
ANALYTICAL PARAMETER:
- Test substance consumed: Sorption to cartridges, UV absorption
- Metabolites formed: Sorption to cartridges, elution, GC; identification by retention times / authentic standards
- Growth: Cell counting
TEST CONDITIONS
- Composition of medium: See "Method of cultivation" above
- Test temperature: 30 degree C
- Other relevant factors: Addition of test substance via vapor phase, i.e. with the aeration flow or from reservoirs in the test vessels
CONTROLS: blank plates

Test substance : Origin: Bergbau-Forschungs GmbH (Essen, Germany); Purity 99 %

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

Flag : Critical study for SIDS endpoint

19.01.2004 (119)

Memo : Oxidation by camphor (cytochrome P450) 5-monooxygenase

Result : IDENTITY OF THE REACTION PRODUCT:
1,2,3,4-tetrahydro-1-naphthol (CAS RN 529-33-9) was identified as reaction product by GC-MS;
(R)-(-)-1,2,3,4-tetrahydro-1-naphthol (CAS RN 23357-45-1) was identified as the predominant isomer by HPLC on a chiral stationary phase;
both identifications were confirmed by analyses of authentic standards;
the ratio (S) isomer / (R) isomer was approximately 0.04.
KINETIC RESULTS: The reaction obeys Michaelis-Menten kinetics. Dimethyl sulfoxide, methanol, and p-dioxane serve as accelerators; tetrahydrofuran is an inhibitor.
REVERSIBILITY:
No 1,2,3,4-tetrahydronaphthalene was identified when pure (R)-(-)-1,2,3,4-tetrahydro-1-naphthol was exposed to the reaction system.
FURTHER REACTION:
The primary reaction product identified above is further reacted under the test conditions leading to many small peaks in the chromatograms derived from the reaction mixture.

Test condition : - Enzyme system: Camphor (cytochrome P450) 5-monooxygenase, originally isolated from Pseudomonas putida PpG 786, here prepared from three Escherichia coli clones (DH5-alpha)
- Reaction system:
(1) Mixing of 1,2,3,4-tetrahydronaphthalene, buffer, enzyme subunits, and (for some studies) additional solvent;
(2) Pipetting 2.75 ml each of this mixture into 5-ml glass vials; teflon sealing to minimize adsorption;
(3) Starting the reaction by addition of 0.5 ml 24 M NADH in buffer;
(4) Reaction for various durations at 22 °C with shaking at approximately 80 rpm;
(5) Stopping the reaction by addition of 1 ml hexane and 0.5 g NaCl, vigorous mixing for 1 minute;
(6) Centrifugation and analysis
- Analysis: HPLC with chiral stationary phase; GC-FID; GC-MS

Test substance : 1,2,3,4-Tetrahydronaphthalene of Aldrich; no data on purity

Reliability : (1) valid without restriction
Test procedure in accordance with generally accepted scientific standards and described in sufficient detail

13.07.2004 (57)

Memo : Oxidation by fungi

Result : Products, yield, enantiomeric excess obtained with:
- Mortierella isabellina:
1,2,3,4-tetrahydro-1-naphthol (CAS No. 529-33-9),
17 %, 33 % excess R
- Helminthosporium species:
1,2,3,4-tetrahydro-1-naphthol (CAS No. 529-33-9),
3 %, 75 % excess R
1,2,3,4-tetrahydro-1-oxonaphthalene (CAS No. 529-34-0), 3 %
- Cunninghamella echinulata var. elegans
1,2,3,4-tetrahydro-1-naphthol (CAS No. 529-33-9),
23 %, 60 % excess R
1,2,3,4-tetrahydronaphthalenediol, 1.5 %
- Control: Autoclaved incubation gave no conversion
ADDITIONAL RESULTS:
- Incubation of Helminthosporium species with 1,2,3,4-tetrahydro-1-naphthol (CAS No. 529-33-9, racemat) gave 40 % recovery of the starting material with 97 % excess R plus 60 % 1,2,3,4-tetrahydro-1-

oxonaphthalene (CAS No. 529-34-0). The authors conclude that probably the S enantiomer was converted to the ketone leaving the R enantiomer unreacted.

Test condition : INOCULUM/TEST ORGANISM
- Species/strain: Mortierella isabellina, Helminthosporium species, Cunninghamella echinulata var. elegans
- Pretreatment: 3 days growth at 28 degree C
TEST SYSTEM
- Culturing apparatus: 1 l Erlenmeyer flask
- Number of culture flasks per concentration: e.g. 15
- Control: Autoclaved incubation (inactivated fungus)
INITIAL TEST SUBSTANCE CONCENTRATION: 0.1 or 1 g/l (unclear), solubilizer e.g. 20 ml ethanol/l
DURATION OF THE TEST: 72 hours
TEST CONDITIONS
- Test temperature: 25 degree C
INTERMEDIATES / DEGRADATION PRODUCTS:
- Isolation: Continuous extraction with methylene chloride for 96 hours, filtration, evaporation, separation by flash chromatography, combination of replicates
- Identification: Proton NMR, MS, IR, optical rotation analysis

Test substance : Commercial, purity checked, redistillation where necessary

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

19.01.2004 (64)

Memo : Pathway of anaerobic degradation

Result : - Growth: The culture N47 was able to grow with 1,2,3,4-tetrahydronaphthalene as the sole source of carbon and electrons.
- Metabolic pathway: The proposed initial pathway for the degradation of 1,2,3,4-tetrahydronaphthalene is:
(1) 5,6,7,8-tetrahydro-2-naphthoic acid, i.e. addition of a carbon to the aromatic ring;
(2) octahydro-2-naphthoic acid isomers, i.e. hydrogenation;
(3) decahydro-2-naphthoic acid isomers, i.e. further hydrogenation; may be a side reaction;
(4) a C11H16O4-diacid with an aliphatic double bond, i.e. ring cleavage; may be formed from (2) not via (3);
(5) cis-2-carboxycyclohexylacetic acid, i.e. further degradation.
- Common pathway: 5,6,7,8-tetrahydro-2-naphthoic acid and the further metabolites were also found as a metabolites of naphthalene and of 2-methyl naphthalene in studies with the same culture.
- Labelling experiments:
(a) Using 13C-bicarbonate buffer, the additional carbon was shown (for naphthalene) to come from the solution. The label was not found in metabolite (5), indicating that this carbon atom was eliminated again.
(b) Using 13C-naphthalene as starting material (label in position 1), the molecular weight of all metabolites was increased by one amu.
(c) Using perdeuterated naphthalene as starting material, five deuterium atoms were found in each of the metabolites (4) and (5).

Test condition : INOCULUM/TEST ORGANISM
- Type of sludge: naphthalene-degrading, sulfate-reducing bacterial culture
- Source: enriched from a contaminated aquifer
- Preparation of inoculum: Subcultures were inoculated with a 10% volume of the liquid phase in 100-ml serum bottles half-filled with carbonate-buffered, sulfide-reduced freshwater mineral medium (pH 7.4) with trace element solution SL10 and 10 mM sulfate.
TEST SYSTEM
- Culturing apparatus: 100-ml serum bottles

- Aeration device: Flushing with N2 / CO2 (80:20)
- Closed vessels used: yes, sealed with rubber stoppers
INITIAL TEST SUBSTANCE CONCENTRATION: 2-4 mg/50 ml
ANALYTICAL PARAMETER: Enrichment and derivatisation of degradation products, GC-MS analysis, comparison of mass spectra with those of reference compounds
TEST CONDITIONS
- Test temperature: 30 °C
- pH value: 7.4
SULFIDE MEASUREMENT: continuous

Test substance : 1,2,3,4-Tetrahydronaphthalene from Merck (Darmstadt, Germany); no information on purity

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

Flag : Critical study for SIDS endpoint

07.01.2004 (5)

4.1 ACUTE/PROLONGED TOXICITY TO FISH

Type	:	semistatic
Species	:	Brachydanio rerio (Fish, fresh water)
Exposure period	:	96 hour(s)
Unit	:	mg/l
LC0	:	= 2.4
LC50	:	= 3.2
LC100	:	= 7.9
Limit test	:	no
Analytical monitoring	:	yes
Method	:	Directive 92/69/EEC, C.1
Year	:	1992
GLP	:	yes
Test substance	:	other TS: 1,2,3,4-Tetrahydronaphthalene of Hüls AG, produced 29 October 1993 Purity 98.9 % (GC-FID area) Sample No. 1451/931130, Sample ID 0637/81590
Remark	:	In some test vessels, high oxygen consumption was observed. The prescribed oxygen level of >= 60 % saturation could not be maintained since the volatility of the test substance did not allow continuous aeration. As this effect was observed also at sublethal concentrations as well as with the solubilizer control, it was considered not to affect the result significantly.
Result	:	Control: 0 % dead Solvent: 0 % dead 1.5 mg/l: 0 % dead 2.4 mg/l: 0 % dead 3.7 mg/l: 80 % dead (6 died on day 3, 2 on day 4) 9.1 mg/l: 100 % dead (all died day 2) 7.9 mg/l: 100 % dead (all died day 2) LC50 after 24 h: > 9.1 mg/l after 48 h: 5.5 mg/l after 72 h: 3.5 mg/l after 96 h: 3.2 mg/l
Test condition	:	TEST ORGANISMS - Supplier: West Aquarium, Bad Lauterberg (Germany) - Wild caught: no - Age/size/weight/loading: 3 cm +/- 0.5 cm - Feeding: daily 1 % of body weight TetraMin - Pretreatment: Three times per week treatment with malachite green followed by 14 days under quarantine - Feeding during test: no STOCK AND TEST SOLUTION AND THEIR PREPARATION - Vehicle, solvent: 10 g test substance / l ethanol (abs.) - Concentration of vehicle/ solvent: 1.4 ml ethanol/l STABILITY OF THE TEST CHEMICAL SOLUTIONS: Analysis of one test solution per concentration level was repeated after 24 hours (parallel sample without fish). DILUTION WATER - Source: Drinking water (Gelsenwasser AG) - Aeration: no (test vessels covered) - Hardness: ca. 12 degree dH TEST SYSTEM - Concentrations: 3.5, 5.0, 7.0, 10, 14 mg/l (nominal) 1.5, 2.4, 3.7, 9.1, 7.9 mg/l (geometric mean of two analyses): (1) 1.9, 2.8, 5.4, 9.8, 9.9 mg/l (beginning of test)

(2) 1.2, 2.1, 2.6, 8.4, 6.3 mg/l (stability control)
The geometric mean analytical concentrations were used for the evaluation.
- Renewal of test solution: daily, freshly prepared
- Exposure vessel type: ca. 20 l aquarium with 10 l test solution
- Number of replicates, fish per replicate: 1, 10
- Test temperature: 20 degree C (constant)
- Dissolved oxygen: 13 - 102 % saturation.
Individual percentages (0 hours / 24 hours for daily solutions):

	day 1	day 2	day 3	day 4
control:	91/97 %	95/87 %	96/83 %	94/83 %
solvent:	93/102 %	92/87 %	94/76 %	92/13 %
1.5 mg/l:	94/101 %	93/87 %	93/85 %	96/19 %
2.4 mg/l:	93/99 %	93/72 %	94/74 %	94/14 %
3.7 mg/l:	94/97 %	94/61 %	91/18 %	93/25 %
9.1 mg/l:	95/98 %	92/62 %	-	-
7.9 mg/l:	95/98 %	92/84 %	-	-

- pH: 7.7 - 8.0
- Adjustment of pH: no
- Photoperiod: 16 hours light / 8 hours dark
MONITORING OF TEST SUBSTANCE CONCENTRATION: Photometric at 214 nm, applied to parallel solutions in deionized water

Reliability : (2) valid with restrictions
Guideline study with acceptable restrictions: Dissolved oxygen found low in several solutions

Flag : Critical study for SIDS endpoint

25.06.2004 (79)

Type : static
Species : Leuciscus idus melanotus (Fish, fresh water)
Exposure period : 48 hour(s)
Unit : mg/l
LC0 : = 16
LC50 : = 21
LC100 : = 30
Limit test : no
Analytical monitoring : no
Method : other: DIN 38412 part 15
Year : 1985
GLP : no
Test substance : other TS: 1,2,3,4-Tetrahydronaphthalene of Hüls AG, composition as prescribed by 1.1-1.4

Result : - Effect data (Mortality): after 48 hours
16 mg/l: 0 % dead
20 mg/l: 40 % dead
25 mg/l: 90 % dead
30 mg/l: 100 % dead
95 % confidence interval of LC50: 20 - 22 mg/l

Test condition : TEST ORGANISMS
- Strain: Leuciscus idus melanotus HECKEL ***
- Supplier: Fischzucht Eggers, Hohenwestedt (Germany) ***
- Wild caught: no ***
- Age/size/weight/loading: length 6 cm +/- 2 cm ***
- Feeding: daily 3 % of body weight TetraMin ***
- Pretreatment: single treatment with Zephirol 1:50,000 for 1 hour followed by 14 days under quarantine ***
- Feeding during test: no ***
STOCK AND TEST SOLUTION AND THEIR PREPARATION
- Dispersion: MARLOWET EF (castor oil, ethoxylated, 40 EO) was added as solubilizer

DILUTION WATER
- Source: dechlorinated drinking water ***
- Aeration: continuous ***
- Hardness: ca. 15 degree dH ***
TEST SYSTEM
- Concentrations: 16, 20, 25, 30 mg/l (nominal)
- Exposure vessel type: 10 l solution in 18 l aquarium ***
- Number of replicates, fish per replicate: 1, 10 ***
- Test temperature: 20 +/- 1 degree C ***
- Photoperiod: 8 hours light / 16 hours dark ***
NOTE: Data marked with *** are not included in the test report but were usual in the testing facilities by the time the test was performed according to other reports from that time.

Test substance : Hüls AG

Reliability : (3) invalid
Documentation insufficient for assessment: In view of the high volatility of the test substance, analytical monitoring and / or covering of test vessels would be required for reliable exposure information.

27.05.2004 (69)

4.2 ACUTE TOXICITY TO AQUATIC INVERTEBRATES

Type : static
Species : Daphnia magna (Crustacea)
Exposure period : 48 hour(s)
Unit : mg/l
EC0 : = 4.9
EC50 : = 9.5
EC100 : = 14
Limit Test : no
Analytical monitoring : yes
Method : Directive 92/69/EEC, C.2
Year : 1992
GLP : yes
Test substance : other TS: 1,2,3,4-Tetrahydronaphthalene of Hüls AG, produced 29 October 1993
Purity 98.9 % (GC-FID area)
Sample No. 1451/931130, Sample ID 0637/81590

Result : RESULTS: EXPOSED, CONTROL
- Effect data (Immobilisation): No. of immobile daphnia
Control: 0 (24 h) / 0 (48 h)
1.0 mg/l: 0 (24 h) / 0 (48 h)
1.7 mg/l: 0 (24 h) / 0 (48 h)
3.0 mg/l: 0 (24 h) / 0 (48 h)
4.9 mg/l: 1 (24 h) / 1 (48 h)
7.9 mg/l: 5 (24 h) / 5 (48 h)
14.0 mg/l: 20 (24 h) / 20 (48 h)
EC50 (24 h) = EC50 (48 h) = 9.5 mg/l
RESULTS: TEST WITH REFERENCE SUBSTANCE
- Concentrations: 1.0 mg/l / 2.0 mg/l
- Results: 45 % immobile / 100 % immobile (24 hours)

Test condition : TEST ORGANISMS
- Strain: Daphnia magna Straus, clone 5
- Source/supplier: Hüls AG (inhouse)
- Breeding method: in 1 l beakers with M4 medium (Elendt, 1990), water renewal each 2-3 days, isolation of offspring for further breeding each ca. 4 weeks
- Age: < 24 hours

- Feeding: Scenedesmus subspicatus, daily as much as consumed
- Pretreatment: Filtration of adults 24 h prior to testing
- Feeding during test: no
- Control group: 2 reference substance controls (1.0 and 2.0 mg/l), one blank

STOCK AND TEST SOLUTION AND THEIR PREPARATION
- Concentration: 1 g/l stirred in synthetic fresh water for 18 hours and filtered, no vehicle or solvent; analytical concentration 99 mg/l

REFERENCE SUBSTANCE: potassium dichromate, CAS RN 7778-50-9

DILUTION WATER
- Source: Synthetic:
  CaCl2 x 2 H2O: 294 mg/l
  MgSO4 x 7 H2O: 123 mg/l
  NaHCO3: 63 mg/l
  KCl: 5.5 mg/l
- Ca/Mg ratio: 4:1
- Na/K ratio: 10:1
- Aeration: none

TEST SYSTEM
- Concentrations:
  1.00, 1.7, 3.0, 4.9, 7.9, 14.0 mg/l (nominal)
  0.93, 1.7, 2.9, 4.8, 7.8, 14.0 mg/l (analysis at 0 hours)
  0.85, 1.5, 2.6, 4.4, 7.1, 12.0 mg/l (analysis at 48 hours)
  Since the geometric mean of the analytical concentrations after 0 and 48 hours deviated by less than 20% from the nominal concentrations, the latter were used for the evaluation.
- Renewal of test solution: no
- Exposure vessel type: round-bottom test tubes with 10 ml
- Number of replicates, individuals per replicate:
  4 replicates with 5 individuals each
- Test temperature: 20 +/- 1 degree C
- Dissolved oxygen: 8.4 - 8.7 mg/l
- pH: 7.9 - 8.1
- Adjustment of pH: no
- Photoperiod: dark

DURATION OF THE TEST: 48 hours

TEST PARAMETER: immobilisation

MONITORING OF TEST SUBSTANCE CONCENTRATION: photometric at 214 nm

Reliability : (1) valid without restriction
Guideline study

Flag : Critical study for SIDS endpoint

28.05.2004 (75)

Type : other: no data
Species : Daphnia magna (Crustacea)
Exposure period : 48 hour(s)
Unit : mg/l
EC50 : = 1.74 - 2.35
Limit Test : no
Analytical monitoring : no data
Method : other: QSAR study based on a data base (TerraTox) with 776 organic compounds.
Year : 2001
GLP : no data
Test substance : other TS: 1,2,3,4-Tetrahydronaphthalene, no further data

Result : Model: Exp. / Model 2 / Model 3 / Model 4 / Model 5 / ECOSAR
pT: 1.75 / 1.829 / 1.853 / 1.814 / 1.840 / 1.88
LC50: 2.35 / 1.960 / 1.855 / 2.029 / 1.911 / 1.74 mg/l

Test condition : 24 h- and 48 h-LC50 values were related by the following equation based

on 173 substances for which both data were available: DM48 = 0.991 x DM24 + 0.3274
All results are expressed in pT notation: pT = -log(mmol/l). QSAR values are for probabilistic neural network (PNN) models presented by the authors plus for ECOSAR (U.S. EPA).

