

Environment Report 2019

Think ahead for sustainability.

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0 Preface

In 1997, we introduced the Environmental Management System according to the international standard DIN EN ISO 14001 and together with the Quality Management System according to DIN EN ISO 9001 certified for the first time in April 1993 it is an essential contribution to the future-oriented international business policy of RUDOLF GmbH.

With this environment report, we present our current environmental data to our customers, neighbours and all parties interested.

RUDOLF GmbH is a strongly export-oriented enterprise and represented by its own companies and partnerships on all continents. The heart of the company group is the headquarters in Geretsried.

In addition to a high quality standard, environmental protection, occupational and product safety and ecological product requirements are indispensable components of our company policies. This is what we want to be known for in our markets. Based on this conception, RUDOLF GmbH can confidently look into the future and stand its ground in the world market.

Any questions that arise from studying this environment report are welcome. Please contact us, if you are interested in a dialogue with a medium-sized company group of chemical industry.

Rudolf GmbH
The Management



Wolfgang Schumann Dr. Wolfgang Schumann

Geretsried, den 01/04/2019

1 The company at its location in Geretsried

In 1922, the chemical factory Rudolf & Co. KG was founded in Varnsdorf, the centre of an important textile area in Sudetenland (today Czech Republic). At the end of the war, the company was refounded at its present location in Geretsried. At the time, Geretsried consisted of the remains of a former armaments factory. In a bunker assigned by the American military administration, the company was reconstructed and, from there, it started to open up domestic and foreign markets.

The present RUDOLF GmbH is an international company group with subsidiaries and representatives in more than 50 countries on all continents. The product range includes textile auxiliaries for all stages of textile finishing processes and products for textile care as well as building protection. One focus is still the production of tailor made speciality products for certain textile qualities, process steps and textile plants.

In Geretsried with its 24,500 inhabitants, which is characterised by its small to medium-scale economic structure, RUDOLF GmbH with its 385 employees features amongst the major industrial companies.

The factory is situated in the southern industrial area of Geretsried and connected to the municipal road network by two gates.

The plant site is surrounded by further industrial areas (machine construction, electroplating) in the south, east and west and in the north it borders on a large residential area. On the factory premises, which cover an area of 44,000 m², there are 21 buildings (from transformer tower to high-bay racking), three of which date from time of the ar-

maments factory. A new exhaust air cleaning plant was launched in the beginning of 2018.

The buildings are surrounded by extensive green areas and woods.

Since 1993, RUDOLF GmbH has had a certified Quality Management System according to ISO 9001. In August 1997, it was completed by the certified Environmental Management System according to ISO 14001.

Product quality, environmental protection and safety are a joint, inseparable prerequisite for success in the global market.

2 Activities at the location

Products

RUDOLF GmbH converts approx. 720 raw materials (mainly organic chemicals) into nearly 800 different sales products. Most of these products are used as textile auxiliaries for pre-treatment (e.g. desizing, washing, bleaching) and for finishing (e.g. soft handle, water, oil and soil repellency, coating). Textile dyestuffs and auxiliaries for textile printing are less important. Whereas, products for textile care used in industrial laundries or as substances in impregnation sprays are more important. A relatively new but steadily growing segment is the building protection with its own speciality products based on the know-how of textile auxiliaries.

Our products have to comply with a multitude of legal requirements, e.g. clear marking for handling and transportation, biodegradability in effluent treatment plants and the aquatic environment, defined emissions to the air during processing and the assessment of the impact on the users of finished textiles.

Processes

The whole production has been approved according to the German Federal Law on the Prevention of Immissions (BImSchG) and is subject to the Hazardous Incidents Ordinance (lower class). As a consequence, certain duties have to be fulfilled, e.g. extensive safety analyses have to be conducted and an emergency plan, which is revised regularly, has to be established. The products are manufactured by chemical and physical processes in closed reactors under most varied process conditions (in vacuum and up to 6 bar excess pressure as well as at temperatures of up to 175 °C). Examples of chemical processes applied are polymerisation,

esterification and amidation, which comprise one or more stages. Physical processes are simple mixing processes, but also one to multi-stage emulsifying processes using special homogenising machines.

At the end of 2018, a new plant, which continuously manufactures a product by chemical reaction, was put into operation.

