

balewa Letter Nr. 02 Off gas related consulting

Dear reader

This **balewa** letter focuses on our consultation service to efficiently use gases in production and optimally treat and dispose of exhaust gases.

Challenges with off gases are multifaceted, and the off gas related issues are usually very complex. The environmental gaseous conditions vary often: They may be hot or cold, humid or dry, contaminated with complex mixtures of solvents, acids and alkaline compounds, aerosols, dusts or traces of odorous compounds.

Common to most of our off gas related projects in production are that changes

in composition occur very dynamically. During a production process, short peaks of gaseous emissions of a few seconds or minutes may generate a harmful off gas problem such as a safety related critical situation, hygienic problems, or the surpassing of a legal emission limit.

Treatment of huge volumes of odor laden air is most often carried out at industrial effluent treatment plants. Since such systems require considerable quantities or resources and energy, efficient technologies deserve top priority.



At ARA Rhein in Pratteln, Switzerland, up to 60'000 m³/h of weakly contaminated, odor laden air is treated in a compost biofilter

Off gas concepts

balewa's off gas consultation service and concepts follow the strategy to **avoid, minimize, and treat the gases/exhausts at their source** wherever possible and reasonable. Based on our know-how of the numerous projects realized, the measures put into practice and the operator's experiences, we develop and apply tailor cut and economic concepts.

In rare cases, the generation of off gas can be **avoided** at the production level. The use of mechanical stirrers instead of the mixing with gas, or by the transfer of liquids using pumps instead of vacuum or pressure will result in almost zero gaseous emissions. Water soluble gas streams such as CO₂ or ammonia may be treated such that no gaseous emission will occur.

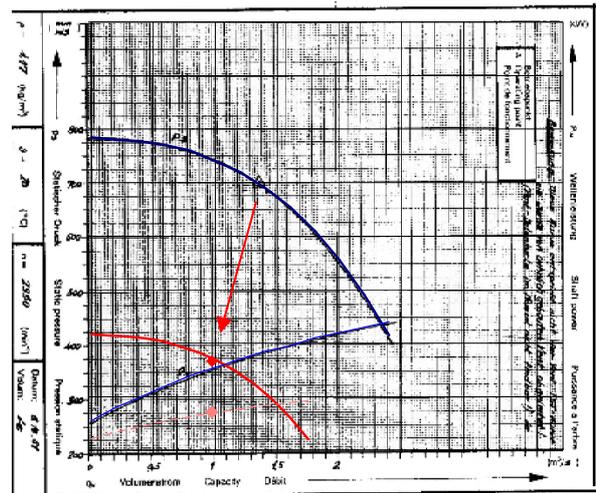
Off gas minimization measures consist of modern process technological infrastructure as well as an **efficient off gas management**. Based on our long experience, we estimate that about 80 % of the gaseous emissions may be reduced at the source by the application a good working culture.

The basis for **efficient solutions of off gas issues** is our detailed knowledge of chemical properties of off gas components, analytical methods, measurement techniques, the understanding of the processes generating the off gas and the potential safety issues (ATEX). Competent and familiar with potentially available technologies, their status of development and their optimal fields of application, **balewa** is capable to plan, construct and start up efficient off gas treatment units.

Energy efficiency

The treatment of off gas may frequently result in high energy demand. That is why **balewa** focuses on energy efficiency. One of our means to identify energy savings potential in complex production processes and buildings is our well-structured approach for the **situations analysis**.

When modifying or replacing old infrastructure, we consequently opt for modern, energy saving units and systems.



Reduction in energy requirements by the use of frequency controlled regulators



New fan with energy saving drive

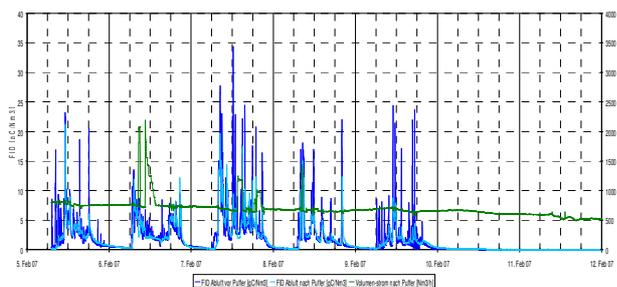
Analysis of off gas situation

A big challenge for existing off gas treatment installations is their permanent adaptation and optimization to new situations. Such situations might result due to a higher trough-put, modified production parameters, additional processes using other solvents, new products, or a new look to energy consumption, production costs, or tougher legal limits.