Reliability : (4) not assignable
Data from handbook or collection of data (not peer reviewed)

27.05.2004 (83)

Type : static
Species : Daphnia pulex (Crustacea)
Exposure period : 48 hour(s)
Unit : mg/l
EC50 : = 2.412
EC10 : ca. .8
Limit Test : no
Analytical monitoring : no
Method : other: Am. Soc. Test. Mater. (1980) and U.S. EPA (1975)
Year : 1988
GLP : no
Test substance : other TS: 1,2,3,4-Tetrahydronaphthalene, minimum purity 96 %

Remark : Potential losses of test material, which may have occurred due to the high volatility of the test substance, were not determined analytically. Thus the results, which are based on nominal concentrations, may underestimate the toxicity of the test substance.
Result : EC50 = 2.412 +/- 0.9184 (standard error) mg/l
Test condition : TEST ORGANISMS
- Breeding method: Protocols as for test method
- Age: < 24 hours
- Feeding: Mixture of green algae from four single-species cultures combined with a cerophyl infusion at a ration of 1:1:1:1:4; Chlorella vulgaris, Chlorella pyrenoidosa, Ankistrodesmus falcatus, Chlamydomonas reinhardii
- Feeding during test: no
- Control group: water or solvent control
REFERENCE SUBSTANCE: DDT
DILUTION WATER
- Alkalinity: 120-125 mg/l as CaCO3
- Hardness: 160-180 mg/l as CaCO3
TEST SYSTEM
- Concentrations: series of 5 concentrations
- Renewal of test solution: no
- Exposure vessel type: beaker in water bath
- Number of replicates, individuals per replicate: 1 replicate with at least 10 individuals
- Test temperature: 20 degree C
- Dissolved oxygen: 8-9 mg/l
TEST PARAMETER: immobilization (no movement when prodded)
STATISTICAL METHODS: probit analysis for EC50 determination

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment
Flag : Critical study for SIDS endpoint
25.06.2004 (128)

Type : static
Species : Artemia salina (Crustacea)
Exposure period : 24 hour(s)
Unit : mg/l
EC50 : = 78

Limit Test	:	no
Analytical monitoring	:	no
Method	:	other: Tarzwell CM (1969). Proc. Joint Conf. on Prevention and Control of Oil Spills, sponsored by API and EPA
Year	:	1974
GLP	:	no
Test substance	:	other TS: Tetrahydronaphthalene, no further data
Remark	:	- It should be noted that the solubility in synthetic seawater is claimed in this study to be higher than that in pure water by a factor of about 8, which cannot be validated due to insufficient documentation (see also chapter 2.6.1). - Potential losses of test material, which may have occurred due to the high volatility of the test substance, were not determined analytically. Thus the results, which are based on nominal concentrations, may underestimate the toxicity of the test substance.
Test condition	:	TEST ORGANISMS - Source/supplier: dried eggs from Carolina Biological Supply Co., Burlington, N.C. - Breeding method: aeration in synthetic seawater until hatching was completed; settling out of unhatched eggs, concentration of shrimps in beam of light and transport to separate container - Control group: synthetic seawater - Age: 48 hours DILUTION WATER - Synthetic seawater: 557.37 g NaCl, 27.20 g CaSO4, 63.36 g MgSO4 x 7 H2O, 168.30 g MgCl2, 15.84 g KCl, 3.14 g MgBr2 x 6 H2O, all dissolved in 20 l of distilled water in this order TEST SYSTEM - Concentrations: 10, 18, 32, 56, 100 mg/l - Renewal of test solution: no - Exposure vessel type: 150 ml wide-mouth bottles, loosely capped - Number of replicates, individuals per replicate: 1; 30-50 - Test temperature: 24.5 degree C DURATION OF THE TEST: 24 hours TEST PARAMETER: no movement of the phyllopodia
Reliability	:	(2) valid with restrictions Study well documented, meets generally accepted scientific principles, acceptable for assessment

25.06.2004 (115)

4.3 TOXICITY TO AQUATIC PLANTS E.G. ALGAE

Species	:	Scenedesmus subspicatus (Algae)
Endpoint	:	biomass
Exposure period	:	72 hour(s)
Unit	:	mg/l
NOEC	:	= 3.6
EC10	:	= 3.8
EC50	:	= 7
EC90	:	= 13
Limit test	:	no
Analytical monitoring	:	yes
Method	:	Directive 92/69/EEC, C.3
Year	:	1992
GLP	:	yes

Test substance : other TS: 1,2,3,4-Tetrahydronaphthalene of Hüls AG, produced 29 October 1993
Purity 98.9 % (GC-FID area)
Sample No. 1451/931130, Sample ID 0637/81590

Result : RESULTS: EXPOSED AND CONTROL
- Cell density data:
Cells/ml after 0; 24; 48; 72 hours (mean)

Control:	2; 6; 22; 90 (x 10,000)
1.2 mg/l:	2; 7; 27; 108 (x 10,000)
2.0 mg/l:	2; 7; 23; 96 (x 10,000)
3.6 mg/l:	2; 6; 21; 84 (x 10,000)
6.0 mg/l:	2; 5; 14; 52 (x 10,000)
10.0 mg/l:	2; 5; 6; 17 (x 10,000)
17.0 mg/l:	2; 3; 3; 6 (x 10,000)

- Growth curves:
EC10 (growth rate) = 5.3 mg/l
EC50 (growth rate) = 11.0 mg/l
EC90 (growth rate) = 25.0 mg/l (extrapolated)

Test condition : TEST ORGANISMS
- Strain: Scenedesmus subspicatus (CHODAT (86.81 SAG))
- Source/supplier: Origin: Institute "Wasser-, Boden- und Lufthygiene", Berlin; further bred inhouse
- Laboratory culture: A preculture is seeded from a stock culture by transfer 3 days prior to begin of test. Test cultures are seeded from the latter.
- Controls: yes (0 mg test substance/l)
- Initial cell concentration: approximately 20,000 cells/ml
STOCK AND TEST SOLUTION AND THEIR PREPARATION
- Concentration of vehicle/solvent: 1 g test substance/l was stirred in deionized water for 18 hours and filtered. The resulting concentration was 63 mg/l. The maximum concentration tested was 17 mg/l. No vehicle or solvent was used.
STABILITY OF THE TEST CHEMICAL SOLUTIONS:
Parallel samples without algae were analyzed after 0 and 72 hours
GROWTH/TEST MEDIUM CHEMISTRY: As described in 92/69/EEC
TEST SYSTEM
- Test type: static
- Concentrations (measured unless stated otherwise):
1.20; 2.0; 3.6; 6.0; 10.0; 17.0 mg/l (nominal)
1.05; 1.8; 3.3; 5.7; 9.1; 16.1 mg/l (0 hours)
0.99; 1.7; 3.2; 5.4; 8.7; 15.1 mg/l (72 hours)
Since the analytical concentrations after 0 hours deviated by less than 20% from the nominal concentrations and the values at 72 hours indicate stability, nominal concentrations were used for the evaluation.
- Renewal of test solution: no
- Exposure vessel type: Sterile-aerated Erlenmeyer flasks on light benches
- Number of replicates: 5 (test substance) or 8 (control)
- Test temperature: 24 +/- 2 degree C
- pH: 8.8-8.9 (beginning); 7.9-9.4 (end of test)
- Intensity of irradiation: approx. 8000 lux, white
TEST PARAMETER: Light absorption at 685 nm, related to cell density via calibration curve
MONITORING OF TEST SUBSTANCE CONCENTRATION
photometric at 214 nm
STATISTICAL METHODS
Probit analysis (Cavalli-Sforza, 1972)

Reliability : (1) valid without restriction
Guideline study

Flag : Critical study for SIDS endpoint

28.05.2004 (76)

4.4 TOXICITY TO MICROORGANISMS E.G. BACTERIA

Type	:	aquatic
Species	:	Pseudomonas putida (Bacteria)
Exposure period	:	5 hour(s)
Unit	:	mg/l
EC10	:	= 16
EC50	:	= 402
Analytical monitoring	:	no
Method	:	other: Inhibition of oxygen consumption by Pseudomonas putida (Hüls method)
Year	:	1994
GLP	:	yes
Test substance	:	other TS: 1,2,3,4-Tetrahydronaphthalene of Hüls AG, produced 29 October 1993 Purity 98.9 % (GC-FID area) Sample No. 1451/931130, Sample ID 0637/81590
Result	:	- Effect data: Percent effect 50 mg/l: 19.7 % 75 mg/l: 24.7 % 100 mg/l: 31.7 % 150 mg/l: 33.1 %
Test condition	:	TEST ORGANISMS - Strain: Pseudomonas putida Migula - Source/supplier: Dr. Reinhard Kanne (Bayer AG, Leverkusen) STOCK AND TEST SOLUTION AND THEIR PREPARATION - Dispersion: Vehicle stock solution: 10 ml nonylphenol ethoxylated (10 EO) and propoxylated (5 PO) + 190 ml aqua bidest., neutralized with phosphoric acid, final pH 7.0 Primary stock solution: 0.5 g test substance + 20 ml vehicle stock solution; Secondary stock solution: Primary stock solution diluted stepwise at levels designed to obtain the desired test concentrations by addition of 1 ml stock solution per test flask. - Concentration of vehicle/ solvent: 1 % (v/v) TEST SYSTEM - Test type: static - Concentrations: 50; 75; 100; 150 mg/l - Renewal of test solution: no - Exposure vessel type: 100 ml flasks, airtight, designed for BOD determination, filled completely - Number of replicates: 2 - Controls (No. of replicates): Test substance + HgCl2 for detn. of autoxidation (2) HgCl2 for determination of initial O2 concentration (4) blank for determination of baseline O2 consumption (5) - Test temperature: 25.5-27.0; mean 26.2 degree C - pH: ca. 7.0 DURATION OF THE TEST: 4.58 hours; end: addition of HgCl2 TEST PARAMETER: dissolved oxygen STATISTICAL METHODS: linear regression, probit analysis
Reliability	:	(2) valid with restrictions Study well documented, meets generally accepted scientific principles, acceptable for assessment; restriction: testing above solubility limit (but with solubilizer)
Flag	:	Critical study for SIDS endpoint

27.05.2004 (77)

Type	:	aquatic
Species	:	other bacteria: see Test Conditions
Exposure period	:	7 day(s)
Unit	:	mg/l
EC100	:	= 14.6
Analytical monitoring	:	no data
Method	:	other: see Test Conditions
Year	:	1991
GLP	:	no data
Test substance	:	other TS: 1,2,3,4-Tetrahydronaphthalene of Janssen Chimica (Beerse, Belgium); no further data
Result	:	The test substance was toxic at concentrations of 15 ul/l and higher for all strains.
Test condition	:	INOCULUM/TEST ORGANISM - Species/strain: criterion: ability to use 1,2,3,4-tetrahydronaphthalene as sole source of energy and carbon Acinetobacter T5 Arthrobacter A177 Arthrobacter T2 Arthrobacter T6 Corynebacterium C125 Moraxella T7 Nocardia S3 Pseudomonas A2 - Source: inhouse and other culture collections or isolated from samples from hydrocarbon-polluted areas - Method of cultivation: On slants of 5 g glucose/l and 3.5 g yeast extract medium/l with 15 g Oxoid no. 3 agar/l - Initial cell concentration: 1 g wet weight/l TEST SYSTEM - Culturing apparatus: 1 l serum bottles with 100 ml phosphate buffer (pH 7.0) - Measuring equipment: GC for CO2 evolution (headspace samples) - Closed vessels used: yes ANALYTICAL PARAMETER: CO2 evolution TEST CONDITIONS - Test concentrations: various, not reported - Test temperature: probably 30 degree C
Reliability	:	(2) valid with restrictions Study well documented, meets generally accepted scientific principles, acceptable for assessment

28.05.2004 (124)

4.5.1 CHRONIC TOXICITY TO FISH

4.5.2 CHRONIC TOXICITY TO AQUATIC INVERTEBRATES

4.6.1 TOXICITY TO SEDIMENT DWELLING ORGANISMS

4.6.2 TOXICITY TO TERRESTRIAL PLANTS

Species	:	other terrestrial plant: peas, lettuce, spinach, carrot, onion, timothy

Endpoint	:	other: herbicidal properties
Exposure period	:	
Unit	:	
Method	:	other
Year	:	1948
GLP	:	no
Test substance	:	other TS: "pure" Tetrahydronaphthalene, no further dat
Result	:	- Rating: 9 = complete, rapid kill; A = Acute; tolerated by no crop
Test condition	:	- Application: with hand-operated atomizer to obtain good coverage of leaves - Cultivation: greenhouse conditions, 70 to 80 degree F = 21.1 - 26.7 degree C - No. of replicates: 2 - Rating for evaluation: 1 = no injury / 9 = complete, rapid kill A = acute / C = chronic
Reliability	:	(4) not assignable Documentation insufficient for assessment

27.05.2004 (61)

Species	:	other terrestrial plant: bean, citrus, cotton, maize, rape, soybeans, tomato
Endpoint	:	other: leaf damage (visual assessment)
Exposure period	:	
Unit	:	
Method	:	other: see Test Conditions
Year	:	1986
GLP	:	no data
Test substance	:	other TS: Tetrahydronaphthalene, no further data
Result	:	- Rating for 1,2,3,4-tetrahydronaphthalene: 6.0 - 8.0
Test condition	:	- Test organisms: One to two months post emergent, three to five leaf stage; additional species wheat not considered in evaluation because of poor growth - Application: hand-held spinning disc applicator - Doses: 10, 20, 40, and 80 l/ha single dose (1-4 l/ha is usual in pesticide use) - Evaluation: Visual inspection by three assessors Inspection at various time intervals up to 2 months Visual assignment to < 10 % or > 10 % leaf damage Different indices for overall observations Overall index on relative scale from 1 (least phytotoxic) to 10 (most phytotoxic)
Reliability	:	(4) not assignable Documentation insufficient for assessment

27.05.2004 (90)

4.6.3 TOXICITY TO SOIL DWELLING ORGANISMS

4.6.4 TOX. TO OTHER NON MAMM. TERR. SPECIES

Species	:	Musca domestica (arthropod (Diptera))
Endpoint	:	mortality
Exposure period	:	24 hour(s)
Unit	:	other: ml/individual
LC100	:	<= .0002

Method	:	other
Year	:	1954
GLP	:	no
Test substance	:	other TS: Tetralin, no further data
Result	:	100 % knockdown caused by standard dose
Test condition	:	TEST ORGANISMS - Strain: Musca domestica L (K1 strain) - Age / weight / sex: 3 days / mean 17.5 mg / females - Pretreatment: Immobilization by chilling with cold water TEST SYSTEM - Test type: single dose / observation after 24 hours - Doses: 0.0002 ml / individual - Application: to ventral abdomen - Number of replicates: at least 10 x 10 flies - Controls: yes, no details - Test temperature: 23 degree C after treatment TEST PARAMETER: knockdown after 24 hours
Reliability	:	(2) valid with restrictions Study well documented, meets generally accepted scientific principles, acceptable for assessment

27.05.2004 (87)

4.7 BIOLOGICAL EFFECTS MONITORING

4.8 BIOTRANSFORMATION AND KINETICS

4.9 ADDITIONAL REMARKS

Memo	:	Electroantennogram studies and attraction assays in fruit flies
Result	:	- Electroantennogram (EAG) assay: Clear effect with positive dose-response relationship; Females more sentive than males Maximum effect ca. 60% that of 100 µg hexanal - Attraction assay: No flies attracted for 4 minutes 1 fly attracted after 5 minutes 2-5 flies attracted thereafter Classification "attractive"
Test condition	:	TEST ORGANISMS - Strain: Ceratitis capitata (Wied.) - Cultivation: at 26 +/- 1 °C, 70 +/- 5% rel. humidity; photoperiod 16 hours light / 8 hours dark; - Age/size/weight/loading: 5 to 6 days after emergence - Feeding: diet of sugar, hydrolyzed protein and water - Pretreatment: segregation according to sex TEST SYSTEM - Test type "Electroantennogram (EAG) assay" - Number of individuals: 5 per sex, each tested sequentially with all dosages - Dosing: six different dosages ranging from 0.01 to 1,000 µg and separated by factors of 10 - Control: Dichloromethane (10 µl) - Standard: Hexanal (100 µg) - Observation: Signal recorded on oscilloscope coupled to computer

Test type "Attraction assay"
- Number of individuals: 100 females
- Test vessel: 30 x 30 x 30 cm3 cage, homogeneously illuminated
- Adaptation: 24 hours prior to assay
- Feeding: Food was removed 30 min before the assay; water was continuously available
- Dosing: 1 mg test substance on a 3 x 3 cm2 filter paper in one upper corner of the cage; a second filter with the control substance in the opposite corner
- Observation: Counting number of flies attracted to filter paper with test substance every minute for 15 minutes.

Test substance : 1,2,3,4-Tetrahydronaphthalene, probably commercial, purified; no data on final purity

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

05.01.2004 (62)

Memo : Treatment of head lice

Result : 0/80 lice dead in control
26/101 lice dead with 1% solution
50/50 lice dead with 10% solution

Test condition : - Test organisms: Live adult head lice were collected off school children, pooled together and tested within 2 hours.
- Exposure: 5 cm diameter cellulose filter papers were dipped into solutions (see below) of the test substance in isopropanol and dried.
- Doses: 1% and 10% solutions
- Control: unimpregnated filter papers
- Number of test organisms: 10 per filter paper
- Exposure period: 2 hours
- Observation: Mortality judged by absence of internal or external movement on tactile stimulation.

Test substance : 1,2,3,4-Tetrahydronaphthalene of Sigma-Aldrich Co. Ltd. (Poole, Dorset, UK); no data on purity

Reliability : (4) not assignable
Documentation insufficient for assessment

06.01.2004 (45)

Memo : Treatment of housefly larvae

Result : Mortality: 99%

Test condition : TEST ORGANISMS:
Larvae of houseflies (Musca domestical L.)
Age: 5 to 7 days
Number: 25 larvae for each test substance
Control: 25 larvae, concurrent no treatment
TEST SYSTEM:
Immersion in test material for 5 seconds,
Placing on filter paper for at least 5 minutes,
Mortality counts after 24 hours
Average of 4 tests (= total of 100 larvae)

Test substance : Tetrahydronaphthalene, no further information

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

02.06.2004 (96)

Memo : Treatment of plant neoplasms

Method : Search for substances selectively eradicating plant neoplasms
Result : A concentration of 5 % v/v 1,2,3,4-tetrahydronaphthalene caused the following ratings:
- 0 on axillary bud, leaf, petiole, and stem
- 4-5 on tumor
1,2,3,4-tetrahydronaphthalene was one of the most selective and most useful substances for plant tumor treatment.
Test condition : - Test organism: Crown gall tumors 2 cm in diameter, incited on 2- to 3-month-old tomato plants by Agrobacterium tumefaciens
- Application: Test substances were dissolved in SA 360 paraffin oil and liberally swabbed on tumors and surrounding healthy stem, leaf blades, axillary buds, and petioles
- Test concentrations: 1, 5, or 15 % v/v initially, modified in a second test series based on results from first test series
- Evaluation: Observation for 7-14 days (or longer), rating of injury on axillary bud, leaf, petiole, stem, and tumor on a scale from 0 to 5.
Test substance : 1,2,3,4-Tetrahydronaphthalene. Practical and technical grades were used. Mixtures with other hydrocarbons and emulsions were used in search for the most effective formulation.
Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

07.10.2003 (120)

5.0 TOXICOKINETICS, METABOLISM AND DISTRIBUTION

In Vitro/in vivo : In vivo
Type : Toxicokinetics
Species : rat
Number of animals
Males : 5
Females : 5
Doses
Males : vehicle; 15; 50; 150 mg/kg bw d; 150 mg/kg bw d reversal group
Females : vehicle; 15; 50; 150 mg/kg bw d; 150 mg/kg bw d reversal group
Vehicle : other: corn oil
Route of administration : gavage
Exposure time : 28 day(s)
Product type guidance :
Decision on results on acute tox. tests :
Adverse effects on prolonged exposure : See chapter 5.4
Half-lives : 1st: 1.5 hours
2nd: 4.7 hours
3rd:
Toxic behaviour : see chapter 5.4
Deg. product : not measured
Method : other: Directive 84/449/EEC, B.7 (1992), modified
Year : 1995
GLP : yes
Test substance : other TS: tetrahydronaphthalene of Hüls AG, produced 02 February 1993
Purity 98.5 %
Sample No. 0099 (internal)
Sample ID 3633/81495

Result : MAXIMUM CONCENTRATIONS FIRST / SECOND DAY OF SAMPLING:
low dose, male: 0.78 mg/l (36 min) / 0.62 mg/l (34 min)
low dose, female: 0.76 mg/l (30 min) / 1.35 mg/l (29 min)
mid dose, male: 2.57 mg/l (99 min) / 1.04 mg/l (90 min)

mid dose, female: 3.46 mg/l (43 min) / 3.14 mg/l (84 min)
high dose, male: 19.01 mg/l (30 min) / 5.54 mg/l (31 min)
high dose, female: 9.64 mg/l (30 min) /12.02 mg/l (88 min)
"high dose" includes reversal group
Maximum concentrations of first sampling males > females
Maximum concentrations of second sampling females > males
=> The tetrahydronaphthalene blood concentration maximum was reached approximately 30 minutes after administration of the highest dose.
AREA UNDER CURVE (AUC) FIRST / SECOND SAMPLING (mg*h/ml)
low dose, male: 1.70 / 1.57
low dose, female: 1.22 / 2.61
mid dose, male: 6.81 / 6.29
mid dose, female: 5.91 / 8.26
high dose, male: 72.32 / 51.23
high dose, female: 71.89 / 81.81
"high dose" includes reversal group
AUC of second sampling always lower with males, higher with females as compared to first sampling
=> The AUC of the high dose groups is more than proportional higher than that of the lower dose groups indicating that elimination may be saturated at this dose level. An accumulation of test substance after repeated oral administration of up to 150 mg/kg body weight was, however, not observed.
FIRST ORDER HALF LIVES OF ELIMINATION (1 compartment model)
high dose, male: 82.2 min
reversal, male: 99.5 min
high dose, female: 80.8 min
reversal, female: 85.0 min
FIRST ORDER HALF LIFE OF ELIMINATION (2 compartments model)
ca. 4.7 hours (males)
=> After 23 hrs, only traces of test substance were detectable in the blood. The elimination half life was determined in the range of 30 to 100 minutes. In the low and mid dose groups, elimination was almost finished after 6 hours.
OTHER / GENERAL OBSERVATIONS:
Dark coloured urine was observed in all treated animals.

