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In 1997, we introduced the Environmental Management System according to the international standard DIN EN ISO 14001. Together with the Quality Management System according to DIN EN ISO 9001, which was 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 headquaters in Geretsried.

In addition to a high quality standard, environmental protection, safety and ecological product requirements are indispensable components of our company policies. This is what we want to be known for in our markets, and 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 dialogue with a medium-sized company group of the chemical industry.

Rudolf GmbH The Management

V. Humany W. M

Wolfgang Schumann

Dr. Wolfgang Schumann

Geretsried, 5th March 2018

1 The company at its location in Geretsried

In 1922, the chemical factory Rudolf & Co. KG was founded in the town of Varnsdorf, the centre of an important textile area in Sudetenland (today Czech Republic). At the end of the war, the company moved to its present location in Geretsried. At that 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 the 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 the textile finishing processes and products for textile care and building protection. One focus is still the production of tailor made special products for certain textile qualities, process steps and textile plants.

In Geretsried (24.000 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; at its north side 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 the time of the armaments factory.

A new production hall has been commissioned at the beginning of 2015. 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 complemented 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.

Products

RUDOLF GmbH converts approx. 700 raw materials (mainly organic chemicals) into nearly 800 different sales products. These products are used as textile auxiliaries for the pretreatment (e.g. desizing, scouring, bleaching), dyeing and finishing (e.g. soft handle, water and soil repellency) as well as the printing of textiles. Most of these products are used as textile auxiliaries for the pre-treatment (e.g. desizing, washing, bleaching) and for the finishing (e.g. soft handle, water, oil or soil repellency, coating). Textile dyes and auxiliaries for the textile print are less important. Whereas, products for the textile care used in industrial laundries or as substances in impragnation sprays are more important. A relatively new but steadily growing segment is the building protection with its own special 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 production as a whole 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. a safety analysis has to be conducted and an

emergency plan, which is revised regularly, has to be worked out. The products are manufactured by chemical and physical processes in closed reactors under the 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 the 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.

The emissions released to air when charging and operating mixing vessels and reactors are treated in two central exhaust air purification plants. One plant consists of a cryogenic condenser, of a scrubber and of 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 daily.

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

Storage and transportation

The raw materials are delivered, and our products are dispatched 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 fire-fighting facilities complementary to the goods stored. Over 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 the products made on the night shift. On the other hand, there are goods stored 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 that can take in total over 3250 m³ water for fire fighting.

The transportation of chemical raw materials and products fundamentally differs from that of other industrial goods.

The international dangerous goods regulations regulate in detail the type of packaging, shipping quantity and corresponding transportation documents. Although only part of the Rudolf products are subject to the dangerous goods regulations, we expect our forwarding agents to offer a high standard for all products transported. Detailed forwarding agreements were concluded with the forwarding agents with which RUDOLF GmbH co-operates.

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 co-operation 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 and 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 2013 to 2017, the following annual consumptions were established. The relative indications refer to the respective annual production quantity.

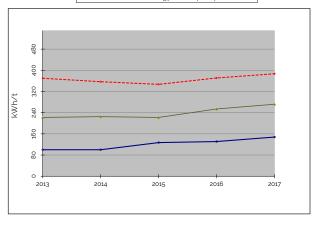
Energy consumption

	Gas [kWh/a] 	Light fuel oil [kWh/a] 	Electricity [kWh/a]
2013	8.769.126	173.267	2.658.780
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

	Total [kWh/a] c	energy onsumptio	Production quantity on (2013 = 100)
2013	11.601.173	370	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

	Relative energy consumption production [kWh/t]
2013	222
2014	225
2015	222
2016	254
2017	272





Evaluation:

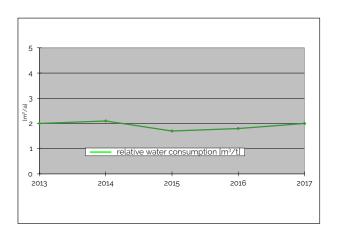
Depending on the season, one third to one half of the total gas used is required to heat the many buildings scattered over the plant site. In a cold winter month about twice as much gas is consumed as in a warm summer month. A new boiler house for the creation of process steam was commissioned at the 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 still is the oil-run boiler as a reserve.

