

NATURAL POOL INFO 2022



NEWS+FACTS ON NATURAL POOLS



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CLIMATE NEUTRAL SWIMMING ? [P.1]

CO2 emissions of Natural Pools

DANA 2.0 – DATA STORAGE + CONTROL CENTER OF NATURAL SWIMMING POOLS - PART 2 [P.3]

Current state of the natural pool at a glance

GERM-ELIMINATION USING ZOOPLANKTON [P.6]

A factor which should not be underestimated

„USOs“–UNKNOWN SWIMMING OBJECTS IN NATURAL POOLS [P.7]

What can be found in the natural pool water

INDOOR POOLS AND BIOLOGICAL WATER TREATMENT ... AND IT WORKS! [P.9]

Insight into indoor facilities and experiences

PHOSFERRUM [P.11]

Patented granules for phosphorus binding

WOODEN DECKS IN NATURAL POOLS [P.11]

Alternative materials for wooden decks

„SPONGE CITY“ MEETS SWIMMING POND [P.13]

Rainwater utilization with a difference



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Editorial

Natural Pool Info Editorial

Dear Readers,

While there has been less going on in pools in the last two years than in previous years due to the Covid situation, a lot has happened in the area of planning and development. Judging by the number of new pool designs, the industry is slowly transitioning out of the niche and into a larger market. Accordingly, it is important to continue optimizing the facilities and adapting them to the demands of the times. In the future, the CO₂ balance of a pool will play an increasingly important role (*climate-neutral swimming?* – p. 1), the digitalization of the facilities will become more important (*DANA 2.0 - from data storage to the control centers of the natural swimming pool* – p.3), new concepts such as natural indoor pools (*indoor pools with biological water treatment, ... yes, it is a possibility!* – p.9) and rainwater utilization as filling water (“*Sponge City*” meets *natural swimming pond* – p.13) will increasingly move into the focus of planning. At the same time, it is still important to better understand the facilities (*germ elimination by zooplankton, USOs - Unknown Swimming Objects in Natural swimming Pools* – p.6) and to improve them both in terms of design (*footbridges in natural swimming pools* – p.11) and water treatment (*Phosferrum* – p.11).

We look forward to presenting some interesting news in this issue and hope you enjoy reading it. Best regards and stay healthy!

Stefan Bruns, Hannes Kurzreuther, Janne Baden, Nina Röttgers, Leon Müller [Polyplan-Kreikenbaum] Inga Eydeler, Dr. Antje Kakuschke, Dr. Stefanie Hirch, Dr. Jürgen Spieker [KLS Gewässerschutz]

On behalf of the Working Group Swimming Lakes and Ponds „Arbeitsgemeinschaft Badeseen und Schwimmteiche“ (ABS)



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Sustainability

Climate neutral swimming?

CO₂ emissions in the operation and construction of natural outdoor pools & swimming pools

While the German government is pursuing the goal of climate neutrality by 2045¹ and promoting corresponding projects, the operation and construction of natural outdoor pools is faced with the very specific question of how this goal can be implemented in their own industry. And what would a climate-neutral natural outdoor pool actually be?

According to the German Association for the Swimming Industry², the CO₂ footprint per visit to a classic public swimming pool is 4.06 kg. This means that the operation of swimming pools is significantly better than that of indoor pools (7.70 kgCO₂ per visit), but it also shows the savings potential which still exists here. In practice, two central areas can be distinguished; the construction/refurbishment phase and the operating phase.