The emissions released to air when charging and operating mixing vessels and reactors are treated in 2 central exhaust purification plants. One plant consists of a cryogenic condenser, a scrubber and three activated carbon adsorbers. Two out of three are in operation mode and one is regenerated or on standby. The second plant consists of a burning chamber according to the regenerative thermal oxidation process.

As a self-regulating measure, the effluent is analysed every day.

All dangerous substances used in the factory are listed in an internal inventory of dangerous substances as a part of many activities to ensure occupational safety and to protect the employees' health. The fire brigade and police can be provided with daily updated storage lists at any time. As with all technical installations, particular attention must be paid to the protection of ground water sources. These are only some examples of our activities in this area.

2 Activities at the location

Storage and transportation

The delivery of raw materials and the dispatch of our products is realised by a large number of transport companies. The raw materials and products are packed into drums, containers or bags. The key raw materials are delivered in tankers.

The raw materials and products are stored in the fully automatic high-bay racking warehouse, various special warehouses (e.g. for flammable liquids and special hazardous products, also various heat cabinets) and the tank farm. The storage buildings are equipped with automatic fire alarm boxes and firefighting facilities complementary to the goods stored. More than 600 m³ water for firefighting are permanently stored in the factory. The buffer stock put into operation in 2012 serves on the one hand as a temporary storage for products made in the night shift. On the other hand, there are stored goods already provided with shipping labels for which the handling hall has become too narrow in the meantime. The high-bay racking warehouse and the buffer stock stand in liquid-tight tanks which can take over 3250 m³ water in total for firefighting.

The transportation of chemical raw materials and products fundamentally differs from that of other industrial goods. The international regulations for dangerous goods regulate in detail the type of packing, shipping quantity and corresponding transportation documents. Although only part of the RUDOLF products are subject to the regulations for dangerous goods, we expect our forwarding agents to offer a high standard for all products transported. Detailed forwarding agreements were concluded with the forwarding agents cooperating with RUDOLF GmbH.

Objectives

With the optimisation of products and production, importance is attached to the following aspects:

Products

- Improved effects
- Improved process properties
- Readily biodegradable
- Minor water pollution when used at the customer
- Minor emissions during processing
- Doing without or, in case of indispensable components (e.g. preservatives), reducing ecologically or toxicologically problematic components

Production ranges

- Minimising safety and environmental risks during planning
- Observing all legal requirements due to a close cooperation with specialised authorities in the planning stage
- Safety analysis for complex ranges together with external experts in the planning stage
- Preventive maintenance of all safety and environmentally relevant machine components
- Company alarm and contingency plan as rules of action in case of breakdowns

3 Environmental impact

For the storage of the raw materials and products, the production, offices and laboratories we need:

Energy

- for steam generation (heating medium in production)
- for driving electric motors
- for room heating

Water

- for production (as product component)
- for steam generation
- for cooling the reactors and mixing vessels
- for laboratory purposes
- for sanitary purposes
- for cleaning purposes

These activities result in:

Waste heat

- due to heat losses
- due to cooling with water
- due to flue gas from combustions

Effluent

- from production
(cleaning of reactors, pumps, etc.)
- from exhaust air cleaning (scrubbers)
- from steam generation and water processing
- from laboratories
- from sanitary installations

Waste

- from non reusable packaging / drums
- from chemical production
("special waste")
- from workshops (metals, electric waste)
- from offices (paper etc.)
- from laboratories (paper, glass, chemical residues)

Emissions to air

- from production
- from flue gases
- from various suction systems

Noise

- by arriving and departing cars of employees and visitors
- by lorry-traffic (delivery and dispatch)
- by fork-lift trucks
- by ventilation and exhaust air systems

4 Environmental data

For the years 2014 to 2018, the following annual consumptions were established. The relative indications refer to the respective annual production quantity.