Test condition : TEST ORGANISMS
- Strain: Wistar (Hsd/Win:WU)
- Source: Harlan Winkelmann, Borchen (Germany)
- Age: 6 - 8 weeks
- Weight at study initiation:
range of group mean weights, males: 190-200 g
range of group mean weights, females: 146-155 g
- Number of animals: total 30 males, 30 females
ADMINISTRATION / EXPOSURE
- Vehicle: corn oil
- Total volume applied: 2 ml/kg bw
SATELLITE GROUPS AND REASONS THEY WERE ADDED: additional 150 mg/kg bw d and control group for recovery study
CLINICAL OBSERVATIONS AND FREQUENCY:
- Clinical signs: twice daily (weekends: once daily); detailed once a week
- Mortality: twice daily (weekends: once daily)
- Body weight: before first treatment, weekly thereafter until day of necropsy
- Food consumption: weekly for each cage (5 rats/cage)
- Water consumption: daily for each cage
- Ophthalmoscopic examination: control and high dose groups during acclimatization and prior to terminal bleeding

- Haematology: all animals once (terminal) for serum chemical and haematological investigations plus twice for toxicokinetics during study

(high dose group days 1 and 16; medium and low dose groups days 3 and 18 of treatment); detailed sampling times (approximately): sampling 0.5; 1.5; 3.0; 6.0; 23.0 hours after treatment on days 1 and 16 from one animal per sex and group each; sampling on days 2 and 17 from control groups sampling 0.5; 1.5; 6.0 hours after treatment on days 3 and 18 from 2; 2; 1 animals per sex and group additional sampling from two animals each of the high dose groups at five different times during the 14 day reversal period (first sampling was from non-reversal animals before their sacrifice); 200-500 ul/sample

- Urinalysis: end of study; non-satellite groups additionally on days 3 (males) and 4 (females)
ORGANS EXAMINED AT NECROPSY (MACROSCOPIC AND MICROSCOPIC):
- Macroscopic:
weights of adrenals, kidneys, liver, spleen, testes
adrenals, aorta (thoracic), anus, brain, caecum, coagulation gland, colon, concha (tattooed), duodenum, epididymides, eyes, exorbital lacrimal glands, gross lesions, heart, ileum, jaw (upper), jejunum, kidneys, larynx, liver, lungs, lymph nodes (skin, cervical & mesenteric), mammary gland, muscle (skeletal), ovaries, oesophagus, pancreas, pituitary, prostate, rectum, salivary glands, sciatic nerve, seminal vesicles, skin, spinal cord (cervical), spleen, stomach, testes, thymus, thyroid / parathyroid, tongue, trachea, urinary bladder, uterus, vagina
bone marrow smears
- Microscopic: eyes, kidney, liver, lung, lymph nodes, oesophagus, Peyer's patches, spleen, uterus
OTHER EXAMINATIONS: toxicokinetics: see separate report and entry
STATISTICAL METHODS:
- Kruskal Wallis non parametric analysis of variance, in case of significance followed by Wilcoxon, Mann, and Whitney U tests: body weights, body weight changes, organ weights, differential blood count, urine analysis data
- one way analysis of variance (ANOVA) incorporating Bartlett's test for homogeneity of variance and if indicated followed by Kruskal Wallis or Scheffe Test: haematological data (except differential blood count) and serum clinical chemistry data
- Median (geometric mean), minimum, maximum: differential blood count
DEVIATIONS FROM PROTOCOL: No fixation of tibia during necropsy

Conclusion : Resorption is rapid, but is probably decreased upon repeated dosing.

Reliability : (1) valid without restriction
Comparable to guideline study

Flag : Critical study for SIDS endpoint

06.05.2004 (80) (99)

In Vitro/in vivo : In vivo

Type : Metabolism

Species :

Number of animals

Males :

Females :

Doses

Males :

Females :

Vehicle :

Remark : Information on metabolism is reported in chapter 5.11.

06.05.2004

5.1.1 ACUTE ORAL TOXICITY

Type	:	LD50
Value	:	ca. 2860 mg/kg bw
Species	:	rat
Strain	:	Sherman
Sex	:	male
Number of animals	:	10
Vehicle	:	water
Doses	:	2,000; 2,520; 3,160; 3,980; 7,950 mg/kg bw, maybe additional doses
Method	:	other: Smyth HF Jr, Carpenter CP (1944): The place of the range finding test in the industrial toxicology laboratory. J. Ind. Hyg. Toxicol. 26, 269-273 and subsequent updates
Year	:	1949
GLP	:	no
Test substance	:	other TS: tetrahydronaphthalene procured from Eastman Kodak Co. under their number P550 on 10 Jan. 1949. No data on purity
Result	:	MORTALITY: LD50 = 2.86 (2.58-3.18) g/kg bw - Time of death: often delayed 3 to 4 days - Number of deaths at each dose: 2,000 mg/kg bw: 1/10 (day 5) 2,520 mg/kg bw: 2/10 (day 4) 3,160 mg/kg bw: 3+2+2/10 (days 1, 3, 4) 3,980 mg/kb bw: 3+2+3+2/10 (days 1, 2, 3, 4) other doses: not reported CLINICAL SIGNS: Following the doses, the rats exhibited symptoms of sluggishness, prostration, and narcosis. The urine had a brownish coloration. NECROPSY FINDINGS: A dose of 7,950 mg/kg bw produced severe lung hemorrhage, congestion of the liver, paleness of the kidney with edema in some instances, opacity and adhesions of the intestines. Several of the livers were jaundiced after the administration of a dosage of 3,980 mg/kg bw. This effect was not found at the higher level because of rapid death. Lower dosage levels produced similar symptoms of lesser intensity.
Test condition	:	TEST ORGANISMS: - Weight at study initiation: 90-120 g - Feeding: No previous withdrawal of food ADMINISTRATION: - Vehicle: Test substance fed by stomach tube as a 20% dispersion in 1% "Tergitol" 7 - Post dose observation period: 14 days EXAMINATIONS: - Statistical method: Thompson, W.R. (1947): Use of moving averages and interpolation to estimate median effective dose. Bact. Rev. 11, 115
Reliability	:	(2) valid with restrictions Study well documented, meets generally accepted scientific principles, acceptable for assessment. Restriction: Only male animals used (no evidence of sex specificity in other studies).
Flag	:	Critical study for SIDS endpoint

15.09.2004 (129) (141)

5.1.2 ACUTE INHALATION TOXICITY

Type	:	LC0
Value	:	> 1.3 mg/l
Species	:	rat
Strain	:	no data

Sex	:	male
Number of animals	:	6
Vehicle	:	
Doses	:	ca. 1.3 mg/l and higher
Exposure time	:	8 hour(s)
Method	:	other: Smyth HF Jr, Carpenter CP (1944): The place of the range finding test in the industrial toxicology laboratory. J. Ind. Hyg. Toxicol. 26, 269-273 and subsequent updates
Year	:	1949
GLP	:	no
Test substance	:	other TS: tetrahydronaphthalene procured from Eastman Kodak Co. under their number P550 on 10 Jan. 1949. No data on purity
Test condition	:	The maximum duration for no deaths of saturated vapor inhalation by rats is reported by Smyth et al. (1951). A vapor pressure of 24 Pa at 20 degree C corresponds to a concentration of 1.3 mg/l. Union Carbide (1992) add that 8 hour exposures to mist, which was generated by aerating the compound while it was heated to 170 °C, were also tolerated.
Reliability	:	(4) not assignable Documentation insufficient for assessment

16.01.2004 (129) (141)

5.1.3 ACUTE DERMAL TOXICITY

Type	:	LDLo
Value	:	> 7300 mg/kg bw
Species	:	rat
Strain	:	Wistar
Sex	:	male
Number of animals	:	2
Vehicle	:	
Doses	:	1,800; 3,600; 7,300 mg/kg bw
Method	:	other: Acute dermal toxicity
Year	:	1983
GLP	:	no data
Test substance	:	no data
Result	:	All doses caused mild skin irritation, otherwise no systemic effects.
Test condition	:	TEST ORGANISMS: - Weight at study initiation: 225-306 g ADMINISTRATION: - Area covered: shaved, approximately 20-25 % of body surface - Occlusion: no - Vehicle: none - Total volume applied: maximum 2.0 ml per rat
Reliability	:	(2) valid with restrictions Study well documented, meets generally accepted scientific principles, acceptable for assessment

18.12.2003 (29)

Type	:	LD50
Value	:	ca. 16800 mg/kg bw
Species	:	rabbit
Strain	:	no data
Sex	:	male
Number of animals	:	5
Vehicle	:	other: undiluted
Doses	:	12.6; 15.8; 20.0 g/kg bw

Method	:	other: Smyth HF Jr, Carpenter CP (1944): The place of the range finding test in the industrial toxicology laboratory. J. Ind. Hyg. Toxicol. 26, 269-273 and subsequent updates
Year	:	1949
GLP	:	no
Test substance	:	other TS: tetrahydronaphthalene procured from Eastman Kodak Co. under their number P550 on 10 Jan. 1949. No data on purity
Result	:	MORTALITY: LD50 = 17.3 (14.5 - 20.6) ml/kg bw = 16.8 (14.1 - 20.0) g/kg bw - Number of deaths at each dose: 12,600 mg/kg bw: 1/5 on day 4 15,800 mg/kg bw: 1/5 on day 13 20,000 mg/kg bw: 1+2+1/5 on days 11, 12, 14 CLINICAL SIGNS: Upon removal of the covering the skin was erythematous, on subsequent examination it was necrosed and ultimately leathery and dry. NECROPSY FINDINGS: Autopsy revealed pale livers and kidneys and congestion of the pancreas and intestines.
Test condition	:	TEST ORGANISMS: - Weight at study initiation: 2,202-2,718 g ADMINISTRATION: - Area covered: clipped trunk - Occlusion: impervious flexible film ("vinylite" sheeting) - Exposure period: 24 hours - Observation period: 14 days EXAMINATIONS: - Statistical method: Thompson, W.R. (1947): Use of moving averages and interpolation to estimate median effective dose. Bact. Rev. 11, 115
Reliability	:	(2) valid with restrictions Study well documented, meets generally accepted scientific principles, acceptable for assessment
Flag	:	Critical study for SIDS endpoint

18.12.2003 (129) (141)

5.1.4 ACUTE TOXICITY, OTHER ROUTES

5.2.1 SKIN IRRITATION

Species	:	rabbit
Concentration	:	undiluted
Exposure	:	Occlusive
Exposure time	:	4 hour(s)
Number of animals	:	3
Vehicle	:	other: no vehicle
PDII	:	4.55
Result	:	moderately irritating
Classification	:	
Method	:	other: OECD Guideline 404 "Acute Dermal Irritation/Corrosion" (1981)
Year	:	1984
GLP	:	no
Test substance	:	other TS: Produced by Hüls AG, purity > 98 %, main impurities naphthalene and decahydronaphthtalene
Result	:	AVERAGE SCORE - Erythema: 3.11 - Edema: 1.56

- Irritation index: 4.55/8 = moderately irritant
REVERSIBILITY: not complete within 14 days

Test condition : TEST ANIMALS:
- Strain: Small white Russian, Chbb-SPF
- Sex: male and female
- Source: Dr. Karl Thomae GmbH, Biberach
- Weight at study initiation: 2.2-2.5 kg
- Number of animals: 3 males, 3 females
ADMINISTRATION/EXPOSURE
- Area of exposure: 6 cm2
- Occlusion: mull patch, polyethylene film, elastic dressing
- Vehicle: none
- Total volume applied: 0.5 ml
- Postexposure period: 14 days
- Removal of test substance: washing with warm water
EXAMINATIONS
- Scoring system: according to Draize
- Examination time points: 1, 24, 48, 72 hours, 6, 9, 11, and 14 days after administration of the test substance

Reliability : (2) valid with restrictions
Guideline study with acceptable restrictions: In deviation from OECD TG 404 occlusive dressing was used.

Flag : Critical study for SIDS endpoint

18.12.2003 (68)

Species : rabbit
Concentration : undiluted
Exposure : no data
Exposure time : 24 hour(s)
Number of animals : 5
Vehicle :
PDII : 4
Result : irritating
Classification :
Method : other: Smyth HF Jr, Carpenter CP (1944): The place of the range finding test in the industrial toxicology laboratory. J. Ind. Hyg. Toxicol. 26, 269-273 and subsequent updates
Year : 1949
GLP : no
Test substance : other TS: tetrahydronaphthalene procured from Eastman Kodak Co. under their number P550 on 10 Jan. 1949. No data on purity

Result : Symptoms: Moderate to marked erythema, intensity comparable to 2-ethyl hexyl acetate Irritation index: 4/10, where 4 is a slight erythema resulting of exposure to an undiluted sample of the test
substance.

Test condition : ADMINISTRATION/EXPOSURE
- Area of exposure: clipped belly
- Total volume applied: 0.01 ml
EXAMINATIONS
- Scoring system: Draize et al. (1944): Methods for the study of irritation and toxicity of substances applied topically to the skin and mucous membranes. J. Pharmacol. Exper. Therap. 82, 377; maximum scores: 10
- Examination time points: 24 hours after application

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

19.01.2004 (129) (141)

Species : rat
Concentration : undiluted

Exposure	:	Open
Exposure time	:	
Number of animals	:	2
Vehicle	:	
PDII	:	
Result	:	slightly irritating
Classification	:	
Method	:	other: Acute dermal toxicity
Year	:	1983
GLP	:	no data
Test substance	:	no data
Remark	:	No irritation index provided.
Test condition	:	TEST ORGANISMS: - Weight at study initiation: 225-306 g - Strain: COBS/Wistar - Sex: male ADMINISTRATION: - Area covered: shaved, approximately 20-25 % of body surface - Occlusion: no - Vehicle: none - Total volume applied: maximum 2.0 ml per rat
Reliability	:	(2) valid with restrictions Study well documented, meets generally accepted scientific principles, acceptable for assessment

21.01.2004 (29)

5.2.2 EYE IRRITATION

Species	:	rabbit
Concentration	:	undiluted
Dose	:	.1 ml
Exposure time	:	
Comment	:	not rinsed
Number of animals	:	3
Vehicle	:	none
Result	:	not irritating
Classification	:	
Method	:	other: OECD Guideline 405 "Acute Eye Irritation/Corrosion" (1981)
Year	:	1984
GLP	:	no
Test substance	:	other TS: Produced by Hüls AG, purity > 98 %, main impurities naphthalene and decahydronaphthtalene
Result	:	AVERAGE SCORE - Cornea: 0 - Iris: 0 - Conjunctivae (Redness): 1.33 - Conjunctivae (Chemosis): 0.22 - Overall irritation score: 5.17/110 = non irritant REVERSIBILITY: complete within 6 days
Test condition	:	TEST ANIMALS: - Strain: Small white Russian, Chbb-SPF - Sex: male and female - Source: Dr. Karl Thomae GmbH, Biberach - Weight at study initiation: 2.2-2.7 kg - Number of animals: 3 males, 3 females - Controls: untreated (left) eye

EXAMINATIONS
- Ophtalmoscopic examination: 1, 24, 48, 72 hours, 6 days after treatment
- Scoring system: Draize (1959); Appendix VI of 79/831/EEC
- Tool used to assess score: Na fluorescein / ophthalmic lamp / visual inspections

Reliability : (1) valid without restriction
Guideline study
Flag : Critical study for SIDS endpoint
18.12.2003 (67)

Species : rabbit
Concentration : undiluted
Dose : .5 ml
Exposure time :
Comment : not rinsed
Number of animals : 5
Vehicle : none
Result : slightly irritating
Classification :
Method : other: Carpenter CP, Smyth HF (1946): Chemical burns of the rabbit cornea, Am. J. Ophthalmol. 29, 1363-1372
Year : 1946
GLP : no
Test substance : other TS: tetrahydronaphthalene procured from Eastman Kodak Co. under their number P550 on 10 Jan. 1949. No data on purity

Result : - Overall irritation score: 1
"No damage"
Test condition : TEST ANIMALS:
- Strain: Albino, not specified
ADMINISTRATION/EXPOSURE
- Exposure period: 18 - 24 h
EXAMINATIONS
- Scoring system: maximum 10 scores
- Tool used to assess score: eye examined in strong diffuse daylight, then stained with fluorescein

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment
18.12.2003 (129) (141)

5.3 SENSITIZATION

Type : Guinea pig maximization test
Species : guinea pig
Concentration : 1st: Induction 20 % intracutaneous
2nd: Induction 100 % occlusive epicutaneous
3rd: Challenge 100 % occlusive epicutaneous
Number of animals : 20
Vehicle : other: corn oil
Result : not sensitizing
Classification : not sensitizing
Method : other: OECD Guideline 406 "Skin Sensitization" (1981)
Year : 1989
GLP : no
Test substance : other TS: produced by Hüls AG, purity ca. 98 %, main impurities 0.2 % naphthalene, 0.56 % decahydronaphthalene

Result : RESULTS OF TEST

- Sensitization reaction: 0/20 (none of the animals showed a positive reaction at 24 and 48 hrs)
- Irritation: No reaction was caused by the corn oil patch.
- Body weights: No treatment-related effects were observed.
- Clinical signs: After intracutaneous application, the places of injections showed intense erythema and edema as well as necroses in case of treatment with Freund's Complete Adjuvant (FCA), distinct erythema and edema in case of treatment with 20 % test substance, and slight erythema in case of treatment with corn oil.
- After removal of the first patch (i.e. 2nd induction treatment), all animals treated with FCA displayed at the locations of injection moderate to severe inflammation, part of them bleeding and showing crusts 24 hours after patch removal.

Test condition : TEST ANIMALS:
- Strain: Dunkin-Hartley (Bor: DHPW)
- Sex: female
- Source: F. Winkelmann, Borchen
- Weight at study initiation:
  test group mean 293 g; control group mean 301 g
- Number of animals: 20
- Controls: 10 animals; treatment: vehicle

ADMINISTRATION/EXPOSURE
- Induction schedule: single intracutaneous treatment, 1 week later dermal induction; slight to medium inflammation caused (10 % SDS in vaseline) before application of patch; patch removed after 48 h
- Challenge schedule: after 2 further weeks, occlusive epicutaneous, removal of patch after 24 h, readings after further 24 and 48 hours.