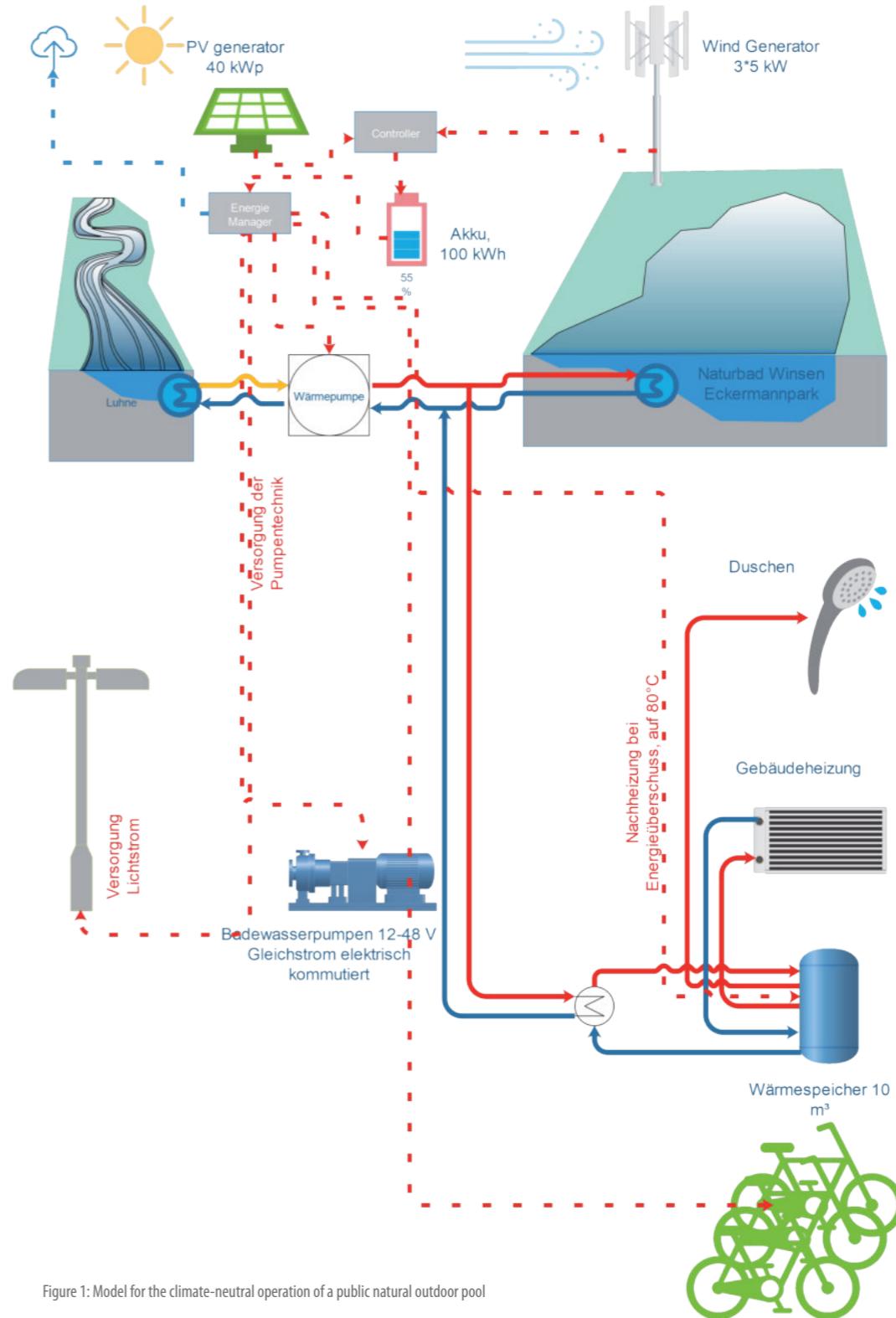
Many new construction projects are already aiming for climate-neutral operation, and the first pool operators are advertising with the description “climate-neutral”³. This refers to operation, and “climate neutrality” is usually achieved through the use of renewable energies obtained from the grid. A holistic approach for a possible self-sufficient energy supply using wind, solar, heat pump and heat recovery is shown in Figure 1.