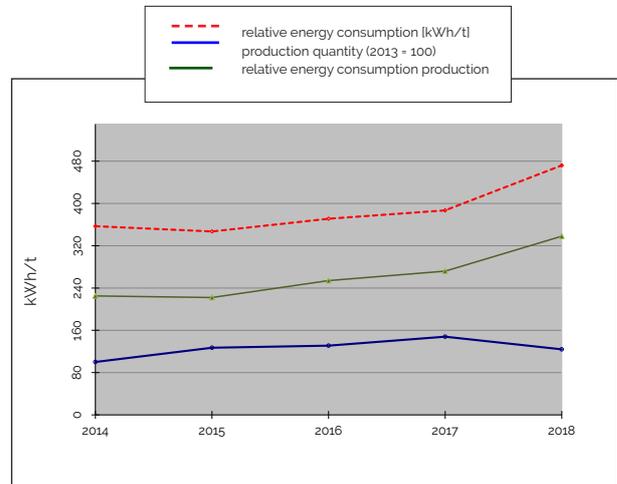
Energy consumption

	Gas [kWh/a]	Light fuel oil [kWh/a]	EL Electricity [kWh/a]
2014	8,369,817	152,593	2,669,337
2015	10,687,438	21,916	3,062,815
2016	11,928,365	126,593	3,214,102
2017	14,278,237	66,117	3,662,004
2018	14,391,131	118,137	3,893,738

	Total [kWh/a]	Relative energy consumption [kWh/t]	Produc- tion quantity (2014 = 100)
2014	11,191,747	357	100
2015	13,772,169	347	127
2016	15,269,060	371	131
2017	18,006,358	387	148
2018	18,403,006	472	124

	relative energy consumption production [kWh/t]
2014	225
2015	222
2016	254
2017	272
2018	338

Energy consumption per metric ton



Evaluation:

Depending on the season, one third to one half of the total gas used is required to heat the many buildings scattered over the plant site. In a cold winter month, about twice as much gas is consumed as in a warm summer month. A new boiler house for the creation of process steam was commissioned at the end of 2004, which can be operated with either natural gas or light fuel oil. At the beginning of 2015, another gas-run boiler has been commissioned at the new production hall. There is still the oil-run boiler as a reserve.

In 2018, unfortunately, the relative energy consumption in general as well as for production increased. This increase was analysed by an internal team. As a total of possible reasons, amongst others, the following aspects were identified:

- commissioning of a new, extensive ventilation system for one production hall
- more complex production processes with longer operating times

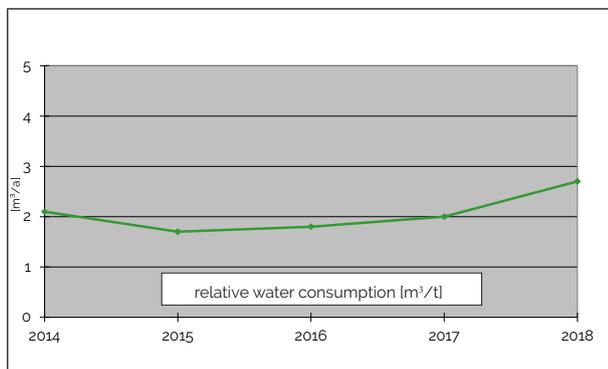
4 Environmental data

- installation of further trace heating
- transitory and parallel run of the new and the old activated carbon filtering machine during 6 months
- commissioning of a new employee restaurant with extensive ventilation system

In 2015, an energy audit was conducted at RUDOLF GmbH. No significant energy saving potentials were found. Therefore, the introduction of an energy management system has been refrained from for the time being. The next energy audit will be realised in 2019.

	Total water consumption [m ³ /a]	Water consumption [m ³ /t]	Production quantity (2014 = 100)
2014	64,572	2.1	100
2015	67,890	1.7	127
2016	75,115	1.8	131
2017	95,311	2.0	148
2018	103,585	2.7	124

Water consumption per metric ton product



Evaluation:

In recent years, RUDOLF GmbH has covered more than 80 % of its water need with raw water from a well, which had been put into operation in 2004. Thus, the increasingly precious drinking water supply is protected.

The water consumption increased to an unsatisfying value. The reasons for this were analysed by an internal team. The road salt applied during winter penetrates the groundwater within 3 to 6 months. In 2018, due to the severe drought, the groundwater level was low and, therefore, the salt content of the groundwater extremely high. Therefore, in 2018, more effluent per litre demineralised water was produced during the generation of demineralised water for the production than in the past years.