In the last three years, the relative energy consumption as well as the relative energy consumption for production increased due to increasing distillation processes, which are very energy-intensive. Regarding only the difference between those two values (primarily heating and lighting of the buildings), a decreasing value can be noticed.

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

	Total water consumptio [m³/a]	Water consumption [m³/t]	Production quantity (2013 = 100)
2013	 62.941	2,0	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

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 has been operated since 2004. Thus, the increasingly precious drinking water supply is protected.

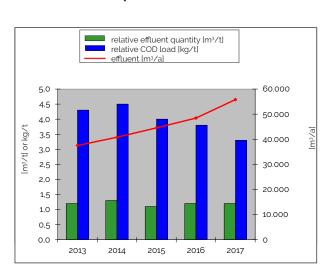
Also the water consumption has stabilized around a value of ca. 2 m^3/t in the past five years. A further consumption reduction always implicates an increase of the effluent's COD concentration because the same quantity of COD is contained in a smaller quantity of the effluent.

Effluent

	Effluent [m³/a]	COD load [kg/a]	
2013	37.512	134.578	
2014	40.806	141.196	
2015	44.526	157.835	
2016	48.431	154.781	
2017	55.779	154.683	

	Relative effluent quantity [m³/t]	Relative COD load [kg/t]	Production quantity (2013 = 100)
2013	1,2	4,3	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

Effluent quantities and COD load



Typical effluent analysis (Monthly values from composite samples in 2017)

Fluctuations are due to the discontinuous chemical production.			
	Average values	Limits	
pH value	7,2 – 8,8	6.5 - 9.5	
COD [mg/l]	1.600 - 5.500	none	
BOD ₅ [mg/l]	360 - 1.900	none	
COD/BOD ₅ ratio	2,0 - 8,8	none	
AOX [mg/l]	< 0,24	< 0.39	
MBAS [mg/l]	< 450	none	
BIAS [mg/l]	< 420	none	
Zinc [mg/l]	< 0,18	< 2	
Tin [mg/l]	< 0.05	< 2	

The percentage of Rudolf effluent discharged to the nearest municipal clarification plant (Weidach) was:

	Clarification plant at Weidach [million m³/a]	Effluent share RUDOLF [%]	
2012	4,054	0,93	
2013	4,237	0,96	
2014	3,705	1,10	
2015	3,787	1,17	
2016	4.192	1,33	

	COD clarification plant inlet [g/m³]	COD Rudolf average [g/m³]	COD share Rudolf [%]
2012	933	3.337	2,9
2013	866	3.596	3.7
2014	1.008	3.460	3,8
2015	958	3.545	4.3
2016	871	2.773	4,2

The data for 2017 from the effluent association for sewage treatment ISAR-Loisachgruppe for the clarification plant Weidach is not available yet.

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.

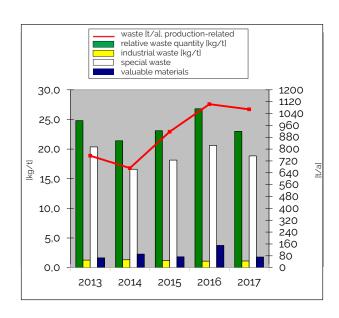
With approx. 1.1%, the share of Rudolf effluent in the total effluent treated by the clarification plant in Weidach is considerably lower than frequently assumed by the public. By timing the introduction of Rudolf effluent in agreement with the clarification plant Weidach, we essentially contribute to the biological treatment stage of the sewage treatment plant being effective also at night when nearly no domestic effluent is introduced.

Waste

	Waste (production- related) [t/a]	Relative waste [kg/t]	Industrial waste [kg/t]
2013	778	24,8	1,28
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

		Valuable materials (wood, paper, sheets, metal [kg/t]	
2013	20,36	1,65	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

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 raised 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. Ca. 64% of the accumulated waste were re-cycled. Slightly less than 30% of the total waste could be classified as "non-hazardous".

The industrial waste contains unavoidable waste from the entire factory premises. It is comparable to household waste and is sorted again before disposal. The special waste covers non-reusable textile auxiliaries and raw materials. Together with laboratory waste, chemically polluted operating materials and sewage sludge it is disposed of via GSB (Bavarian Society for the Disposal of Special Waste). Polluted solvents are - as far as possible - energy-recycled.

The increased amount of impure solvents is explained by more complex production methods, these are unavoidable.