EXAMINATIONS
- Grading system:
  0 % of animals positive: no sensitisation
  1 - 8 % of animals positive: very slight sensitisation
  9 - 28 % of animals positive: slight sensitisation
  29 - 64 % of animals positive: distinct sensitisation
  65 - 80 % of animals positive: severe sensitisation
  81 -100 % of animals positive: extreme sensitisation

Reliability : (2) valid with restrictions
Guideline study with acceptable restrictions: No positive control (not required by 1981 version of Test Guideline)

Flag : Critical study for SIDS endpoint

25.07.2003 (72)

5.4 REPEATED DOSE TOXICITY

Type	:	
Species	:	guinea pig
Sex	:	male/female
Strain	:	no data
Route of admin.	:	oral feed
Exposure period	:	35 days (one animal only 10 days)
Frequency of treatm.	:	daily
Post exposure period	:	1 month (one animal)
Doses	:	ca. 1000 mg/kg bw
Control group	:	no
Method	:	other
Year	:	1942
GLP	:	no
Test substance	:	no data

Result : TOXIC RESPONSE/EFFECTS:

- Mortality and time to death: Animals died on days 22 (animal 2) and 35 (animal 1).
- Clinical signs: Piloerection, restlessness, apathy, immobility, and trembling
- Body weight gain: Weight loss down to 110 and 200 g for animals 1 and 2, respectively
- Food/water consumption: Food consumption reduced
- Haematology: Slight anemia and leucopenia
- Urinalysis: Oliguria, albuminuria, haematuria, increased formation of urine cylinders, dark green staining of urine
- Gross pathology: Skin application area showed squamous and crusted eczema (refers to additional animals with dermal application).
- Histopathology: Toxic centrilobular atrophia of the livers, signed by hyperaemia, cloudy swelling and fatty degeneration. Kidneys of all animals showed necrotic nephrosis. Lungs showed localised broncho-pneumonia. Additionally diarrhoea and a ulcerous gastritis were observed.
One animal was treated for 10 days and sacrificied one month after last treatment. Histopathology showed slight changes of liver and kidney.

Test condition : TEST ORGANISMS
- Weight at study initiation: 1. male 260 g; 2. female 275 g; 3. male 260 g
- Number of animals: 3
ADMINISTRATION / EXPOSURE
- Duration of test/exposure: animals 1 and 2: until death; animal 3: 1 month
- Doses: 0.25 g daily (= ca. 1.0 g/kg bw at 250 g bw)
- Post exposure period: ca. 20 days (animal 3)
CLINICAL OBSERVATIONS AND FREQUENCY:
- Clinical signs: daily
- Mortality: daily
- Body weight: at beginning and at 10 day intervals
- Haematology: at beginning and at 10 day intervals
- Urinalysis: daily after exposure
ORGANS EXAMINED AT NECROPSY (MACROSCOPIC AND MICROSCOPIC):
- Macroscopic: lung, liver, heart, kidney, brain, skin, others not specified
- Microscopic: liver, kidney, lung, skin, others not specified

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

20.01.2004 (23)

Type : Sub-acute
Species : rat
Sex : male/female
Strain : Wistar
Route of admin. : gavage
Exposure period : 28 days
Frequency of treatm. : daily
Post exposure period : 14 days recovery (satellite groups only)
Doses : 15; 50; 150 mg/(kg bw d)
Control group : yes, concurrent vehicle
NOAEL : = 15 mg/kg bw
LOAEL : = 50 mg/kg bw
Method : other: Directive 84/449/EEC, B.7 (1992)
Year : 1995
GLP : yes
Test substance : other TS: Hüls AG, produced 02 February 1993
Purity 98.5 %
Sample No. 0099 (internal)
Sample ID 3633/81495

Result : TOXIC RESPONSE/EFFECTS BY DOSE LEVEL:

- Mortality and time to death: No mortalities in either dose group
- Clinical signs:
Control group: slight alopecia for a maximum of 4 (males) and 19 (females) consecutive days; piloerection slight in females and moderate in males
Low dose: Alopecia in one female; piloerection slight to moderate in females (maximum 10 consecutive days) and throughout the study in males; squatting position and closed eyes in either sex (maximum 5 consecutive days)
Intermediate dose: Piloerection slight to moderate in all animals throughout the study; alopecia in one female; squatting position for several times in all animals; closed eyes in 7 animals (maximum 3 consecutive days); slightly abnormal gait and lop-sided head in one male
High dose: Slight to moderate piloerection (maximum 14 consecutive days in females / throughout the study in males); Squatting position in all females (maximum 5 consecutive days) at begin of study, repeatedly and transient in all males throughout the study; closed eyes for 1 (first) day in females and for up to 5 days in all males; reduced activity in all males on days 1 and 2; lethargy in two animals (1 day); tonic convulsions on day 2 and absence of auditory startle reflex in one male
Recovery groups: Complete absence of piloerection in all animals within several days after end of treatment

- Body weight gain: No statistically significant differences in either dose group of either sex.
Absolute body weights only affected significantly in all treated males (decrease) on days 7 and 21 and in high dose males additionally on day 28 (11.3 % below control). A gain in this latter group was the only significant observation in body weights during recovery.
- Food/water consumption: Food conversion rate was clearly increased in high dose males. Low and high dose females showed a less pronounced increase. Food conversion of high dose males decreased during recovery. No overt intergroup differences in water consumption were observed.

- Ophthalmoscopic examination: Cornea damages in several animals due to repeated blood sampling; no signs of test substance related effects in either dose group

- Clinical chemistry:
Sodium: statistically significant increases in all high dose animals and in low dose males, close to historical control data maximum in control males, still statistically increased after recovery in high dose males
Total bilirubin: Experimental difficulties (lipaemia, values close to detection limit) were met. No clear differences could be observed in treated versus control groups.
Calcium and creatinine: Increased only in females of intermediate dose group
Glucose: The range of historical control data was slightly exceeded in seven dosed animals (one low, two intermediate, four high dose animals including two recovery)
Other parameters: No clear pattern of change
Recovery group: For cholesterol, total bilirubin, and alkaline phosphatase small, yet significant differences were observed for both sexes

- Haematology:
Red blood cell count: decreased significantly in males and insignificantly in females of high dose group, improvement with males during recovery still left a significant decrease
Reticulocytes: significantly increased in high dose females
Eosinophiles: significant increase in high dose females
Recovery group: significant increase in haemoglobin and consequently in

MCV and MCH of dosed females
Other: Deviations in two individual intermediate dose animals could in one case be explained by application failure
- Urinalysis:
Colour: change to yellow-brown, darker colour in treated animals, not dose dependent
Urine sediment analysis: dose-dependent increase in oxalates, statistically significant in high dose males with individual values beyond the range of the historical control data also for three intermediate dose males. Recovery left oxalates of two individuals beyond the range of the historical control data. High presence of oxalates in urine was also observed in one or two individuals each of all female control and high dose groups including both recovery groups. Triplephosphates were significantly increased and erythrocytes significantly decreased in high dose males.
Urine volume: significantly increased in high dose females
Urine pH: significantly decreased in high dose females (6.80, control 8.20) and one intermediate dose female. Unusual presence of glucose in urine and high presence of ketone was also observed in the high dose female with the lowest pH of urine.

- Organ weights:
Relative kidney weights were insignificantly increased in high dose animals.
Relative spleen weights were increased statistically significantly in high dose males and insignificantly, not dose related in intermediate and high dose females. Absolute spleen weights were decreased in low dose females.
In the high dose male recovery group, absolute weight of spleen and relative weight of adrenals were increased.

- Gross pathology: No macroscopic lesions considered to be related to treatment were observed. There were rare cases of ophthalmia / ulceration of the cornea due to blood sampling and one subcutaneous purulent alteration due to application failure.
- Histopathology: Findings consisted of spontaneous lesions in males and females of all groups such as hydrometriosis of the uterus, calcification of Peyer's patches, hyaline casts in the kidney and multifocal lymphocytes in the lung. Acute and chronic lesions of the eyes due to bloodletting were observed occasionally. In the oesophagus subacute or chronic traumatization due to application failure was observed in some animals. There were also pigmentation in the lymph nodes cervicales caused by tattooing ears.
Kidneys: No lesions except hyaline casts, also in controls; no lesions in recovery group
Liver: Extramedullary haematopoiesis in animals of all groups, considered normal; no lesions in recovery group
Spleen: Treatment related slight increase of haematopoiesis in 4/5 high dose males and 2/5 high dose females
- Other: Several clinical signs in one intermediate dose female could be attributed at necropsy to an application failure.

Test condition : TEST ORGANISMS
- Source: Harlan Winkelmann, Borchen (Germany)
- Age: 6 - 8 weeks
- Weight at study initiation:
range of group mean weights, males: 190-200 g
range of group mean weights, females: 146-155 g
- Number of animals: total 30 males, 30 females
ADMINISTRATION / EXPOSURE
- Vehicle: corn oil
- Total volume applied: 2 ml/kg bw
SATELLITE GROUPS AND REASONS THEY WERE ADDED: additional

150 mg/kg bw d and control group for recovery study
CLINICAL OBSERVATIONS AND FREQUENCY:
- Clinical signs: twice daily (weekends: once daily); detailed once a week
- Mortality: twice daily (weekends: once daily)
- Body weight: before first treatment, weekly thereafter until day of necropsy
- Food consumption: weekly for each cage (5 rats/cage)
- Water consumption: daily for each cage
- Ophthalmoscopic examination: control and high dose groups during acclimatization and prior to terminal bleeding
- Haematology: all animals twice for toxicokinetics during study plus once (terminal) for serum chemical and haematological investigations:
sodium, potassium, calcium, aspartate aminotransferase, alanine aminotransferase, glucose, triglycerides, cholesterol, total bilirubin, blood urea nitrogen, creatinine, total protein, albumin
red blood cell count, total white blood cell count, platelet count, haemoglobin, haematocrit, erythrocyte indices (mean corpuscular volume, mean corpuscular haemoglobin concentration), differential white blood cell count, reticulocyte count
- Urinalysis: end of study; non-satellite groups additionally on days 3 (males) and 4 (females)
volume, specific gravity, pH, colour,
semiquantitative: protein, glucose, ketone, urobilinogen, blood ingredients
urine sediment analysis: leucocytes, erythrocytes, bacteria, epithelial cells (squamous), oxalate crystals, triple phosphate crystals, urate crystals
ORGANS EXAMINED AT NECROPSY (MACROSCOPIC AND MICROSCOPIC):
- Macroscopic:
weights of adrenals, kidneys, liver, spleen, testes
adrenals, aorta (thoracic), anus, brain, caecum, coagulation gland, colon, concha (tattooed), duodenum, epididymides, eyes, exorbital lacrimal glands, gross lesions, heart, ileum, jaw (upper), jejunum, kidneys, larynx, liver, lungs, lymph nodes (skin, cervical & mesenteric), mammary gland, muscle (skeletal), ovaries, oesophagus, pancreas, pituitary, prostate, rectum, salivary glands, sciatic nerve, seminal vesicles, skin, spinal cord (cervical), spleen, stomach, testes, thymus, thyroid / parathyroid, tongue, trachea, urinary bladder, uterus, vagina
bone marrow smears
- Microscopic: eyes, kidney, liver, lung, lymph nodes, oesophagus, Peyer's patches, spleen, uterus
OTHER EXAMINATIONS: toxicokinetics: see separate report and entry
STATISTICAL METHODS:
- Kruskal Wallis non parametric analysis of variance, in case of significance followed by Wilcoxon, Mann, and Whitney U tests: body weights, body weight changes, organ weights, differential blood count, urine analysis data
- one way analysis of variance (ANOVA) incorporating
Bartlett's test for homogeneity of variance and if indicated followed by Kruskal Wallis or Scheffe Test: haematological data (except differential blood count) and serum clinical chemistry data
- Median (geometric mean), minimum, maximum: differential blood count
DEVIATIONS FROM PROTOCOL: No fixation of tibia during necropsy

Reliability : (1) valid without restriction
Guideline study

Flag : Critical study for SIDS endpoint

20.01.2004 (78)

Type :
Species : rat
Sex : male
Strain : no data
Route of admin. : other: oral feed / s.c. / i.v.

Exposure period	:	1+1+11 days (no treatment on days 2-5 and 7-11)
Frequency of treatm.	:	13 times
Post exposure period	:	6 days
Doses	:	0.1 ml/animal and application
Control group	:	no data specified
Method	:	other: See Test Conditions
Year	:	1935
GLP	:	no
Test substance	:	other TS: purified 1,2,3,4-Tetrahydronaphthalene
Result	:	TOXIC RESPONSE/EFFECTS BY DOSE LEVEL: - Mortality and time to death: No mortalities - Food/water consumption: Decreased (not quantified) - Urinalysis: Variations in quantity; Nitrogen concentration approximately constant, increased upon repeated exposure indicating increase of protein conversion rate; Carbon content and COD significantly increased; No proteins found; Dark discoloration only after repeated application or after application of test substance not purified from hydroperoxides. - Gross pathology: Yellow stained, slightly swelled kidneys and livers - Histopathology: No findings in kidneys and livers
Test condition	:	TEST ORGANISMS - Weight at study initiation: range 170-270 g (adults) - Number of animals: 2 per route of application, total 6 ADMINISTRATION / EXPOSURE - Duration of test/exposure: Days 1, 6, 12-22 - Type of exposure: oral, s.c., or i.v. CLINICAL OBSERVATIONS AND FREQUENCY: - Body weight: daily - Food consumption: daily - Urinalysis: daily 24 hour-samples analyzed for nitrogen, carbon, and chemical oxygen demand ORGANS EXAMINED AT NECROPSY (MACROSCOPIC AND MICROSCOPIC): - Macroscopic: liver, kidney, others not listed - Microscopic: liver, kidney
Reliability	:	(2) valid with restrictions Study well documented, meets generally accepted scientific principles, acceptable for assessment

15.08.2003 (84)

Type	:	
Species	:	rabbit
Sex	:	no data
Strain	:	no data
Route of admin.	:	oral feed
Exposure period	:	14 days
Frequency of treatm.	:	daily
Post exposure period	:	yes, duration not reported
Doses	:	2 g/day
Control group	:	no data specified
Method	:	other: No standard method
Year	:	1922
GLP	:	no
Test substance	:	no data
Result	:	TOXIC EFFECTS: - Mortality and time to death: no mortalities

- Clinical signs: not reported
- Urinalysis: Reduced urine secretion, red-brownish colour of urine, increased number of erythrocytes in urine.
- Gross pathology: No findings in kidneys and livers
- Other: Abortion of 6 dead fetuses on day 3 in one female

Test condition : Number of animals exposed not provided.
Reliability : (4) not assignable
Documentation insufficient for assessment

15.08.2003 (117)

Type :
Species : dog
Sex : no data
Strain : no data
Route of admin. : oral feed
Exposure period : 14 days
Frequency of treatm. : daily
Post exposure period : no data
Doses : 5 g/day
Control group : no data specified
Method : other: No standard method
Year : 1922
GLP : no
Test substance : no data

Result : TOXIC EFFECTS:
- Mortality and time to death: no mortalities
- Clinical signs: diarrhoea
- Urinalysis: Oliguria, albuminuria, increased formation of urine cylinders, dark staining of urine

Test condition : Number of animals exposed not provided.
Reliability : (4) not assignable
Documentation insufficient for assessment

15.08.2003 (117)

Type : Sub-chronic
Species : rat
Sex : male/female
Strain : Fischer 344
Route of admin. : inhalation
Exposure period : 13 weeks
Frequency of treatm. : 6 h/day, 5 days/week; additionally: last sunday before terminal sacrifice
Post exposure period : sacrifice on day after last exposure
Doses : 7.5; 15; 30; 60; 120 ppm = 41.2; 82.4; 165; 330; 660 mg/m3 (nominal)
Control group : yes, concurrent no treatment
NOAEL : < 41.2 mg/m³
LOAEL : = 41.2 mg/m³
Method : other: NTP Test Protocol, see Test Conditions
Year : 1996
GLP : yes
Test substance : no data

Result : TOXIC RESPONSE/EFFECTS BY DOSE LEVEL:
- Mortality and time to death: no mortalities in any group
- Clinical signs: no clinical abnormalities in any group
- Body weight gain: lower by 6.1 % (males) and 5.7 % (females), respectively, in highest dose groups
- Clinical chemistry: Minimal nephropathy was observed in males in the higher exposure groups. Clinical chemistry data were consistent with nephropathy.

- Haematology: A modest regenerative anemia was observed in both sexes, primarily in groups exposed to 60 and 120 ppm.
- Urinalysis:
Dark-stained urine at 30, 60, and 120 ppm.
Urine aspartate aminotransferase values significantly higher in males (ca. 2.5) and females (ca. 17 times control values) at the 120 ppm level.
Urine lactic dehydrogenase (LDH):creatinine ratio significantly, but modestly increased in the two highest dose levels, LDH activity increased in 120 ppm females group.
- Organ weights:
Kidney: Increased right kidney:body weight ratio in males (15, 60, and 120 ppm) and females (15 ppm and higher); mean absolute right kidney weight slightly increased in all treated groups;
Liver: Liver:body weight ratios increased in males (15 and 120 ppm) and females (60 and 120 ppm); mean absolute liver weight slightly increased in all groups exposed;
- Gross pathology: no gross observations in any dose group
- Histopathology:
Olfactory necrosis and regeneration, confirming the irritation potential of 1,2,3,4-tetrahydronaphthalene. The NOAEL for nasal lesions was 15 ppm in males and 7.5 ppm in females.
Hyaline droplet accumulation in kidneys of males increased slightly with increased exposure; a NOAEL was not clear.
Minimal nephropathy in males in the higher exposure groups
- Other: Concentrations of a2u-globulin generally increased with exposure concentration and time on study.

Test condition : TEST ORGANISMS
- Source: Taconic, Germantown (New York, USA)
- Age: approximately 6 weeks at first exposure
- Number of animals: Total of 25 males and 20 females per dose = 5 male renal toxicity rats + 10 male and 10 female core study rats + 10 male and 10 female clinical pathology rats
ADMINISTRATION / EXPOSURE
- Type of exposure: whole-body inhalation
CLINICAL OBSERVATIONS AND FREQUENCY:
- Clinical signs: twice daily including weekends
- Mortality: twice daily including weekends
- Body weight: weekly (core study rats)
- "Observations": weekly
- Hematology: Sampling from 10 animals per dose and sex on days 3 and 23 (after exposures, clinical pathology rats) and at terminal sacrifice (core study rats). Evaluations included: red blood cell count, volume of packed cells and spun hematocrit, hemoglobin, mean corpuscular volume, mean corpuscular hemoglobin, mean corpuscular hemoglobin concentration, white blood cell count, differential count (absolute), absolute reticulocyte count, platelet count, Morphological assessment.
- Biochemistry: Blood urea nitrogen, sorbitol dehydrogenase, alanine aminotransferase, total protein, albumin, alkaline phosphatase, total bile acids, creatine kinase, creatinine.
- Urinalysis: 16-hour collection during week 12 on all surviving core study animals, with access to water but not food. Measurements included: volume, specific gravity, appearance (visual inspection), microscopic examination of sediment from centrifuged sample, glucose, protein, N-acetyl-beta-glucosaminidase, creatinine (to be used to normalize other values), alkaline phosphatase, aspartate aminotransferase, lactate dehydrogenase, gamma glutamyl transaminase
ORGANS EXAMINED AT NECROPSY (MACROSCOPIC AND MICROSCOPIC):
- Macroscopic: Complete necropsy; weights of liver, thymus, right kidney, right testis, heart, lungs.
- Microscopic: Complete histopathology on all 0- and 120-ppm-rats

included the following tissues: adrenal glands, brain, clitoral glands, esophagus, femur (including bone marrow & joint surfaces), gross lesions, tissue masses, regional lymph nodes, heart, aorta, large intestine (cecum, colon, rectum), small intestine (duodenum, jejunum, ileum), kidneys (left only for males), larynx, liver, lungs, mainstem bronchi, lymph nodes (mandibular, mesenteric, bronchial, mediastinal), mammary glands & adjacent skin, nasal cavity & nasal turbinates (three sections), ovaries, pancreas, parathyroid glands, pituitary glands, preputial glands, prostate, salivary glands, spleen, stomach (forestomach & glandular), testes / epididymis / seminal vesicles, thymus, thyroid glands, trachea, urinary bladder, uterus.
Target tissues identified at 120 ppm were examined at lower concentrations to no-effect level or lowest exposure concentrations. Gross lesions were examined in all groups.
OTHER EXAMINATIONS:
- Assessment of kidneys after 2 weeks (5 renal toxicity rats), at 6 weeks (5 male clinical pathology rats), and at terminal sacrifice (5 male core study rats): Histopathology and evaluation of cell proliferation (positive control: cross section of small intestine) in left kidney, measurement of a2u-globulin in right kidney
- Sperm morphology & vaginal cytology (SMVCE): Vaginal cytology was evaluated for 12 days during the last 2 weeks of the study in all remaining females in the 0-, 30-, 60-, and 120-ppm groups. Epididymal sperm concentration, spermatid heads/testis, and left caudal, epididymal & testicular weights were evaluated in surviving males from the same groups.
STATISTICAL METHODS: A modified Dunnett's t-test (Xybion Path / Tox System; Cedar Knolls, New Jersey) was used to compare the treated groups to the control group with respect to body and organ weights, and organ:body weight ratios. Corresponding statistics for hematology, and clinical chemistry were calculated using the Statistical Analysis System (SAS Institute; Berkeley, California).