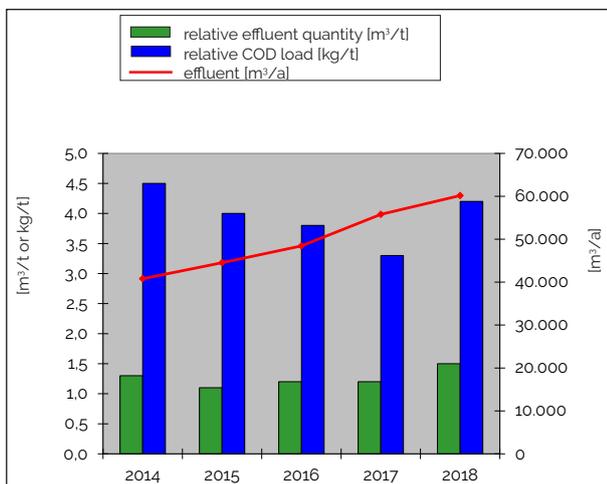
4 Environmental data

Effluent

	Effluent [m ³ /a]	COD load [kg/a]
2014	40,806	141,196
2015	44,526	157,835
2016	48,431	154,781
2017	55,779	154,683
2018	60,162	164,689

	Relative effluent quantity [m ³ /t]	Relative COD load [kg/t]	Production quantity (2014 = 100)
2014	1.3	4.5	100
2015	1.1	4.0	127
2016	1.2	3.8	131
2017	1.2	3.3	148
2018	1.5	4.2	124

Effluent quantities and COD load



Typical effluent analysis

(Monthly values from composite samples in 2018)

Fluctuations are caused by the discontinuous chemical production.

	Average values	Limits
pH value	7.1 - 8.3	6.5 - 9.5
COD [mg/l]	1,780-4,760	none
BOD ₅ [mg/l]	300-3,300	none
COD/BOD ₅ ratio	1.4 - 8.0	none
AOX [mg/l]	< 0.40*	< 0.39
MBAS [mg/l]	< 15-400	none
BIAS [mg/l]	< 610	none
Zinc [mg/l]	< 0.22	< 2
Tin [mg/l]	< 0.05	< 2

* limit of AOX was minimally exceeded one-time in 2018

4 Environmental data

The percentage of Rudolf effluent regarding quantity and COD load discharged to the nearest municipal clarification plant (Weidach) was:

	Clarification plant at Weidach [million m ³ /a]	Effluent share RUDOLF [%]
2013	4.237	0.96
2014	3.705	1.10
2015	3.787	1.17
2016	4.192	1.33
2017	3.876	1.55

	COD clarification plant inlet [g/m ³]	COD Rudolf average [g/m ³]	COD share Rudolf [%]
2013	866	3.596	3.7
2014	1.008	3.460	3.8
2015	958	3.545	4.3
2016	871	3.196	4.2
2017	929	2.773	4.3

The data for 2018 from the effluent association for sewage treatment ISAR-Loisachgruppe for the clarification plant Weidach is not yet available.

Evaluation:

The effluent of RUDOLF GmbH produced during a work day is collected, mechanically pre-clarified and neutralised in a mixing and balancing plant. It is discharged to the public sewage system predominantly at night, where it is easily biodegraded or eliminated. This is above all due to the fact that, according to the requirements of the law on scouring and cleaning agents, a majority of the products processed have to be at least 90 % biodegradable. Additionally, water insoluble components (e.g. oils, fats, waxes, polymers) are mechanically separated in the purification plant of RUDOLF GmbH and disposed of as special waste.

The share of Rudolf effluent in the total effluent treated by the clarification plant Weidach is considerably lower than frequently assumed by the public. By timing the introduction of RUDOLF effluent in agreement with the clarification plant Weidach, we essentially contribute to the biological treatment stage of the sewage treatment plant being effective even at night, when nearly no domestic effluent is introduced.