Fortunately, the quantity of produced special waste per ton of product decreased. After a huge amount of wooden pallets having been disposed of in 2016, the relative quantity of valuable substances normalized, too.

The exhaust air purification plant of the new production hall is operated on the principle of regenerative thermal oxidation. Since spring 2015 the by-product isopropyl acetate (a solvent) can be re-used as fuel and, thus, be energy-recycled. Just as the hazardous waste, the valuable substances occurring in the factory are production-related (e.g. packaging material).

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

Emissions to air from steam generation/ heating

	2013	2014	2015	2016	2017
CO ₂ from furnaces (t/a)	1.799	1.714	2.143	2.419	2.873
SO ₂ from furnaces (kg/a)	62	56	18	52	36
NO _x from furnaces (kg/a)	912	868	1.083	1.224	1.452

Evaluation:

The increasing amount of emitted carbon dioxide and nitrogen dioxide reflects the increased quantity of production as well as the increased energy need. The emissions of sulphur dioxides result primarily from the consumption of light fuel oil, which is minimized as possible. Due to an interruptible supply for firing with gas, the gas supplier can ask for the boiler to be switched off by RUDOLF GmbH on 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.

Emission to air from the 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. Regular emissions measurement will be realized in autumn 2018.

The test run of the new ALURA started in the first quarter of 2018. The cryogenic condenser eliminates solvents using cryogenic nitrogen, which reduces effectively 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. Three months after running without problems, the first emission measurement will take place, probably in late summer or autumn 2018.

Measuring .	Unit of	Max.	Limit
component	measure-	measure-	
	ment	ment plus	
		measuring —	
		inaccuracy	
Total C	mg/cbm	6	20
Sulphur	g/cbm	<< 0.0005	0.35
dioxide			
Nitrogen	g/cbm	0.04	0.1
oxides,			
indicated			
as NO ₂			
Carbon	g/cbm	<< 0.003	0.1
monoxide			
Total dust	mg/cbm	7	20
Hydro-	mg/cbm	< 0.1	30
chloric acid			
Ammonia	mg/cbm	1	30
Organic	mg/cbm	1	20
substances			
No. 5.2.5,			
Class 1 of			
TA air			
Acetic	g/cbm	0.008	0.1
acid	_		
Benzyl	mg/cbm	<< 0.003	0.05
chloride			-
Acryla-	mg/cbm	<< 0.01	0.5
mide	Ŭ		
Allyl gly-	mg/cbm	<< 0.09	1
cidyl ether			

<< = smaller than the measurement limit

The poorer value (firing with natural gas/firing with IPAC) is indicated as a maximum measurement.

Emission measurement results at the RTO (2015)

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 systems 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 developed further.

All efforts focus on:

Products

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

Production facilities

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

Employees

that, being environmentally and safety-conscious, co-operate in meeting the targets

Managers

that exemplify the environmental policy

Public relations and relationships with the authorities

that are built on partnership and permanent dialogue.

In the individual case this means:

Products

RUDOLF GmbH does not produce or market any products that intentionally contain carcinogenic or mutagenic substances or substances accumulating in nature. 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 humantoxicological 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.

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 continual 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

re-use of drums and containers

best possible precautions in occupatio-

nal

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 all employees, combined 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 that exemplify the environmental policy.

Public relations

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. Legal regulations are met as a matter of course. Only by acting responsibly can the sometimes very detailed legal regulations and requirements 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 by the Bavarian Trade and Industry and the Bavarian Government.

6 Contact

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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.

BOD

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.

CO

Carbon dioxide

SO,

Sulphur dioxide

NO,

Nitrogen oxides

SVHC-Stoffe

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.



CERTIFICATE

The Certification Body of TÜV SÜD Management Service GmbH

certifies that

Rudolf GmbH Altvaterstraße 58-64 82538 Geretsried Germany

has established and applies a Quality and Environmental Management System for the following scope of application:

Development and production of chemical products, especially for the textile industry.

Performance of audits (Report No. 70010046) has furnished proof that the requirements under:

ISO 9001:2015 ISO 14001:2015

are fulfilled.

The certificate is valid from ${\bf 2017\text{-}08\text{-}05}$ until ${\bf 2020\text{-}08\text{-}04}$.

Certificate Registration No.: 12 100/104 3047 TMS.











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