Reliability : (2) valid with restrictions
Comparable to guideline study with acceptable restrictions: Limited documentation

Flag : Critical study for SIDS endpoint

15.07.2004 (109)

Type : Sub-chronic
Species : mouse
Sex : male/female
Strain : B6C3F1
Route of admin. : inhalation
Exposure period : 13 weeks
Frequency of treatm. : 6 h/day, 5 days/week; additionally: last sunday before terminal sacrifice
Post exposure period : sacrifice on day after last exposure
Doses : 7.5; 15; 30; 60; 120 ppm = 41.2; 82.4; 165; 330; 660 mg/m3 (nominal)
Control group : yes, concurrent no treatment
Method : other: NTP Test Protocol, see Test Conditions
Year : 1996
GLP : yes
Test substance : no data

Result : NOAEL (NOEL), LOAEL (LOEL): ignoring transitional epithelial eosinophilic granules of urinary bladder:
- females: NOAEL = 7.5 ppm (uterus atrophy)
- males: NOAEL = 15 ppm (dark-colored urine); decreased kidney weights at this dose, but not at 30 ppm
TOXIC RESPONSE/EFFECTS BY DOSE LEVEL:
- Mortality and time to death: no mortalities in any group
- Clinical signs: no gross observations in any group
- Body weight gain: lower by 8.9 % (males, significant) and 7.0 % (females,

insignificant), respectively, in highest dose groups
- Haematology: Total erythrocytes and packed cell volumes were decreased, accompanied by increased mean corpuscular hemoglobin, mean corpuscular volume, and mean corpuscular hemoglobin concentration measurements and reticulocyte concentrations in both sexes at 60 or 120 ppm. Platelet concentrations were increased in these same groups.
- Urinalysis:
Dark-colored urine at 30 ppm (7/10 each for males and females) and higher (all animals)
- Organ weights:
Kidney: relative and absolute weights of right kidneys reduced in males of 15, 60, and 120 ppm groups
Liver: relative liver weights increased for males (120 ppm) and females (60 and 120 ppm), may be primarily attributed to lower body weight gain in these groups
Heart: relative (120 ppm) and absolute (60 and 120 ppm) decrease in males
- Gross pathology: no gross observations in any group
- Histopathology:
No lesions were observed in the liver, kidney, heart, or testes that correlated with any of the weight changes observed.
Atrophy of olfactory epithelium correlated very well with observations in the previous 14-day study.
Ovary and uterus atrophy was observed in high dose females. Incidences of ovary atrophy at minimal doses of observation and above were 4/10 (330 mg/m3), and 8/10 (660 mg/m3). Incidences of uterus atrophy at minimal doses of observation and above were 2/10 (82.4 mg/m3), 2/10 (165 mg/m3), 6/10 (330 mg/m3), and 8/10 (660 mg/m3). Information on severity is not reported.
Transitional epithelial eosinophilic granules were observed in the urinary bladder of all animals exposed (dose-related), the significance of this finding is unclear.

Test condition : TEST ORGANISMS
- Source: Taconic, Germantown (New York, USA)
- Age: approximately 6 weeks at first exposure
- Number of animals: 10 per dose and sex
ADMINISTRATION / EXPOSURE
- Type of exposure: whole-body inhalation
SATELLITE GROUPS AND REASONS THEY WERE ADDED: As part of the disease control program, five male and five female mice were submitted for a pre-exposure health examination. Sera were collected from five mice of each sex from extra animals 20 days after arrival and from the control group at the end of the study. Sera were tested for viral and mycoplasmal antibodies.
CLINICAL OBSERVATIONS AND FREQUENCY:
- Clinical signs: twice daily including weekends
- Mortality: twice daily including weekends
- Body weight: weekly
- "Observations": weekly
- Hematology: All animals were bled at terminal necropsy. Hematologic evaluations included: red blood cell count, volume of packed cells & spun hematocrit, hemoglobin, mean corpuscular volume, mean corpuscular hemoglobin, mean corpuscular hemoglobin concentration, white blood cell count, differential count (absolute), absolute reticulocyte count, platelet count & morphologic assessment, erythrocyte morphologic assessment.
ORGANS EXAMINED AT NECROPSY (MACROSCOPIC AND MICROSCOPIC):
- Macroscopic: Complete necropsy; weights of liver, thymus, right kidney, right testis, heart, lungs.
- Microscopic: Complete histopathology on all 0- and 120-ppm mice

included the following tissues: adrenal glands, brain, clitoral glands, esophagus, femur (including bone marrow & joint surfaces), gallbladder, gross lesions, tissue masses, regional lymph nodes, heart, aorta, large intestine (cecum, colon, rectum), small intestine (duodenum, jejunum, ileum), kidneys (left only for males), larynx, liver, lungs & mainstem bronchi, lymph nodes (mandibular, mesenteric, bronchial, mediastinal), mammary glands & adjacent skin, nasal cavity & nasal turbinates (three sections), ovaries, pancreas, parathyroid glands, pituitary glands, preputial glands, prostate, salivary glands, spleen, stomach (forestomach & glandular), testes, epididymis, seminal vesicles, thymus, thyroid glands, trachea, urinary bladder, uterus.
Target tissues identified at 120 ppm were examined at lower concentrations to no-effect level or lowest exposure concentration. Gross lesions were examined in all groups.
OTHER EXAMINATIONS:
- Micronuclei in erythrocytes: Two blood smears were taken from all core study animals at necropsy. One of these slides was subject to micronuclei determination.
- Sperm morphology & vaginal cytology (SMVCE): Vaginal cytology was evaluated for 12 days during the last 2 weeks of the study on all remaining females in the 0-, 30-, 60-, and 120-ppm groups. Epididymal sperm concentration, spermatid heads/testis, and left caudal, epididymal & testicular weights were evaluated in surviving males from the same groups.
STATISTICAL METHODS: A modified Dunnett's t-test (Xybion Path / Tox System; Cedar Knolls, New Jersey) was used to compare the treated groups to the control group with respect to body and organ weights, and organ:body weight ratios. Corresponding statistics for hematology, and clinical chemistry were calculated using the Statistical Analysis System (SAS Institute; Berkeley, California).

Reliability : (2) valid with restrictions
Comparable to guideline study with acceptable restrictions: Limited documentation

Flag : Critical study for SIDS endpoint

17.09.2004 (108)

Type	:	
Species	:	rat
Sex	:	male/female
Strain	:	other: Fischer 344 and NCI Black Reiter, NBR
Route of admin.	:	inhalation
Exposure period	:	15 days
Frequency of treatm.	:	6 h/day, 5 days/week
Post exposure period	:	None (no indications are to be found in the abstract)
Doses	:	7.5; 15; 30; 60; 120 ppm = 41.2; 82.4; 165; 330; 660 mg/m3 (nominal, vapour)
Control group	:	yes, concurrent no treatment
LOAEL	:	= 41.2 mg/m³
Method	:	other: NTP Test Protocol
Year	:	1996
GLP	:	yes
Test substance	:	no data

Result : TOXIC RESPONSE/EFFECTS BY DOSE LEVEL:
- Mortality and time to death: All rats survived the exposure period.
- Clinical signs: Bloody urine was observed in all rats exposed to 120 ppm and in one or more male NBR rats in the 7.5 and 60 ppm tetralin exposure groups. Squinting, weeping, matting, or unkempt fur around eye is reported for 4/5 animals each of the 120 ppm F344 groups (no data for NBR group).
- Body weight: The mean final body weights for all male NBR groups exposed were significantly below the control. The only significant decrease ($p \leq 0.01$) in F344 rat body weights was -10.6% in the female 120 ppm

group.
- Body weight gain: The mean weight gain for all exposed groups was lower (9-77%) than the weight gain of the respective controls.
- Organ weights: The mean right kidney:body weight ratio was significantly increased in male F344 rats exposed to 60 and 120 ppm tetralin, female F344 rats exposed to 15, 30, 60, and 120 ppm, and male NBR rats exposed to 7.5 ppm tetralin. The mean absolute right kidney weight was slightly increased in all F344 groups exposed to tetralin (statistically significant only in the female 60 ppm
exposure group).
Mean liver:body weight ratios were increased in the female F344 groups exposed to 60 and 120 ppm tetralin and the male NBR 120 ppm group.
- Gross pathology: There were no treatment-related gross lesions.
- Histopathology: Exposure to tetralin was associated with nasal mononuclear cell infiltrate in all exposure groups.
Minimal or mild olfactory degeneration, necrosis and/or Bowman's gland hypertrophy was found in most F344 males exposed to 120 ppm and NBR males exposed to 60 ppm. Hyaline droplet formation was seen in kidneys of F344 males with Mallory-Heidenhain staining; it decreased with decreased exposure concentration.
- Other: Concentrations of a2u-globulin in the kidneys of male F344 rats were significantly higher in the 60- and 120-ppm groups than in the controls (60 ppm males +159%, 120 ppm males +193%; no further details).
STATISTICAL RESULTS: There were no significant differences in the labeling indices in the kidney between control rats and those exposed to tetralin for either F344 or NBR rats.

Test condition : TEST ORGANISMS
- Number of animals: (5 F344 per sex + 5 male NBR) / dose
ADMINISTRATION / EXPOSURE
- Type of exposure: whole-body inhalation
ORGANS EXAMINED AT NECROPSY (MACROSCOPIC AND MICROSCOPIC):
- Macroscopic: Complete necropsies, with selected organ weights, were done on all rats (no further details).
- Microscopic: Tissues from the control and high exposure group animals: nose, lung, liver, and kidney

Reliability : (4) not assignable
Abstract

10.03.2004 (107)

Type	:	
Species	:	mouse
Sex	:	male/female
Strain	:	B6C3F1
Route of admin.	:	inhalation
Exposure period	:	17 days
Frequency of treatm.	:	6 h/day, 5 days/week
Post exposure period	:	None (no indications are to be found in the abstract)
Doses	:	7.5; 15; 30; 60; 120 ppm = 41.2; 82.4; 165; 330; 660 mg/m3 (nominal, vapour)
Control group	:	yes, concurrent no treatment
NOAEL	:	= 165 mg/m³
LOAEL	:	= 330 mg/m³
Method	:	other: NTP Test Protocol
Year	:	1996
GLP	:	yes
Test substance	:	no data

Result : TOXIC RESPONSE/EFFECTS BY DOSE LEVEL:
- Mortality and time to death: No animal died during the study.
- Clinical signs: Blood was observed in the urine of at least three of five

mice in all except one exposed groups; in the 7.5 ppm group only one male exhibited blood in the urine.
- Body weight gain: Mean body weights were not significantly affected by exposure. The mean body weight gain for seven of ten groups exposed was lower (2-25%) than that of their respective controls.
- Organ weights: Mean liver and liver:body weight ratios were increased in all groups exposed, which may be a result of increased metabolism in the liver.
- Gross pathology: There were no treatment-related gross lesions at necropsy.
- Histopathology: Histopathology lesions included olfactory epithelial atrophy and hyperplasia and/or dilation of Bowman's glands in noses of mice exposed to 60 or 120 ppm.
- Other: Two female mice exposed to 120 ppm also had minimal mononuclear cell infiltrate in nasal Section II.

Test condition : TEST ORGANISMS
- Number of animals: 5 per dose and sex
ADMINISTRATION / EXPOSURE
- Type of exposure: whole-body inhalation
ORGANS EXAMINED AT NECROPSY (MACROSCOPIC AND MICROSCOPIC):
- Macroscopic: no details reported
- Microscopic: no details reported

Reliability : (4) not assignable
Abstract

10.03.2004 (106)

Type :
Species : guinea pig
Sex : male/female
Strain : no data
Route of admin. : inhalation
Exposure period : 22 days
Frequency of treatm. : 8 hours/day
Post exposure period : not applicable
Doses : 1.48 mg/l air (consumption of test substance divided by volume of air)
Control group : no
Method : other
Year : 1942
GLP : no
Test substance : no data

Result : TOXIC RESPONSE/EFFECTS:
- Mortality and time to death: Animals died on day 17 (animal 3); day 22 (animals 1 & 2).
- Clinical signs: Piloerection, restlessness, apathy, immobility, and trembling
- Body weight gain: Weight loss down to 220, 160, and 195 g for animals 1, 2, and 3, respectively
- Food/water consumption: Food consumption reduced
- Haematology: Slight anemia and leucopenia
- Urinalysis: Oliguria, albuminuria, haematuria, increased formation of urine cylinders, dark staining of urine
- Histopathology: Toxic centrilobular atrophia of the livers, signed by hyperaemia, cloudy swelling and fatty degeneration. Kidneys of all animals showed necrotic nephrosis. Lungs showed localised broncho-pneumonia.

Test condition : TEST ORGANISMS
- Weight at study initiation: 1. male 280 g; 2. female 190 g; 3. male 230 g
- Number of animals: 3
ADMINISTRATION / EXPOSURE
- Duration of test/exposure: until death

- Type of exposure: inhalation of saturated atmosphere (3 wash bottles with pure test substance in sequence)
CLINICAL OBSERVATIONS AND FREQUENCY:
- Clinical signs: daily
- Mortality: daily
- Body weight: at beginning and at 10 day intervals
- Haematology: at beginning and at 10 day intervals
- Urinalysis: daily after exposure
ORGANS EXAMINED AT NECROPSY (MACROSCOPIC AND MICROSCOPIC):
- Macroscopic: lung, liver, heart, kidney, brain, others not specified
- Microscopic: liver, kidney, lung, others not specified

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

20.01.2004 (23)

Type :
Species : guinea pig
Sex : no data
Strain : no data
Route of admin. : inhalation
Exposure period : 6 days
Frequency of treatm. : 30 min/day
Post exposure period :
Doses : Tetrahydronaphthalene vapour (concentration not reported)
Control group : no data specified
Method : other
Year : 1947
GLP : no
Test substance : no data

Result : TOXIC RESPONSE/EFFECTS BY DOSE LEVEL:
- Mortality and time to death: no mortalities
- Clinical signs: sneezing, tremor, labored respiration, paralysis of the rear extremities
- Body weight gain: decreased
- Ophthalmoscopic examination: cataract formation
- Haematology: increase in red and white blood cells
- Urinalysis: albumunuria, urine cylinders, erythrocytes
- Gross pathology: hemorrhages at stomach and lung
- Histopathology: nephritis

Test condition : - Number of animals: 2
CLINICAL OBSERVATIONS AND FREQUENCY:
- Clinical signs: yes
- Body weight: yes
- Ophthalmoscopic examination: end of study
- Haematology: begin and end of study
- Biochemistry: begin and end of study
- Urinalysis: begin and end of study

Reliability : (4) not assignable
Documentation insufficient for assessment

20.01.2004 (11)

Type :
Species : guinea pig
Sex : male/female
Strain : no data
Route of admin. : dermal
Exposure period : 16 days
Frequency of treatm. : 2-times daily rubbing in with test substance

Post exposure period	:	not applicable
Doses	:	no precise data
Control group	:	no
Method	:	other
Year	:	1942
GLP	:	no
Test substance	:	no data

Result : TOXIC RESPONSE/EFFECTS:
- Mortality and time to death: Animals died on days 11 (animal 2) and 16 (animal 1).
- Clinical signs: Piloerection, restlessness, apathy, immobility, and trembling
- Body weight gain: Weight loss down to 230 and 220 g for animals 1 and 2, respectively
- Food/water consumption: Food consumption reduced
- Haematology: Slight anemia and leucopenia
- Urinalysis: Oliguria, albuminuria, haematuria, increased formation of urine cylinders, dark staining of urine
- Gross pathology: Skin application area showed squamous and crusted eczema.
- Histopathology: Toxic centrilobular atrophia of the livers, signed by hyperaemia, cloudy swelling and fatty degeneration. Kidneys of all animals showed necrotic nephrosis. Lungs showed localised broncho-pneumonia.

Test condition : TEST ORGANISMS
- Weight at study initiation: 1. male 260 g; 2. female 240 g
- Number of animals: 2

ADMINISTRATION / EXPOSURE
- Duration of test/exposure: until death
- Type of exposure: 5x5 cm2 skin shaved on back, treated with BaS for removal of hair, and treated twice daily (interval of several hours) with a cotton swab soaked with tetrahydronaphthalene

CLINICAL OBSERVATIONS AND FREQUENCY:
- Clinical signs: daily
- Mortality: daily
- Body weight: at beginning and at 10 day intervals
- Haematology: at beginning and at 10 day intervals
- Urinalysis: daily after exposure

ORGANS EXAMINED AT NECROPSY (MACROSCOPIC AND MICROSCOPIC):
- Macroscopic: lung, liver, heart, kidney, brain, skin, others not specified
- Microscopic: liver, kidney, lung, skin, others not specified

Reliability : (4) not assignable
Documentation insufficient for assessment

14.07.2004 (23)

Type	:	
Species	:	guinea pig
Sex	:	no data
Strain	:	no data
Route of admin.	:	s.c.
Exposure period	:	10 days
Frequency of treatm.	:	daily
Post exposure period	:	no data
Doses	:	200 mg/day
Control group	:	no data specified
Method	:	other: no details reported
Year	:	1939
GLP	:	no
Test substance	:	no data

Result	:	- Mortality and time to death: Two animals died (days 6, 9) - Clinical signs: Unthrifty appearance, restlessness and agitation - Body weight gain: Considerable weight reduction - Haematology: Decrease in hemoglobin and erythrocytes (from 5-6 million to 4 million / mm3), monocytosis, lymphocytosis, neutropenia
Test condition	:	- Number of animals: 8
Reliability	:	(4) not assignable Secondary literature

20.09.2004 (14)

Type	:	Sub-acute
Species	:	rabbit
Sex	:	no data
Strain	:	no data
Route of admin.	:	oral unspecified
Exposure period	:	30 - 40 days
Frequency of treatm.	:	daily
Post exposure period	:	no data
Doses	:	0.2 - 1 ml/day
Control group	:	no data specified
Method	:	other: Study on cataract formation
Year	:	1939
GLP	:	no
Test substance	:	no data

Remark	:	The review author (Gerarde, 1960) suggests that the difference in the effect of tetrahydronaphthalene on the eye of the rat and the rabbit may be due to the metabolic differences between the species: - Rats: predominantly 1-tetralol, not cataractogenic - Rabbits: predominantly 2-tetralol, cataractogenic
Result	:	Cataract formation
Test condition	:	No further details reported
Reliability	:	(4) not assignable Secondary literature

20.09.2004 (14)

Type	:	
Species	:	rat
Sex	:	no data
Strain	:	no data
Route of admin.	:	oral feed
Exposure period	:	up to 6 months
Frequency of treatm.	:	
Post exposure period	:	variable
Doses	:	0.125, 0.25, 0.5, 1.0 and 2.0 % in the diet
Control group	:	no data specified
NOAEL	:	= .125 %
LOAEL	:	= .25 %
Method	:	other: Study on cataract formation
Year	:	1949
GLP	:	no
Test substance	:	other TS: 1,2,3,4-tetrahydro-2-naphthol, CAS No. 530-91-6 (a metabolite of 1,2,3,4-tetrahydronaphthalene)

Remark	:	Additional data: Significant cataract formation was not observed with 1,2,3,4-tetrahydronaphthalene and 1,2,3,4-tetrahydro-1-naphthol (CAS No. 529-33-9). No further details reported, validity not assignable.
Result	:	NOAEL (NOEL), LOAEL (LOEL): NOAEL 0.125 % in the diet (6 months), LOAEL = 0.25 %; effect: cataract formation TOXIC RESPONSE/EFFECTS BY DOSE LEVEL:

- Ophthalmoscopic examination: Cataracts were observed in all rats with dosage levels of 0.25 % or more. Severity and time of development were dose dependent. At a dosage level of 2.0 %, changes in the lenses could already be detected after two weeks.
- Reversibility: Observation after two months treatment followed by four months for recreation indicated that no irreversible damage was produced.