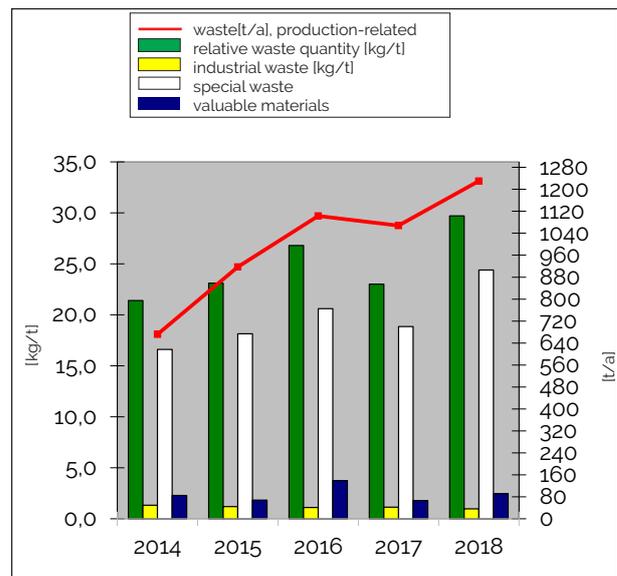
4 Environmental data

Waste

	Waste (production- related) [t/a]	Relative waste [kg/t]	Industrial waste [kg/t]
2014	672	21.4	1.33
2015	917	23.1	1.19
2016	1,103	26.8	1.10
2017	1,068	23.0	1.13
2018	1,230	29.7	0.98

	Special waste [kg/t]	Valuable materials (wood, paper, sheets, metal) [kg/t]	Production quantity (2014 = 100)
2014	16.60	2.29	100
2015	18.14	1.83	127
2016	20.60	3.75	131
2017	18.85	1.79	148
2018	24.39	2.45	124

Waste quantity per metric ton of product



The types and quantities of waste arising during normal operation were evaluated without taking into account the rubble or scrap metal.

4 Environmental data

Evaluation:

The increased quantity of production-related waste can be attributed to a further considerable production-related increase of solvent distillates as well as an increased accumulation on hazardous waste of textile auxiliaries. Approx. 66 % of the accumulated waste were recycled. Slightly less than 23 % of the total waste could be classified as "non-hazardous".

The industrial waste containing waste comparable to household waste is disposed of. In the respective plant, it is pre-sorted in order to increase the recycling rate.

Special waste consists of expired or non-reusable products as well as of faulty and test batches, but in first line of polluted solvents distilled after production. But also sewage sludge or filter plates as well as used gloves, respiration filters or cloths are included. Due to legal requirements, all hazardous waste has to be disposed of at GSB (Bavarian Society for the Disposal of Special Waste) in Baar-Ebenhausen near Ingolstadt.

In the past, polluted solvents were disposed of only thermally. At the end of 2018, we succeeded in establishing a solution for recycling of solvents. In future, we would like to continue developing this solution. This aspect is even more important as the quantity of solvents used during our increasingly more complex production processes increased in 2018.

In Germany, used containers can be returned for reconditioning via a take-back system. Depending on the type, 80 - 100 % of the containers used at RUDOLF GmbH have been reconditioned.

4 Environmental data

Emissions to air from steam generation/ heating

	2014	2015	2016	2017	2018
CO ₂ from furnaces [t/a]	1,714	2,143	2,419	2,873	2,909
SO ₂ from furnaces (kg/a)	56	18	52	36	52
NO _x from furnaces [kg/a]	868	1,083	1,224	1,452	1,471

Evaluation:

The slightly increasing amount of emitted carbon dioxide and nitrogen dioxide reflects the increased energy need. The emissions of sulphur dioxides result primarily from the consumption of light fuel oil. It is minimised as far as possible. Due to an interruptible supply for firing with gas, the gas supplier can ask for boiler to be switched off by RUDOLF GmbH during cold winter days. This helps the provider to decrease peak consumption. During maintenance works at a gas-run boiler, the oil-run boiler has to take over the supply with process steam. In these phases, for RUDOLF GmbH, this means that process steam can be produced only out of light fuel oil, which influences the emission of sulphur dioxides.

4 Environmental data

Emission to air from production

RUDOLF GmbH has two modern exhaust air purification plants. One works according to the principle of regenerative thermal oxidation (RTO). The second plant (ALURA) was implemented as scheduled in the first quarter of 2018 and consists of a cryogenic condenser, a flue gas scrubber and a 3-bed activated carbon filtering machine.

The RTO burns emissions of the production hall C. Co-firing, usually natural gas, is needed to start and operate the plant. With high organic load, the operating temperature can be kept without co-firing.