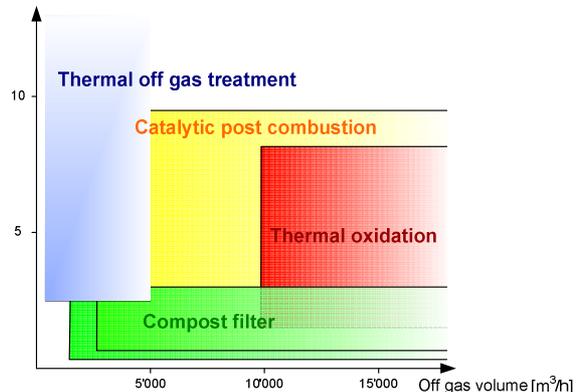
balewa's approach to support you to solve off gas issues is by following a systematic situations analysis using a number of different and self developed tailor cut tools. The theoretical considerations supplement our long experience in the productive industry and enable us - especially in the chemical industry - to rapidly identify potential causes for given off gas problems.

In addition to the evaluation and interpretation of available data, **balewa** measures additional parameters, if required, or let them be determined by capable experts.

Based on the detailed situation analysis, different concepts/solutions for the given case will then be developed. Subsequently, we offer our services for any phases of a project, as e.g. cost estimate, and quote requests, evaluation of offers, planning, time schedules, commissioning and training. **balewa** has profound experiences in the chemical production and knows well potential solutions for off gas issues close to the process. They include organizational and/or technical measures. As an independent consultant, we are not obliged to any supplier.



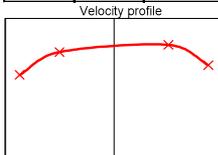
Peak concentrations of different solvents over short time periods are typical for off gas problems in production



Fields of application of different gaseous effluent treatment systems

Measurement of volumetric flow of gases (according to EMPA recommendation)

Data point Nr	distance x [cm]	velocity w [m/s]
1	12.6	7.3
2	30.5	9.2
3	79.5	9.8
4	97.4	8.1



Situation in plant



Pbar	981 mbar
Pstat	+12.76 hPa
Temperature	21.8 °C
rel. humidity	98 %
Average velocity	8.60 m/s
Abs pressure	994 mbar
Volumetric flow	23'353 m³/h
Normvol humid	21'211 Nm³/h
Normvol dry	20'597 Nm³/h dry
Mass flow humid	27'090 kg/h
Mass flow dry	26'651 kg/h
Mass of water	439 kg/h
Water content	16.5 g ₁₀₀ /kg _{dry}
H _{tot}	471.94 kW

Example of a data sheet to analyze a process unit

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Realization of concepts

Well developed and adapted solutions are valuable only if they are turned into practice, and the operators up front apply the implemented measures and enjoy running their new or modified installations. A close contact with our clients and users enables us to maximally respect and include the requests and restrictions during the process development and realization.

References for successfully realized off gas projects:

- Genzyme Ltd.: Analysis of the gas emissions, implementation of measures in production to minimize emissions
- ProReno Ltd.: Energy optimization of any technical installations used to treat gaseous emissions
- Effluent treatment plant ARA Rhein
Upgrading the existing compost biofilter
- Borregaard Schweiz Ltd: Cover of sludge basins and evacuation and treatment of H₂S contaminated air



Wet scrubber used for air treatment at the domestic waste water treatment plant at Basle



Exchange of spent material in a biofilter treating off gas



Covers of two sludge basins to efficiently remove odorous gases for treatment with hydrogen peroxide in a wet scrubber