Test condition : TEST ORGANISMS
- Over 200 rats were used, weanling and adult.
CLINICAL OBSERVATIONS AND FREQUENCY:
- Ophthalmoscopic examination: Eyes were observed in mydriasis with the slit lamp and the opthalmoscope.

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

19.01.2004 (49)

5.5 GENETIC TOXICITY 'IN VITRO'

Type : Ames test
System of testing : Salmonella typhimurium TA 98, TA 100, TA 1535, TA 1537, TA 1538
Test concentration : 10; 50; 100; 250; 500; 1000; 5000 ug/plate
Cycotoxic concentr. : >= 50 ug/plate (-S9); >= 500 ug/plate (+S9)
Metabolic activation : with and without
Result : negative
Method : other: Ames BN et al. (1975). Mutat. Res. 31 (6) 347-364
Year : 1988
GLP : no
Test substance : as prescribed by 1.1 - 1.4

Result : PRECIPITATION CONCENTRATION:
-S9: >= 250 ug/plate
+S9: >= 250 ug/plate
Positive controls were functional.

Test condition : SYSTEM OF TESTING
- Metabolic activation system:
aroclor induced rat liver S9 mix; enzymatic activity tested with aminoanthracene
ADMINISTRATION:
- Number of replicates: 3
- Application: solvent dimethyl sulfoxide
- Positive and negative control groups and treatment:
2.5 ug nitrofluorene/plate: TA 98, TA 1538 (pos.)
2.5 ug sodium azide/plate: TA 100, TA 1535 (pos.)
50 ug aminoacridine/plate: TA 1537 (pos.)
10 ug aminoanthracene/plate: TA 100 (enzymatic activity)
negative control: no
- Pre-incubation: twice

Reliability : (2) valid with restrictions
Comparable to guideline study with acceptable restrictions: TA 102 or E.coli WP2 were not tested, not required by guidelines prior to 1997

Flag : Critical study for SIDS endpoint

06.05.2004 (70)

Type : Ames test
System of testing : Salmonella typhimurium TA 98, TA 100, TA 1535, TA 1537
Test concentration : 0.03; 0.3; 3; 30 µmol/plate = ca. 4; 40; 400; 4000 µg/plate
Cycotoxic concentr. : >= 3 µmol/plate (ca. 400 µg/plate)
Metabolic activation : with and without
Result : negative

Method	:	other: see reference
Year	:	1980
GLP	:	no data
Test substance	:	other TS: Purity >= 97 %
Test condition	:	SYSTEM OF TESTING - Species/cell type: obtained from Dr. B. Ames, Univ. of CA - Metabolic activation system: rat liver S-9 mix induced by Aroclor 1254 (all strains) plus induced by 3-methylcholanthrene (TA 98 and TA 100), always suspended in corn oil; enzymatic activity tested with 2-aminoanthracene ADMINISTRATION: - Number of replicates: not reported - Application: solvent ethanol - Positive and negative control groups and treatment: positive without S9: N-methyl-N'-nitro-N-nitrosoguanidin positive with S9: 2-aminoanthracene
Reliability	:	(2) valid with restrictions Study well documented, meets generally accepted scientific principles, acceptable for assessment

20.01.2004 (50)

Type	:	Ames test
System of testing	:	Salmonella typhimurium TA 100, TA 1535, TA 97, TA 98
Test concentration	:	0; 0.3; 1; 3; 10; 33; 100; 333 µg/plate
Cycotoxic concentr.	:	
Metabolic activation	:	with and without
Result	:	negative
Method	:	other: Haworth et al. (1983). Environ. Mutagen. 5 (Suppl. 1), 3-142 (with minor modifications).
Year	:	
GLP	:	no data
Test substance	:	other TS: 1,2,3,4-tetrahydronaphthalene, aliquot A43612, no data on purity
Test condition	:	SYSTEM OF TESTING - Metabolic activation system: S9 from Aroclor 1254-induced Sprague-Dawley rats and Syrian hamsters ADMINISTRATION: - Dosing: at least 5 doses, limited by toxicity or solubility or 10 mg/plate - Number of replicates: 3 - Positive and negative control groups and treatment: solvent (DMSO) control and positive controls; no details - Pre-incubation time: 20 minutes CRITERIA FOR EVALUATING RESULTS: positive: reproducible, dose related increase in histidine-independent (revertant) colonies in any strain equivocal: not dose related or not reproducible
Reliability	:	(2) valid with restrictions Study well documented, meets generally accepted scientific principles, acceptable for assessment. Restriction: Less strains tested than required by today's OECD Test Guidelines.

01.06.2004 (110)

Type	:	Ames test
System of testing	:	Salmonella typhimurium TA 98, TA 100, TA 1535, TA 1537, TA 1538
Test concentration	:	3.3 - 10,000 µg/plate (or less)
Cycotoxic concentr.	:	
Metabolic activation	:	with and without
Result	:	negative
Method	:	other: Ames test, standard plate, no details reported
Year	:	

GLP : no data
Test substance : other TS: 1,2,3,4-tetrahydronaphthalene, no data on purity

Test condition : SYSTEM OF TESTING
- Metabolic activation system:
S9 from Aroclor 1254-induced Sprague-Dawley rats and Syrian hamsters
ADMINISTRATION:
- Dosing:

Strain	S9	Doses (µg/plate)
TA 98	none	3.3- 333
TA 98	rat/aroclor	10 - 1,000
TA 98	hamster/aroclor	10 - 1,000
TA 100	none	3.3- 333
TA 100	rat/aroclor	10 - 1,000
TA 100	hamster/aroclor	10 - 1,000
TA 1535	none	3.3-10,000
TA 1535	rat/aroclor	10 - 1,000
TA 1535	hamster/aroclor	10 - 1,000
TA 1537	none	3.3-10,000
TA 1537	rat/aroclor	10 - 1,000
TA 1537	hamster/aroclor	10 - 1,000
TA 1538	none	3.3-10,000
TA 1538	rat/aroclor	10 - 1,000
TA 1538	hamster/aroclor	10 - 1,000

Solvent: DMSO
- Number of replicates: no data

Reliability : (4) not assignable
Original reference not yet available

07.06.2004 (103)

Type : Mouse lymphoma assay
System of testing : L5178Y TK+/-
Test concentration : -S9: 30-50 and 35-47.5 µg/ml; +S9: 1-15 and 10-20 µg/ml
Cycotoxic concentr. : see Results
Metabolic activation : with and without
Result : ambiguous
Method : other: Mouse lymphoma assay, suspension plate, no further details
Year : 1991
GLP : yes
Test substance : other TS: 1,2,3,4-tetrahydronaphthalene from Chem Service Inc. (West Chester, Pennsylvania, USA), purity 98.2 %

Result : GENOTOXIC EFFECTS:
Initial study:
- positive with and without metabolic activation
- validity questionable due to findings in controls
Follow-up study:
- negative without metabolic activation
- equivocal with metabolic activation (the only cultures exhibiting a significant increase in mutant frequency had less than 10% total growth)
Controls:
Positive controls were as expected in both studies.
Negative controls showed unacceptably high mutant frequencies in the initial study and were as expected in the follow-up study.
CYTOTOXIC CONCENTRATION:
- Toxicity screening study:
Complete toxicity >= 100 µg/ml, almost complete at 50 µg/ml (-S9); complete toxicity >= 50 µg/ml (+S9)
- Initial study:

"too toxic to clone" at 52 µg/ml (-S9) and 20 µg/ml (+S9)
- Follow-up study:
"too toxic to clone" at 50 µg/ml (-S9) and 22.5 µg/ml (+S9)

Test condition : SYSTEM OF TESTING
- Metabolic activation system: Aroclor 1254-induced rat liver S9 mix
ADMINISTRATION:
- Dosing:
-S9: 30, 35, 40, 45, 50 µg/ml
+S9: 1, 2.5, 5, 10, 15 µg/ml
follow-up -S9: 35, 40, 42.5, 45, 47.5 µg/ml
follow-up +S9: 10, 12.5, 15, 17.5, 20 µg/ml
solvent: DMSO
- Number of replicates: 2
- Positive and negative control groups and treatment:
positive: ethylmethanesulfonate (-S9); 3-methylcholanthrene (+S9)
negative: solvent and untreated
- Pre-incubation time: two-day expression period
CRITERIA FOR EVALUATING RESULTS: dose-dependent increase in mutant frequency

Reliability : (1) valid without restriction
Comparable to guideline study

20.07.2004 (104)

5.6 GENETIC TOXICITY 'IN VIVO'

Type : Micronucleus assay
Species : Mouse
Sex : male/female
Strain : NMRI
Route of admin. : Gavage
Exposure period : one single application (10 ml/kg bw)
Doses : 2000 mg/kg
Result : Negative
Method : other: OECD Guideline 474 (1983)
Year : 1993
GLP : Yes
Test substance : other TS: Produced by Hüls AG, sampled 02 Feb. 1993; Sample ID 3633/81495, purity 98.5 % w/w (GD)

Result : MORTALITY: No mortality in dose finding test within 48 hours at 2000 mg/kg bw. Two females from the satellite group died within 30 hours post treatment.
CLINICAL SIGNS: piloerection, apathy, dark coloured urine; normality within 48 hours
EFFECT ON MITOTIC INDEX OR PCE/NCE RATIO:

- positive control, 24 h: PCE statistically significant
males 362 micronuclei / 10,011 PCE (3.62 +- 1.49 %)
43 micronuclei / 47,756 NCE (0.11 +- 0.05 %)
PCE/NCE = 0.24 +- 0.08
females 350 micronuclei / 10,005 PCE (3.50 +- 0.33 %)
24 micronuclei / 45,909 NCE (0.06 +- 0.04 %)
PCE/NCE = 0.27 +- 0.16
- negative control, 24 h:
males 18 micronuclei / 10,030 PCE (0.18 +- 0.07 %)
24 micronuclei / 17,855 NCE (0.13 +- 0.05 %)
PCE/NCE = 0.59 +- 0.13
females 13 micronuclei / 10,023 PCE (0.13 +- 0.07 %)
11 micronuclei / 17,407 NCE (0.07 +- 0.07 %)

PCE/NCE = 0.66 +- 0.23
- test substance, 24 h: PCE not statistically significant
males 16 micronuclei / 10,013 PCE (0.16 +- 0.15 %)
89 micronuclei / 66,679 NCE (0.13 +- 0.05 %)
PCE/NCE = 0.17 +- 0.06
females 7 micronuclei / 10,009 PCE (0.07 +- 0.07 %)
30 micronuclei / 42,428 NCE (0.07 +- 0.03 %)
PCE/NCE = 0.26 +- 0.08
- negative control, 48 h:
males 20 micronuclei / 10,019 PCE (0.20 +- 0.12 %)
24 micronuclei / 28,511 NCE (0.09 +- 0.05 %)
PCE/NCE = 0.39 +- 0.12
females 16 micronuclei / 10,023 PCE (0.16 +- 0.07 %)
10 micronuclei / 15,394 NCE (0.07 +- 0.05 %)
PCE/NCE = 0.67 +- 0.12
- test substance, 48 h: PCE not statistically significant
males 13 micronuclei / 10,006 PCE (0.13 +- 0.04 %)
66 micronuclei / 89,554 NCE (0.08 +- 0.05 %
PCE/NCE = 0.19 +- 0.14
females 7 micronuclei / 10,009 PCE (0.07 +- 0.06 %)
19 micronuclei / 45,881 NCE (0.05 +- 0.01 %)
PCE/NCE = 0.23 +- 0.07

A significant decrease in the PCE/NCE (NCE = normochromatic erythrocytes) relation in the treated animals proved that the test substance or its metabolites had reached the bone marrow.

Test condition : TEST ORGANISMS:
- Age: young adults
- Source: Winkelmann, Borchen (Germany)
- Weight at study initiation:
test group, male: 32.2 +/- 6.4 g
test group, female: 27.2 +/- 5.4 g
- No. of animals per dose: 5 males, 5 females per test duration
ADMINISTRATION:
- Vehicle: corn oil
- Duration of test: 24 hours; 48 hours
- Sampling times and number of samples: 24 hours; 48 hours
- Control groups and treatment:
positive control cyclophosphamide (vehicle physiol. NaCl), dose 100 mg/kg bw, 24 hours
negative control corn oil (= vehicle)
EXAMINATIONS:
- Clinical observations: yes
- Organs examined at necropsy: femur bone marrow
- Criteria for evaluating results: statistically significant and biologically relevant increase in frequency of micronucleated polychromatic erythrocytes of at least one test group as compared to the negative control group of the same sampling time
- Criteria for selection of M.T.D.: maximum dose <= 2000 mg/kg bw without mortalities within 48 hours

Reliability : (1) valid without restriction
Guideline study

Flag : Critical study for SIDS endpoint

15.09.2004 (74)

Type : Micronucleus assay
Species : Mouse
Sex : male/female
Strain : B6C3F1
Route of admin. : Inhalation

Exposure period : 13 weeks, 6 h/day, 5 days/week; additionally: last sunday before terminal sacrifice
Doses : 0; 7.5; 15; 20; 60; 120 ppm = 0; 41.2; 82.4; 165; 330; 660 mg/m3
Result : Negative
Method : other: NTP Test Protocol, part of a subchronic inhalation toxicity study
Year : 1996
GLP : Yes
Test substance : other TS: 1,2,3,4-tetrahydronaphthalene, aliquot A94802, no data on purity

Result : For general toxicity results see chapter 5.4

Males

Dose (ppm)	Percent NCE	Micronucleated/1000	P
0.0	98.86 +/- 0.10	0.9 +/- 0.1	
7.5	98.20 +/- 0.15	0.7 +/- 0.1	0.8081
15.0	97.81 +/- 0.13	0.8 +/- 0.2	0.6940
30.0	97.67 +/- 0.11	0.8 +/- 0.2	0.7537
60.0	97.81 +/- 0.11	1.1 +/- 0.1	0.3759
120.0	97.41 +/- 0.11	0.5 +/- 0.1	0.9527

Females

Dose (ppm)	Percent NCE	Micronucleated/1000	P
0.0	98.25 +/- 0.10	1.1 +/- 0.2	
7.5	98.06 +/- 0.15	1.6 +/- 0.2	0.0653
15.0	98.11 +/- 0.31	1.3 +/- 0.3	0.2776
30.0	98.06 +/- 0.12	1.0 +/- 0.2	0.5621
60.0	97.49 +/- 0.23	1.2 +/- 0.2	0.3814
120.0	97.30 +/- 0.26	0.9 +/- 0.2	0.6846

Test condition : TEST ORGANISMS
- Source: Taconic, Germantown (New York, USA)
- Age: approximately 6 weeks at first exposure
- Number of animals: 10 per dose and sex
ADMINISTRATION:
- Type of exposure: whole-body inhalation
- Vehicle: air
- Control groups and treatment: concurrent no treatment
EXAMINATIONS:
- Micronuclei in erythrocytes: Two blood smears were taken from all core study animals at necropsy. One of these slides was subject to micronuclei determination.
- 2000 peripheral blood erythrocytes (NCE) counted

Reliability : (2) valid with restrictions
Comparable to guideline study without detailed documentation
Flag : Critical study for SIDS endpoint
21.07.2004 (108) (111)

5.7 CARCINOGENICITY

5.8.1 TOXICITY TO FERTILITY

Type : other: Subchronic toxicity
Species : Rat
Sex : male/female
Strain : Fischer 344

Route of admin.	:	Inhalation
Exposure period	:	13 weeks
Frequency of treatm.	:	6 h/day, 5 days/week; additionally: last sunday before terminal sacrifice
Premating exposure period		
Male	:	
Female	:	
Duration of test	:	
No. of generation studies	:	
Doses	:	7.5; 15; 30; 60; 120 ppm = 41.2; 82.4; 165; 330; 660 mg/m3 (nominal)
Control group	:	yes, concurrent no treatment
Method	:	other: NTP Test Protocol, see Test Conditions
Year	:	1996
GLP	:	Yes
Test substance	:	no data

Result :

TOXIC RESPONSE/EFFECTS BY DOSE LEVEL:
- Mortality and time to death: no mortalities in any group
- Clinical signs: no clinical abnormalities in any group
- Body weight gain: lower by 6.1 % (males) and 5.7 % (females), respectively, in highest dose groups
- Clinical chemistry: Minimal nephropathy was observed in males in the higher exposure groups. Clinical chemistry data were consistent with nephropathy.
- Haematology: A modest regenerative anemia was observed in both sexes, primarily in groups exposed to 60 and 120 ppm.
- Urinalysis:
  Dark-stained urine at 30, 60, and 120 ppm.
  Urine aspartate aminotransferase values significantly higher in males (ca. 2.5) and females (ca. 17 times control values) at the 120 ppm level.
  Urine lactic dehydrogenase (LDH):creatinine ratio significantly, but modestly increased in the two highest dose levels, LDH activity increased in 120 ppm females group.
- Organ weights:
  Kidney: Increased right kidney:body weight ratio in males (15, 60, and 120 ppm) and females (15 ppm and higher); mean absolute right kidney weight slightly increased in all treated groups;
  Liver: Liver:body weight ratios increased in males (15 and 120 ppm) and females (60 and 120 ppm); mean absolute liver weight slightly increased in all groups exposed;
- Gross pathology: no gross observations in any dose group
- Histopathology:
  Olfactory necrosis and regeneration, confirming the irritation potential of 1,2,3,4-tetrahydronaphthalene. The NOAEL for nasal lesions was 15 ppm in males and 7.5 ppm in females.
  Hyaline droplet accumulation in kidneys of males increased slightly with increased exposure; a NOAEL was not clear.
  Minimal nephropathy in males in the higher exposure groups
- Other: Concentrations of a2u-globulin generally increased with exposure concentration and time on study.