The ALURA is constructed as follows:

The cryogenic condenser eliminates solvents using cryogenic nitrogen, which reduces efficiently the impact of the solvents on the following machine parts. The packed bed scrubber washes especially polar substances from emissions. The 3-bed activated carbon filtering machine has two operating beds and one in regeneration or on standby. The take-over is realised automatically. During the regeneration, solvents on the activated carbon are desorbed by water steam and the activated carbon is being dried.

In autumn 2018, as scheduled, the legally required emission measurement at both exhaust air purification plants was conducted. The measurement program adjusted together with the district administration consisted of many parameters at different operating states. In order to conduct the measurements, an external institute with special legal approval regarding the immission protection was present. In the exhaust gas, the complete organic carbon component as well as the concentrations of dust, nitrogen oxides, carbon monoxide and many organic substances are determined. The latter mainly consist of substances used at RUDOLF GmbH, but which do no longer exist in the products due to chemical conversion. The measurement results confirmed the plants' performance, but pointed also to optimisation possibilities during processing. At the end of 2018 (for RTO) and at the beginning of 2019 (for ALURA), the extensive measurement report was handed over to the district administration.

The next emission measurements are scheduled for autumn 2021.

5 Environmental policy

The management of RUDOLF GmbH bears the responsibility for the environmental policy and commits itself to putting the environmental targets into practice.

In 2002, the quality and environmental management system were combined to an integrated management system. With this integrated management system, we make sure that the legal regulations and administrative requirements are observed and that environmental targets are continuously further developed.

All efforts focus on:

Products,

of which the environmental behaviour and eco-toxicological properties are an integral part of the product quality

Production facilities

with a minimum of pollution and an optimum of occupational and plant safety

Employees,

cooperating in meeting the targets with environmental and safety consciousness.

Managers

exemplifying the environmental policy.

Public relations and relationships with authorities

that are built on partnerships and permanent dialogue.

Individually, this means:

Products

The aim is that any RUDOLF products contain intended components being carcinogenic, teratogenic or genetically harmful or accumulating in nature. Due to stricter limits for formaldehyde, there was a change in labelling for a small group of products with unaltered recipe: At present, some of these flame-retardants and products for textile resin finishing must be labelled with "Might be carcinogenic". Although the percentage of formaldehyde was minimised in textile industry, it could not yet been reduced to zero. Research and development related activities are in progress. During textile resin finishing, which confers easy care properties to the textiles, exactly these properties can be achieved only with components based on formaldehyde requiring a small percentage of formaldehyde.

Every customer is provided with all information necessary to ensure that a RUDOLF product, if appropriately used, does not constitute a risk for man or nature. When developing or testing new products on the market, the entire chain from the procurement of raw materials over manufacturing conditions, storage, transportation and use to disposal is examined. Textiles are often referred to as man's "second skin". For this reason, the human-toxicological and ecological behaviour of textile auxiliaries is of paramount importance.

Up-to-date information on substances of very high concern (SVHC) is always available for our customers.

5 Environmental policy

Production

For RUDOLF GmbH, quality, environmental protection and safety are integral parts in the organisation and operation of a chemical production plant. The further development of all pollution control and safety measures is not based on spectacular individual measures, but on a continuous improvement of everyday operating procedures. Our principles when developing products and processes and improving our technical facilities are:

- minimisation of production-related effluent
- minimisation of air and noise emissions
- minimum waste
- reuse of drums and containers
- best possible precautions in occupational and plant safety
- state-of-the-art technical facilities

Employees

For RUDOLF GmbH, the environmentally and safety-conscious employee is the prerequisite for meeting these targets. This requires an open dialogue with regular training.

Consequently, every employee is expected to show a committed and responsible behaviour. The employees must see environmental care and occupational safety as part of their quality-oriented work. This requires managers exemplifying the environmental policy.

Public

RUDOLF GmbH and its employees cannot succeed with their products in the international markets unless a relationship based on partnership and permanent dialogue with the permitting authorities and the public is established. Complying with the legal regulations is a matter of course. Only by acting responsibly, the sometimes very detailed legal regulations and requirements can be translated into everyday practice. By implementing the environmental management system, the principles of the “**Responsible Care**” programme - a global initiative of the chemical industry - are fulfilled, too. Naturally, RUDOLF GmbH also participates in the “**Environmental Pact Bavaria**” - a joint initiative of the Bavarian Trade and Industry and the Bavarian government.

6 Contact

6 Contact

Christoph Andrée
Dept. Quality, Environment and Safety
RUDOLF GmbH
Altvaterstr. 58 - 64

82538 Geretsried
GERMANY

Tel. +49 (0) 81 71 / 53 - 183
Fax +49 (0) 81 71 / 53 - 280
E-mail christoph.andree@rudolf.de

7 Glossary

COD

Chemical Oxygen Demand; a measure of the sum of all organic substances contained in water, including substances that are difficult to degrade. The COD indicates the quantity of oxygen required to completely oxidise organic substances by means of chemicals.

BOD₅

Biochemical Oxygen Demand; a measure of the sum of all biodegradable organic substances in water. The BOD indicates the quantity of dissolved oxygen required

to biodegrade the organic effluent substances in a definite time; usually it is established for a period of 5 days and therefore

referred to as BOD₅.

AOX

Abbreviation for Adsorbable Organic Halogenated Compounds; sum parameter for all adsorbable organic halogenated compounds in the effluent.

MBAS

Methylene Blue Active Substance (DIN 38 409, part 23); group-specific method of analysis by which mainly anionic surfactants are detected.

BIAS

Bismuth Active Substance (DIN 38 409, part 23); group-specific method of analysis by which mainly non-ionic surfactants of the type polyglycol ether

are detected.

TA Luft

Regulatory provision of the Federal Law on Immission Control. Contains guide values for immissions as well as numerous substance and plant-related emission values. Furthermore: requirements for establishing immission parameters, measuring and monitoring emissions as well as renovation of

antiquated plants.

Emissions

Gaseous, liquid or solid substances released to the atmosphere by a plant or a technical process; also noise, vibrations, radiation and heat as well as liquid and solid substances that are not released to the atmosphere but to other environments.

Immissions

Air pollutants or radiation released to the environment.

CO₂

Carbon dioxide

SO₂

Sulphur dioxide

NO_x

Nitrogen oxides

SVHC substance

Substances of Very High Concern are chemical compounds or part of a group of chemical compounds, which, under REACH, have been identified to have particularly hazardous properties.

These substances may have serious impacts on the human health or the environment. The listing as SVHC by ECHA (European Chemicals Agency) is the

first step to authorising and restricting chemicals. The first SVHC list was published on 28th October 2008 and, since then, has been complemented every 6 months, at the end of June and December. There are special reporting requirements for identified SVHCs within the supply chain.



Management Service

ZERTIFIKAT

Die Zertifizierungsstelle
der TÜV SÜD Management Service GmbH

bescheinigt, dass das Unternehmen

Rudolf GmbH
Altvaterstraße 58-64
82538 Geretsried
Deutschland

für den Geltungsbereich

**Entwicklung und Produktion von
chemischen Produkten insbesondere für die Textilindustrie**

ein Qualitäts- und Umweltmanagementsystem
eingeführt hat und anwendet.

Durch Audits, dokumentiert im Auditbericht (Bericht-Nr. 70010046),
wurde der Nachweis erbracht, dass diese Managementsysteme
die Forderungen folgender Normen erfüllen:

ISO 9001:2015
ISO 14001:2015.

Dieses Zertifikat ist gültig vom **05.08.2017** bis **04.08.2020**.

Zertifikat-Registrier-Nr.: **12 100/104 3047 TMS.**



Product Compliance Management
München, 25.07.2017





URKUNDE

Die

Rudolf GmbH

hat sich

zu einer qualifizierten freiwilligen Umweltleistung
verpflichtet und ist deshalb

Teilnehmer am Umweltpakt Bayern
„Gemeinsam Umwelt und Wirtschaft stärken“

München, den 19. Januar 2016

Ulrike Scharf MdL

Bayerische Staatsministerin für
Umwelt und Verbraucherschutz



RUDOLF GmbH
Altvaterstraße 58-64
82538 Geretsried
Germany

Fon + 49 8171 / 53 - 0
Fax + 49 81 71 / 53 191
E-mail info@rudolf.de
www.rudolf-group.com



Responsible Care®
OUR COMMITMENT TO SUSTAINABILITY