Test condition :

TEST ORGANISMS
- Source: Taconic, Germantown (New York, USA)
- Age: approximately 6 weeks at first exposure
- Number of animals: Total of 25 males and 20 females per dose = 5 male renal toxicity rats + 10 male and 10 female core study rats + 10 male and 10 female clinical pathology rats

ADMINISTRATION / EXPOSURE
- Type of exposure: whole-body inhalation

CLINICAL OBSERVATIONS AND FREQUENCY:
- Clinical signs: twice daily including weekends
- Mortality: twice daily including weekends

- Body weight: weekly (core study rats)
- "Observations": weekly
- Hematology: Sampling from 10 animals per dose and sex on days 3 and 23 (after exposures, clinical pathology rats) and at terminal sacrifice (core study rats). Evaluations included: red blood cell count, volume of packed cells and spun hematocrit, hemoglobin, mean corpuscular volume, mean corpuscular hemoglobin, mean corpuscular hemoglobin concentration, white blood cell count, differential count (absolute), absolute reticulocyte count, platelet count, Morphological assessment.
- Biochemistry: Blood urea nitrogen, sorbitol dehydrogenase, alanine aminotransferase, total protein, albumin, alkaline phosphatase, total bile acids, creatine kinase, creatinine.
- Urinalysis: 16-hour collection during week 12 on all surviving core study animals, with access to water but not food. Measurements included: volume, specific gravity, appearance (visual inspection), microscopic examination of sediment from centrifuged sample, glucose, protein, N-acetyl-beta-glucosaminidase, creatinine (to be used to normalize other values), alkaline phosphatase, aspartate aminotransferase, lactate dehydrogenase, gamma glutamyl transaminase

ORGANS EXAMINED AT NECROPSY (MACROSCOPIC AND MICROSCOPIC):
- Macroscopic: Complete necropsy; weights of liver, thymus, right kidney, right testis, heart, lungs.
- Microscopic: Complete histopathology on all 0- and 120-ppm-rats included the following tissues: adrenal glands, brain, clitoral glands, esophagus, femur (including bone marrow & joint surfaces), gross lesions, tissue masses, regional lymph nodes, heart, aorta, large intestine (cecum, colon, rectum), small intestine (duodenum, jejunum, ileum), kidneys (left only for males), larynx, liver, lungs, mainstem bronchi, lymph nodes (mandibular, mesenteric, bronchial, mediastinal), mammary glands & adjacent skin, nasal cavity & nasal turbinates (three sections), ovaries, pancreas, parathyroid glands, pituitary glands, preputial glands, prostate, salivary glands, spleen, stomach (forestomach & glandular), testes / epididymis / seminal vesicles, thymus, thyroid glands, trachea, urinary bladder, uterus.

Target tissues identified at 120 ppm were examined at lower concentrations to no-effect level or lowest exposure concentrations. Gross lesions were examined in all groups.

OTHER EXAMINATIONS:
- Assessment of kidneys after 2 weeks (5 renal toxicity rats), at 6 weeks (5 male clinical pathology rats), and at terminal sacrifice (5 male core study rats): Histopathology and evaluation of cell proliferation (positive control: cross section of small intestine) in left kidney, measurement of a2u-globulin in right kidney
- Sperm morphology & vaginal cytology (SMVCE): Vaginal cytology was evaluated for 12 days during the last 2 weeks of the study in all remaining females in the 0-, 30-, 60-, and 120-ppm groups. Epididymal sperm concentration, spermatid heads/testis, and left caudal, epididymal & testicular weights were evaluated in surviving males from the same groups.

STATISTICAL METHODS: A modified Dunnett's t-test (Xybion Path / Tox System; Cedar Knolls, New Jersey) was used to compare the treated groups to the control group with respect to body and organ weights, and organ:body weight ratios. Corresponding statistics for hematology, and clinical chemistry were calculated using the Statistical Analysis System (SAS Institute; Berkeley, California).

Reliability : (2) valid with restrictions
Comparable to guideline study with acceptable restrictions: Limited documentation

Flag : Critical study for SIDS endpoint

15.07.2004 (109)

Type	:	other: Subchronic toxicity
Species	:	Mouse
Sex	:	male/female
Strain	:	B6C3F1
Route of admin.	:	Inhalation
Exposure period	:	13 weeks
Frequency of treatm.	:	6 h/day, 5 days/week; additionally: last sunday before terminal sacrifice
Premating exposure period		
Male	:	
Female	:	
Duration of test	:	
No. of generation studies	:	
Doses	:	7.5; 15; 30; 60; 120 ppm = 41.2; 82.4; 165; 330; 660 mg/m3 (nominal)
Control group	:	yes, concurrent no treatment
Method	:	other: NTP Test Protocol, see Test Conditions
Year	:	1996
GLP	:	Yes
Test substance	:	no data

Result :

NOAEL (NOEL), LOAEL (LOEL): ignoring transitional epithelial eosinophilic granules of urinary bladder:
- females: NOAEL = 7.5 ppm (uterus atrophy)
- males: NOAEL = 15 ppm (dark-colored urine); decreased kidney weights at this dose, but not at 30 ppm

TOXIC RESPONSE/EFFECTS BY DOSE LEVEL:
- Mortality and time to death: no mortalities in any group
- Clinical signs: no gross observations in any group
- Body weight gain: lower by 8.9 % (males, significant) and 7.0 % (females, insignificant), respectively, in highest dose groups
- Haematology: Total erythrocytes and packed cell volumes were decreased, accompanied by increased mean corpuscular hemoglobin, mean corpuscular volume, and mean corpuscular hemoglobin concentration measurements and reticulocyte concentrations in both sexes at 60 or 120 ppm. Platelet concentrations were increased in these same groups.
- Urinalysis:
  Dark-colored urine at 30 ppm (7/10 each for males and females) and higher (all animals)
- Organ weights:
  Kidney: relative and absolute weights of right kidneys reduced in males of 15, 60, and 120 ppm groups
  Liver: relative liver weights increased for males (120 ppm) and females (60 and 120 ppm), may be primarily attributed to lower body weight gain in these groups
  Heart: relative (120 ppm) and absolute (60 and 120 ppm) decrease in males
- Gross pathology: no gross observations in any group
- Histopathology:
  No lesions were observed in the liver, kidney, heart, or testes that correlated with any of the weight changes observed.
  Atrophy of olfactory epithelium correlated very well with observations in the previous 14-day study.
  Ovary and uterus atrophy was observed in high dose females. Incidences of ovary atrophy at minimal doses of observation and above were 4/10 (330 mg/m3), and 8/10 (660 mg/m3). Incidences of uterus atrophy at minimal doses of observation and above were 2/10 (82.4 mg/m3), 2/10 (165 mg/m3), 6/10 (330 mg/m3), and 8/10 (660 mg/m3). Information on severity is not reported.
  Transitional epithelial eosinophilic granules were observed in the urinary bladder of all animals exposed (dose-related), the significance of this

finding is unclear.

Test condition : TEST ORGANISMS
- Source: Taconic, Germantown (New York, USA)
- Age: approximately 6 weeks at first exposure
- Number of animals: 10 per dose and sex
ADMINISTRATION / EXPOSURE
- Type of exposure: whole-body inhalation
SATELLITE GROUPS AND REASONS THEY WERE ADDED: As part of the disease control program, five male and five female mice were submitted for a pre-exposure health examination. Sera were collected from five mice of each sex from extra animals 20 days after arrival and from the control group at the end of the study. Sera were tested for viral and mycoplasmal antibodies.
CLINICAL OBSERVATIONS AND FREQUENCY:
- Clinical signs: twice daily including weekends
- Mortality: twice daily including weekends
- Body weight: weekly
- "Observations": weekly
- Hematology: All animals were bled at terminal necropsy. Hematologic evaluations included: red blood cell count, volume of packed cells & spun hematocrit, hemoglobin, mean corpuscular volume, mean corpuscular hemoglobin, mean corpuscular hemoglobin concentration, white blood cell count, differential count (absolute), absolute reticulocyte count, platelet count & morphologic assessment, erythrocyte morphologic assessment.
ORGANS EXAMINED AT NECROPSY (MACROSCOPIC AND MICROSCOPIC):
- Macroscopic: Complete necropsy; weights of liver, thymus, right kidney, right testis, heart, lungs.
- Microscopic: Complete histopathology on all 0- and 120-ppm mice included the following tissues: adrenal glands, brain, clitoral glands, esophagus, femur (including bone marrow & joint surfaces), gallbladder, gross lesions, tissue masses, regional lymph nodes, heart, aorta, large intestine (cecum, colon, rectum), small intestine (duodenum, jejunum, ileum), kidneys (left only for males), larynx, liver, lungs & mainstem bronchi, lymph nodes (mandibular, mesenteric, bronchial, mediastinal), mammary glands & adjacent skin, nasal cavity & nasal turbinates (three sections), ovaries, pancreas, parathyroid glands, pituitary glands, preputial glands, prostate, salivary glands, spleen, stomach (forestomach & glandular), testes, epididymis, seminal vesicles, thymus, thyroid glands, trachea, urinary bladder, uterus.
Target tissues identified at 120 ppm were examined at lower concentrations to no-effect level or lowest exposure concentration. Gross lesions were examined in all groups.
OTHER EXAMINATIONS:
- Micronuclei in erythrocytes: Two blood smears were taken from all core study animals at necropsy. One of these slides was subject to micronuclei determination.
- Sperm morphology & vaginal cytology (SMVCE): Vaginal cytology was evaluated for 12 days during the last 2 weeks of the study on all remaining females in the 0-, 30-, 60-, and 120-ppm groups. Epididymal sperm concentration, spermatid heads/testis, and left caudal, epididymal & testicular weights were evaluated in surviving males from the same groups.
STATISTICAL METHODS: A modified Dunnett's t-test (Xybion Path / Tox System; Cedar Knolls, New Jersey) was used to compare the treated groups to the control group with respect to body and organ weights, and organ:body weight ratios. Corresponding statistics for hematology, and clinical chemistry were calculated using the Statistical Analysis System (SAS Institute; Berkeley, California).

Reliability : (2) valid with restrictions
Comparable to guideline study with acceptable restrictions: Limited documentation

Flag : Critical study for SIDS endpoint
17.09.2004 (108)

5.8.2 DEVELOPMENTAL TOXICITY/TERATOGENICITY

Species	:	Rat
Sex	:	Female
Strain	:	Sprague-Dawley
Route of admin.	:	other: oral gavage
Exposure period	:	days 6 through 19 of pregnancy (day 0 = sperm detection)
Frequency of treatm.	:	once daily
Duration of test	:	sacrifice on day 20
Doses	:	15; 45; 135 mg/kg bw/day
Control group	:	yes, concurrent vehicle
NOAEL maternal tox.	:	= 45 mg/kg bw
NOAEL teratogen.	:	= 135 mg/kg bw
NOAEL Embryotoxicity	:	= 135 - mg/kg bw
Result	:	not teratogenic
Method	:	other: OECD Guide-line 414 (2001)
Year	:	2004
GLP	:	Yes
Test substance	:	other TS: 1,2,3,4-tetrahydronaphthalene of Degussa AG, batch No. 2507330, produced 25 July 2003, purity >= 98.0 %

Result :

MATERNAL TOXIC EFFECTS BY DOSE LEVEL:
- Mortality: There was no treatment-related death.
- Description, severity, time of onset and duration of clinical signs: Clinical signs did not occur.
- Body weight: Slightly decreased in high dose group, statistically significant ($p<=0.05$) on days 9 (-3%), 18 (-5%), and 20 (-5%). A significantly lower body weight gain was recorded for the whole treatment period (0-20: -15%).
Body weights slightly decreased also in the mid dose group with statistical significance on days 9 (-11%) and 13 (-6%) and subsequent adaptation to normal, thus considered to be of questionable biological relevance. Normal in low dose group.
- Food/water consumption: Food consumption distinctly to slightly decreased in high dose group, statistically significant on study days
6-9: -33%; 9-13: -12%; 13-16: -10%; 16-18: -12% (absolute);
6-9: -32%; 9-13: -10%; 13-16: -7%; 16-18: -9% (relative).
Food consumption slightly to marginally lower in mid dose females, attaining statistical significance on days 6-9 (-15% abs., -16% rel.) and 13-16 (-6% abs. and rel.) only. Normal in low dose group.
- Number pregnant per dose level: 22/24; 22/24; 23/24; 23/24 (control / low / mid / high dose) = not affected. One control female was pregnant with only corpora lutea and empty implantation sites
- Number aborting: no abortions
- Number of resorptions: no total resorptions
- Number of implantations: 13.6; 14.5; 13.6; 13.7 (control / low / mid / high dose) = not affected.
- Pre and post implantation loss: 4.9; 6.2; 8.3; 10.9% pre-implantation loss (%corpora lutea) (means of control / low / mid / high dose). One total post implantation loss in control group.
- Number of corpora lutea: 14.3; 15.5; 14.6; 15.4 (means of control / low / mid / high dose).
- Gross pathology incidence and severity: No compound-related gross lesions were observed at necropsy.
- Organ weight changes: Insignificantly lower uterus weight for high dose females (-7%).

FETAL DATA:
There were no findings at caesarian section in any group of fetuses which could be related to the test substance administration.
There was no statistically significant difference in the mean crown-rump length for either male or female fetuses in any group. However, evaluation of both genders together revealed a slight but statistically significant (p<=0.05) decrease of the mean crown-rump length for all high dose fetuses against the control (-2.3%).
The mean placenta weight was slightly but statistically significantly (p<=0.05) decreased in the high dose group (0.52; 0.51; 0.51; 0.46 g in control, low, mid, and high dose groups, respectively).
Though considered not biologically significant, a treatment-related influence on these endpoints could not be excluded.
- Litter size and weights: mean weights 3.64; 3.61; 3.64; 3.56 g = not affected
- Number viable: Total number of live fetuses 12.4; 13.7; 13.0; 12.6 (control / low / mid / high dose) = not affected. No dead fetuses.
- Sex ratio: 44.4; 46.3; 44.6; 52.4% males (control / low / mid / high dose) = not affected
- Grossly visible abnormalities: no substance-related findings
- External abnormalities: no substance-related findings
- Soft tissue abnormalities: no substance-related findings
- Skeletal abnormalities: Isolated findings of statistical significance for high-dosed fetuses at the thoracic vertebra centra and in the rib (here also for low-dosed fetuses): There was 1 fetus (out of 152, i.e. 0.7%) in the high dose group with a tail aplasia and spina bifida occulta as a major defect, associated with several skeletal minor defects on the vertebra and skeletal retardations. This complex finding was associated secondary to insufficient oxygen supply of this fetus, which is known to occur incidentally during embryonal development within relatively large litters (14 fetuses in total in this litter). In the absence of correlating findings either in other fetuses or other litters of this group, these findings were considered to be incidental.
Minor skeletal defects of statistical significance included aplasia/fused/fragmented thoracic vertrebra centra in 0% (control), 0.6% (low dose), 0% (mid dose), and 2.0% (high dose, p<=0.05) animals. As the incidences were only slightly above inhouse control data (0-1.5%) and did not follow a dose response relationship, they were considered to be incidental. Another minor defect of statistical significance was uni- or bilateral knoddy ribs in 0% (control), 3.2% (low dose, p<=0.05), 0% (mid dose), and 7.9% (high dose, p<=0.05) animals. As historical control data were not yet available for this endpoint and the occurrence of this effect did not follow a dose response relationship, it was considered to be incidental.

Test condition : TEST ORGANISMS
- Source: Harlan Winkelmann, D-33178 Borchen
- Strain: Hsd: Sprague Dawley SD
- Age: 9-11 weeks
- Weight at study initiation: 208 g (mean)
- Number of animals: 24 per group
- Controls: vehicle

ADMINISTRATION / EXPOSURE
- Vehicle: sesame oil
- Concentration in vehicle: 0; 3.75; 11.25; 33.75 mg/ml
- Total volume applied: 4 ml/kg bw/day, adjusted to most recently recorded body weight

MATING PROCEDURES: Virgin females in the pre-oestrus or oestrus phase were mated overnight with sexually mature males (ratio 1 male : 1 female) and were caged individually after the detection of sperm in vaginal smears. The day of sperm detection was defined as day 0 of gestation. Pregnancy was confirmed at necropsy.
PARAMETERS ASSESSED DURING STUDY:

- Body weights: days 0, 3, 6, 9, 13, 16, 18, 20
- Food consumption: for intervals between body weight determinations
- Clinical observations: survival, health condition and behavior twice daily (once daily on weekends and public holidays); individual clinical observations once daily
- Examination of uterine content: Live and dead fetuses as well as conceptuses undergoing resorption, placentas and corpora lutea were counted, identified in numerical sequence from cervix to ovary and examined macroscopically for visible abnormalities. The implantation sites in the uterus were counted after staining with ammonium sulfide.
- Examination of fetuses: Determination of weight, crown-rump length, examination for gross external abnormalities.
Approximately half of the live fetuses of each litter were skinned and fixed in alcohol, necropsied, sexed and checked for anomalies of the internal organs (including particular attention to the reproductive tract for signs of altered development). The carcasses were placed in a solution of potassium hydroxide for clearing and stained with Alizarin red S and Alcian blue (double-staining). The skeletons (bones and cartilage) were examined and checked for stage of development and abnormalities with the aid of a stereomicroscope.
The remaining fetuses were transferred in Bouin's solution, necropsied, sexed and examined for organ anomalies (including particular attention to the reproductive tract for signs of altered development) referring to Wilson's slicing technique.
Visceral and skeletal changes were subdivided into four categories (major defects, minor defects, variations, and retardations) based on the severity and / or the spontaneous incidence of the finding.
ORGANS EXAMINED AT NECROPSY (MACROSCOPIC AND MICROSCOPIC):
- Macroscopic: P external and internal (thoracic and abdominal contents) for macroscopically visible changes, with emphasis on the uterus; F1 for visible abnormalities
- Organ weights: gravid uterus weight with at least one fetus

Reliability : (1) valid without restriction
Guideline study

Flag : Critical study for SIDS endpoint

20.09.2004 (10)

5.8.3 TOXICITY TO REPRODUCTION, OTHER STUDIES

5.9 SPECIFIC INVESTIGATIONS

5.10 EXPOSURE EXPERIENCE

Type of experience : Human - Exposure through Food

Result : - Dark green coloured urine is observed.
- An unidentified pigment, naphthalene (91-20-3), and 1,2-dihydronaphthalene (447-53-0) are formed.

Test condition : - Test organisms: Humans
- Doses: 5 or 7 g (oral)
- Investigations:
Collection of urine, various reactions, isolation and identification of substances

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles,

acceptable for assessment
15.08.2003 (114)

Type of experience : Direct observation, clinical cases

Result : Observations in children:
- Green coloured urine
- A marked degree of restlessness. This restlessness was tentatively attributed to a direct effect of 1,2,3,4-tetrahydronaphthalene on the central nervous system.

Test condition : - Approximately 3 kg wax containing about 1.5 kg 1,2,3,4-tetrahydronaphthalene were applied in a hospital room of approximately 540 m3 volume.

Reliability : (4) not assignable
Documentation insufficient for assessment
19.01.2004 (117)

Type of experience : Direct observation, clinical cases

Result : - Main symptom: Dark green colored urine
- Other symptoms: intense irritation of mucous membranes, profuse lacrimation, headache, and stupor
- Reversibility: Complete within few days

Test condition : - Persons: 2 painters
- Exposure: Painting for three days with tetralin-containing varnishes in a poorly ventilated area

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment
15.08.2003 (7)

Type of experience : Direct observation, clinical cases

Remark : From the rare occurrence of the symptoms, the author concluded that the persons probably had a high sensitivity.

Result : A skin condition similar to turpentine-induced dermatitis that was eczematous in nature is reported in five painters (four males, one female) that used tetralin (1 case) or mixtures containing tetralin as substitutes for turpentine.

Reliability : (2) valid with restrictions
Lack of documentation, but results not to be ignored
16.01.2004 (52)

Type of experience : Direct observation, clinical cases

Result : Observations: Complaints about headache, nausea, vomiting and irritation of mucous membranes, green-coloured urine.

Test condition : Occupational application of 1,2,3,4-tetrahydronaphthalene or staying in freshly varnished or waxed rooms

Reliability : (4) not assignable
Documentation insufficient for assessment
16.01.2004 (88)

Type of experience : Direct observation, clinical cases

Result : Hospital patients on a ward whose floor was recently waxed with a tetralin-based polish and whose windows were closed due to cold weather experienced eye irritation, headache, nausea, diarrhea, and green urine.

Reliability : (4) not assignable
Documentation insufficient for assessment

15.08.2003 (11)

Type of experience : Direct observation, clinical cases

Result : - Clinical observations:
The patient experienced nausea, vomiting, intragastric discomfort, and had one episode of melena. Green-coloured urine, proteinuria, urine casts, elevated serum levels of bilirubin, creatinine, alkaline phosphatase, GOT and LDH (signs of renal injury liver damage).
- Metabolites:
The following substances were found in the urine beside unchanged 1,2,3,4-tetrahydronaphthalene:
A = 1,2,3,4-tetrahydro-1-naphthol (CAS No. 529-33-9)
B = not identified
C = glucuronide of A
D = glucuronide of 1,2,3,4-tetrahydro-2-naphthol (530-91-6)
Concentration ratio A:B approximately 84:16
Concentration ratio C:D approximately 1:2
Predominant metabolite: A
- Reversibility:
At the time of discharge on the 14th hospital day, all laboratory values had returned to normal.

Test condition : A woman was admitted to the hospital 48 hours after she had drunk about 250 ml (1/2 - 3/4 pint) of Cuprex (tetrahydronaphthalene 31.5 %, copper oleate 0.03 %, paraffin oil 52.7 %, acetone 15.7 %) in an episode of self-poisoning.
A total of 1900 ml of green-grey urine was collected during the 24 h period after admission and analyzed for metabolites, which were identified by comparison of GC retention times and mass spectra with reference compounds.

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

15.08.2003 (46)

5.11 ADDITIONAL REMARKS

Type : Biochemical or cellular interactions

Method : The ability of compounds to increase the permeability of the membranes of human diploid embryonic lung fibroblasts (line MRC-5) was studied in vitro by measuring the release of an intracellular marker after short term exposure.

Result : The membrane damage caused by 1,2,3,4-tetrahydronaphthalene was found to be high (85 % nucleotide release).

Test condition : - Incubation: 3HUridine labelled cultures of human diploid embryonic lung fibroblasts (line MRC-5) were incubated for 30 min at 37 degree C with 25mM test substance in Tris-buffered saline.
- Analysis: The solution was removed and its radioactivity was determined by liquid scintillation.
- Evaluation criteria:
High: nucleotide release > 70%;
moderate: nuccleotide release 70-45%;
nil: nucleotide release < 15%.
(Note: range 15-45 % not assigned)

Test substance : Minimum purity 97 %

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

02.10.2003 (135)

Type : Chemobiokinetics general studies

Result : - Body temperature:
A decrease is observed with all four test substances;
intensity: (1) < (2) < (3) < (4)
The decrease is followed by an increase in body temperature; differences in intensity are not reported.
- Respiration:
A decrease in oxygen consumption is observed with all four test substances; intensity: (1) << (2), (3), and (4)

Test condition : Various studies:
- Test organisms: male rats, adult, ca. 200 g body weight
- Application: One of the four test substances, s.c.
- Investigations: Body temperature, respiration

Test substance : (1) 1,2,3,4-Tetrahydronapthalene purified
(2) 1,2,3,4-Tetrahydronaphthalene with high content of hydroperoxides
(3) 1,2,3,4-tetrahydro-1-naphthol (CAS No. 529-33-9)
(4) 1,2,3,4-tetrahydronaphthalen-1-one (CAS No. 529-34-0)

Reliability : (4) not assignable
Documentation insufficient for assessment

15.08.2003 (84)

Type : Cytotoxicity

Method : Cytotoxicity of tetrahydronaphthalene was studied in Ehrlich-Landschütz diploid (ELD) ascites tumour cells propagated in outbred albino NMRI mice.

Result : Percent of irreversibly injured cells:

Time	0 mg/l	25 mg/l	50 mg/l	75 mg/l	100 mg/l
0 h	2.3	3.0	3.0	3.0	4.0
1 h	2.6	2.5	5.5	4.5	11.0
2 h	3.1	6.5	15.0	17.0	41.5
3 h	3.6	8.0	16.0	17.5	40.5
4 h	3.5	15.0	18.0	24.5	67.0
5 h	4.2	?	18.5	?	95.5

1,2,3,4-tetrahydronaphthalene was assigned a high toxicity towards ELD cells.

Test condition : - Test vessel: sealed 3 ml glass tubes filled to the top
- Test concentrations: 25, 50, 75, or 100 ppm (= mg/l)
- Test temperature: 37 +/- 1 degree C
- Aeration: No; constant stirring
- No. of replicates: one per concentration and observation
- Observation: after 0, 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5 h
- Evaluation: counting of 200 cells per sample after staining with 2 % Lissamine green B

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

19.01.2004 (65)

Type : Cytotoxicity

Result : The activity of the test substances is reported on a scale from 0 to 9:
Test (1) = inhibition of cell growth: 9
Test (2) = inhibition of oxidative metabolism: 7
Test (3) = membrane damage: 8

Test (4) = ciliotoxicity: 6

Test condition : Four different tests were performed:
(1) Inhibition of cell growth
- Test system: Ascites sarcoma BP 8 cells
- Exposure: Incubation with 1 mM test substance for 48 hours
- Endpoint: Cell density as compared to solvent control
- Number of replicates: 2

(2) Inhibition of oxidative metabolism
- Test system: Brown adipocytes from adult hamsters
- Exposure: Incubation with 1mM test substance for 5 min at 37 degree C plus for further 5 min after addition of 0.6 µM norepinephrine (increasing oxygen consumption)
- Endpoint: oxygen consumption as compared to solvent control
- Number of replicates: At least 5

(3) Membrane damage
- Test system: Human diploid embryonic lung fibroblasts (line MRC-5), radiolabelled with [3H]uridine
- Exposure: Incubation with 25 mM test substance for 30 min at 37 degree C
- Endpoint: Release of radioactivity as compared to maximal release and corrected for spontaneous release
- Number of replicates: 2

(4) Ciliotoxicity
- Test system: Tracheas of chicken embryos (16-17 days old)
- Exposure: 5mM test substance at 37 degree C
- Endpoint: Time to ciliotasis, reference value 60 minutes
- Number of replicates: at least 3

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

01.10.2003 (33)

Type : Cytotoxicity

Method : To assess the previously observed inhibitory action of tetralin (1,2,3,4-tetrahydronaphthalene) at concentrations below 100 umol/l on bacterial membranes, a membrane model system and several gram-positive and gram-negative bacteria were studied. The former consisted of proteoliposomes in which beef heart cytochrome c oxidase was reconstituted as the proton motive force-generating mechanism.

Result : - Partition coefficient lipid:buffer = 1100
- Swelling of the membrane was observed but not quantified.
- The generation of the pH gradient and the electrical potential in artificial membranes was decreased.
- Studies with proteoliposomes and intact cells indicated that tetralin makes the membrane permeable for ions (protons) and inhibits the respiratory enzymes, which leads to a partial dissipation of the pH gradient and electrical potential, i.e. to an impairment of the primary energy transduction system.
- Bacterial growth on succinate is inhibited by tetralin only initially at concentrations below 100 umol/l.

Test condition : - Test organisms: Acinetobacter strain T5, Arthrobacter strain T2, Corynebacterium strain C125, Escherichia coli K-12 (ATCC 25404), Bacillus subtilis ATCC 6633
- Test substance concentration: Determined by analysis of aqueous buffer phase and of partitioning between aqueous and lipid phase (liposomes prepared from E. coli phospholipids)
- Swelling of the membrane: Determined by a relief in fluorescence self-

quenching of rhodamine beta-chloride
- Internal pH of proteoliposomes: Measured by monitoring the fluorescence of entrapped pyranine
- Cytoplasmic pH of intact cells: fluorescence of 2'7'-bis-(2-carboxyethyl)-5,6-carboxyfluorescein
- Transmembrane electrical potential: Monitoring the distribution of the tetraphenylphosphonium ion with an appropriate electrode
- Proton fluxes through membranes: pH determination
- Oxygen consumption: Induced by succinate, measured with oxygen electrode

Test substance : Source: Janssen Chimica (Beerse, Belgium); no further data

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

02.10.2003 (127)

Type : Cytotoxicity

Method : The mechanism of the effect of cyclic hydrocarbons on microorganisms was studied in liposomes prepared from Escherichia coli phospholipids.

Result : - PARTITION COEFFICIENT membrane / buffer = 1,100 +/- 56
- EXTRACTION OF PHOSPHOLIPIDS: <= 9.4% of the fluorescence increase obtained with 5 µmol tetrahydronaphthalene/mg phospholipid could be attributed to probe extraction from the membrane. Analysis of the supernatant at this exposure concentration gave 6.2% extraction of the phospholipid content. At higher concentrations solubilization of the liposomes occurred.
- MEMBRANE EXPANSION: Increase in fluorescence was primarily due to swelling of the membrane.
EFFECTS ON pH / PERMEABILITY:
- The transmembrane pH gradient and the electrical potential generated by beef heart mitochondrial cytochrome c oxidase were both decreased upon exposure, while proton permeability was increased. At slightly higher exposure concentrations, the membrame became permeable also for carboxyfluorescein (molecular weight 376.32, CAS No. 72088-94-9). Permeability of the membrane leads to impairment of the primary energy transduction system.
CYTOCHROME C OXIDASE ACTIVITY:
- Inhibition of the enzyme activity upon exposure was observed at concentrations similar to those required for proton permeability.

Test condition : TEST SYSTEM:
- Commercial Escherichia coli phospholipids were washed with acetone/ether and dried. Single membrane liposomes in pH 7.0 buffer suspension were obtained by sonication.
EXPOSURE:
- Hydrocarbons were dissolved in N,N-dimethyl formamide (DMF, CAS No. 68-12-2) at various concentrations. These solutions were used in the tests such that the DMF concentration was 2% (v/v).
PARTITIONING:
- Substances were equilibrated at various concentrations for 30 minutes in suspensions of liposomes in buffer (pH 7.0). After centrifugation, both phases were analyzed.
- Radiolabelled substances were analyzed by scintillation counting. (No radiolabelled 1,2,3,4-tetrahydronaphthalene was used.)
- Non-radioactive substances were determined by gas chromatography.
- Six independent measurements plus controls without liposomes were performed.
MEMBRANE EXPANSION / EXTRACTION OF PHOSPHOLIPIDS:
- Both effects were determined by a relief in fluorescence self-quenching of octadecyl rhodamine beta-chloride or N-(lissamine rhodamine-beta-sulfonyl) phosphatidylethanolamine. To discriminate between both effects,

fluorescence of the supernatant after centrifugation was determined with and without exposure to various concentrations.
- Supernatants were also analyzed by phosphate analysis.
EFFECTS ON pH:
- Internal pH of proteoliposomes: Measured by monitoring the fluorescence of entrapped pyranine
- Transmembrane electrical potential: Monitoring the distribution of the tetraphenylphosphonium ion with an appropriate electrode
- Proton fluxes through membranes: pH determination with indicator phenol red and standard substances KOH and oxalic acid
CYTOCHROME C OXIDASE ACTIVITY:
- Spectrophotometric monitoring of the concentration of reduced cytochrome c (alpha peak)

Test substance : 1,2,3,4-tetrahydronaphthalene "of the highest available commercial grade", no further details.

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

13.01.2004 (126)

Type : Metabolism

Result : - Radioactivity: Of the radioactivity, 87-90 % was excreted in the urine within two days and 0.5 - 3.7 % on the third day. The faeces contained 0.6-1.8 %. No radioactivity was found in the breath and negligible amounts were retained in the tissue.
- Metabolites: The main metabolites in the urine were
glucuronide of 1-tetralol: 52.4 %
glucuronide of 2-tetralol: 25.3 %
4-hydroxy-1-tetralone: 6.1 % (conjugated)
trans-tetralin-1,2-diol: 0.6 % (conjugated)
cis-tetralin-1,2-diol: 0.4 % (conjugated)
1-tetralol = 1,2,3,4-tetrahydro-1-naphthol, CAS No. 529-33-9
2-tetralol = 1,2,3,4-tetrahydro-2-naphthol, CAS No. 530-91-6
- Previously reported as metabolites, but now identified to be artefacts:
1,2,3,4-tetrahydro-2-oxonaphthalene, CAS No. 530-93-8
1-naphthol (CAS No. 90-15-3)
1,2-dihydronaphthalene, CAS No. 447-53-0
naphthalene, CAS No. 91-20-3
- Additional non-metabolites:
1,2,3,4-tetrahydronaphthalene = test substance itself
1,2,3,4-tetrahydro-1-oxonaphthalene, CAS No. 529-34-0
2-naphthol, CAS No. 135-19-3
5,6,7,8-tetrahydro-1-naphthol, CAS No. 529-35-1
5,6,7,8-tetrahydro-2-naphthol, CAS No. 1125-78-6

Test condition : TEST ORGANISMS:
- Strain: Doe albino rabbits
- Age: Adult
- Weight at study initiation: 1-2 kg;
radioautography study: 1.66 kg (1 rabbit)
- Feeding during test: Diet of 120 g of sweet potatoes (Ipomoea reptans) and 120 g of kangkong (Ipomoea balatos) daily; no additional water
- Number of animals:
1 (radioautography study);
4 (radioactivity distribution study);
6 + 12 (metabolism study + hydrolysis study)
ADMINISTRATION:
- Doses: all single
radioautography study: 660 mg/kg bw
radioactivity distrib. study: 210-630 (mean 450) mg/kg bw
metabolism study 6 g/6 rabbits

+ 1 ml/rabbit in 12 rabbits for hydrolysis study
- Route of application: by stomach tube, followed by about 20 ml of water
EXAMINATIONS
- radioautography study: thin layer chromatography of urine
- radioactivity distribution study: determination of radioactivity in tissues, breath, faeces, and urine; isolation and identification of metabolites in urine as derivatives
- metabolism study: isolation and direct identification of main metabolite; hydrolysis study: separation via preparative thin layer chromatography followed by ketodase treatment and identification of (hydrolysed) metabolites

Test substance : Commercial, redistilled twice;
radiolabelled substance: self-made as follows:
(1) Grignard carbonation of 3-phenyl-1-propylmagnesium bromide with [14C]O2 (from Ba[14C]O2) gave 1-[14C]-4-phenylbutanoic acid
(2) Ring closure in anhydrous HF gave 1-[14C]-1,2,3,4-tetrahydro-1-oxonaphthalene.
(3) Reduction with zinc amalgam (reflux in toluene / acetic acid / HCl) gave 1-[14C]-1,2,3,4-tetrahydronaphthalene.

Conclusion : The authors suggest that in rabbits tetralin is oxidized preferentially in the alicyclic ring. A tentative scheme for the metabolism is presented.

Reliability : (1) valid without restriction
Test procedure in accordance with generally accepted scientific standards and described in sufficient detail

Flag : Critical study for SIDS endpoint

16.09.2004 (47)

Type : Metabolism

Result : Both tetrahydronaphthalene and its 1-hydroperoxide were converted to 1,2,3,4-tetrahydro-1-naphthol (CAS RN 529-33-9) by rat liver emzymes. Both conversions required NADHP.

Test condition : Livers of male Holtzman rats weighing about 200 g were homogenized. The supernatant from centrifugation at 10 000 g for 20 min was employed as the enzyme source.

Test substance : commercial, purified by vacuum distillation

Conclusion : Hydroxylation of tetrahydronaphthalene probably occurs via the hydroperoxide.

Reliability : (1) valid without restriction
Test procedure in accordance with generally accepted scientific standards and described in sufficient detail

19.01.2004 (28)

Type : Metabolism

Result : - Metabolites:
The following substances were found in the urine beside unchanged 1,2,3,4-tetrahydronaphthalene:
A = 1,2,3,4-tetrahydro-1-naphthol (CAS No. 529-33-9)
B = not identified
C = glucuronide of A
D = glucuronide of 1,2,3,4-tetrahydro-2-naphthol (530-91-6)
Concentration ratio A:B approximately 84:16
Concentration ratio C:D approximately 1:2
Predominant metabolite: A
- Reversibility:
At the time of discharge on the 14th hospital day, all laboratory values had returned to normal.

Test condition : A woman was admitted to the hospital 48 hours after she had drunk about 250 ml (1/2 - 3/4 pint) of Cuprex (tetrahydronaphthalene 31.5 %, copper oleate 0.03 %, paraffin oil 52.7 %, acetone 15.7 %) in an episode of self-

poisoning.
A total of 1900 ml of green-grey urine was collected during the 24 h period after admission and analyzed for metabolites, which were identified by comparison of GC retention times and mass spectra with reference compounds.

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

07.07.2003 (46)

Type : Metabolism

Result : - Dark green coloured urine is observed.
- A small part of the 1,2,3,4-tetrahydronaphthalene is expired unchanged.
- The predominant primary metabolite in rabbits is the gluronide of 1,2,3,4-tetrahydro-1-naphthol (CAS No. 529-33-9).

Test condition : - Test organisms:
Rabbits, bodyweight 2 kg
- Doses: 5-6 g (gavage)
- Investigations:
Collection of urine, various reactions, isolation and identification of substances

Reliability : (2) valid with restrictions
Study well documented, meets generally accepted scientific principles, acceptable for assessment

19.01.2004 (114)

Type : Metabolism

Result : 1,2,3,4-Tetrahydronaphthalene is metabolized in different ways by rabbits on one hand and by dogs and humans on the other hand.
- Main metabolite in rabbits: 1,2,3,4-tetrahydro-1-naphthol (CAS No. 529-33-9), excreted as glucuronate
- Main metabolite in dogs: 1,2,3,4-tetrahydro-2-naphthol (530-91-6), excreted as glucuronate
- Both main metabolites (529-33-9 more rapidly) are further converted into dihydronaphthalene and subsequently into naphthalene (91-20-3).

Test condition : Urine was collected from rabbits, dogs, and humans after application of 1,2,3,4-tetrahydronaphthalene under various conditions.
Various chemical reactions, physical separations and analyses were performed.
Comparison of derivatives with authentic standards was possible only in exceptional cases (i.e. for naphthalene)

Reliability : (4) not assignable
Documentation insufficient for assessment

15.08.2003 (117)

Type : other: Nephrotoxicity and Metabolism

Result : RENAL DAMAGE:
- Exposed and control female rats did not display any renal damage.
- Male exposed rats exhibited increased cytoplasmic hyaline droplets in proximal convoluted tubular epothelial cells, which were indicative for toxic injury. Additionally, foci of cellular degeneration were present within proximal convoluted tubules. Intratubular cellular casts, overt glomerular changes or significant inflammation was not seen.
METABOLITES identified (mean percentages in all 36 samples):
1,2,3,4-tetrahydro-1-naphthol, CAS No. 529-33-9 (29 %)
1,2,3,4-tetrahydro-2-naphthol, CAS No. 530-91-6 (7 %)
1,2,3,4-tetrahydro-1-oxo-2-naphthol (33 %)
1,2,3,4-tetrahydro-1-oxo-4-naphthol (25 %)

1,2,3,4-tetrahydronaphthalene-1,4-diol (1 %)
1,2,3,4-tetrahydronaphthalene-1,2-diol (traces)

Test condition : TEST ORGANISMS:
- Species: Rat
- Strain: Fischer 344
- Sex: male and female
- Source: Charles River Breeding Laboratories
- Age: 4 months
- Weight at study initiation:
males 311 +/- 18 g; females 185 +/- 6 g
- Number of animals: total 12 males + 12 females
- Controls: Half of these animals (6 males, 6 females)

ADMINISTRATION:
- Type of exposure: 0.5 ml/kg bw = 485 mg/kg bw intragastrically on alternate days over a 14 day period; controls: 0.5 ml water/kg bw

EXAMINATIONS:
- Body weight determination: Daily
- Post observation: Last 24 hour urine sample after last dose followed by sacrifice
- Histopathology: One kidney and the median lobe of the liver
- Metabolite analysis: Other kidney
- Urinalysis: 24 and 48 hour urine collection, metabolite analysis: 16 hours at pH 4 and 37 degree C in presence of glucuronidase / sulfatase, extraction with CH2Cl2, concentration, GC with FID quantification and MS identification (comparison with authentic standards).

Test substance : 1,2,3,4-Tetrahydronaphthalene from Aldrich Chemical Co., Milwaukee; metabolite standards from same source or synthesized according to procedures reported. Purities not reported.

Reliability : (1) valid without restriction
Test procedure in accordance with generally accepted scientific standards and described in sufficient detail

19.01.2004 (121) (122)

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