While the emissions caused by the operation of a swimming pool can still be illustrated relatively well, the evaluation of the construction phase is much more difficult. Here, too, models must be developed that cause as little environmental damage as possible, while materials which conserve resources should also be used. Data from the European Product Declarations (EPDs) provide a basis here. These look at the life cycle of a product and evaluate the individual stages in terms of their impact on the environment. The “Ökobaudat”⁴ database also makes the comparison of individual materials with each other possible. For example, different types of wood, the CO₂ emission equivalents for different concrete classes as well as transport routes can be compared. By taking these aspects into account during the planning stage, the main sources of emissions can be identified and, if necessary, replaced by alternative materials. Refurbishment projects in existing buildings in particular show a great potential for recycling. Possibilities for a significant reduction in potential CO₂ emission equivalents are therefore definitely available, even if many materials and work steps can only be accounted for to

a limited extent for the time being. In addition to the development of suitable models for mapping the emissions resulting from the construction phase, the question will also arise as to how far other environmental impact categories need to be taken into account in order to develop viable concepts for the future. [PK]

Sources:

- 1: Bundesregierung (2022): <https://www.bundesregierung.de/breg-de/themen/klimaschutz/mehr-klimaschutz-in-der-eu-1790042>
 - 2: DGfB (2019): DGfB-report-Bäderkennzahlen 2019
 - 3: OSPA (2022): <https://www.ospa-schwimmbadtechnik.de/aktuelles/artikel/ospa-ist-klimaneutral-als-erster-hersteller-der-branche.html>
 - 4: <https://www.oekobaudat.de/>
- Umweltrat (2016): Survey; Pariser Klimaziele; https://www.umweltrat.de/SharedDocs/Downloads/DE/01_Umweltgutachten/...





Current news on Natural Pools

DANA 2.0 – Data storage and control center of natural swimming pools (Part 2)

Record and control the current state of the natural swimming pool at a glance

The Database of Natural Swimming Pools (DANA) was developed before 2007 as an online platform for documenting operational management and finding causes and solutions when operational problems occur. It also provided the basis for research and data for further development of regulations. The 2019 issue of "Naturbadinfo" had already reported on the changing user requirements and the further development of DANA along these lines as the technical possibilities advanced.

With the completion of the DANA 2.0 database in 2020, you will now find **additional and enhanced features** as well as an exceptionally **user-friendly and intuitive interface**. In its new appearance DANA no longer serves exclusively for data storage, but now also enables facility management among other features.

It is important to emphasize here that DANA 2.0 is no longer limited to the user's stationary computer. Numerous functions are now made available

on any network-capable handheld device, **well laid out, technically up-to-date and visually appealing**, giving the user access to DANA from any location. See graph on left: DANA 2.0 - Functions.

The **dashboard** forms the start page of each system. On the one hand, it contains the live data of the facility (operating status, temperature measurements and facility workloads) and, on the other hand, dynamic or static graphics from the data analysis, which can be displayed in order to gain an immediate and individual overview of the operation of the facility. In addition, there are shortcuts to important menu items such as the facility's **alarm management** or the **control interface**.

See graph 1: Facility Dashboard

The most important site information is stored and can be edited under various tabs in the **site profile**. Among other information, **contact data** of the most important persons responsible for operation, **documents** such as operating instructions, diagrams and schematics can be found here, as well as maintenance plans and the measuring systems created for data acquisition. In order to ensure direct and uncomplicated access to information, it is possible to search and **filter** stored documents directly in the web interface. This makes it possible to quickly access the desired information.

Laboratory data or manual measurements can be entered for a facility's configured measuring points in the **data capturing** and are subsequently available for data analysis. With this, **limit values** are displayed in color and dynamically adapted to the input on the basis of the stored standards and guidelines. Thus, on the one hand, measurement or calibration errors can be noticed directly, while, on the other hand, immediate measures can be taken in the event of limit values being exceeded. In case of exceedance, **measurement-specific information** can be displayed for **problem determination and handling**.

For large amounts of data (e.g. laboratory data) or historically created data, the CSV import can be used. In this case, existing tables in CSV format can be imported directly into DANA 2.0 without having to enter each value manually. Data imported this way can be integrated into existing measurements and offer the full range of functions of manual measurements.

For **data analysis**, numerous data and a wide variety of parameters are often viewed and evaluated in parallel. In order to make the evaluation of op-

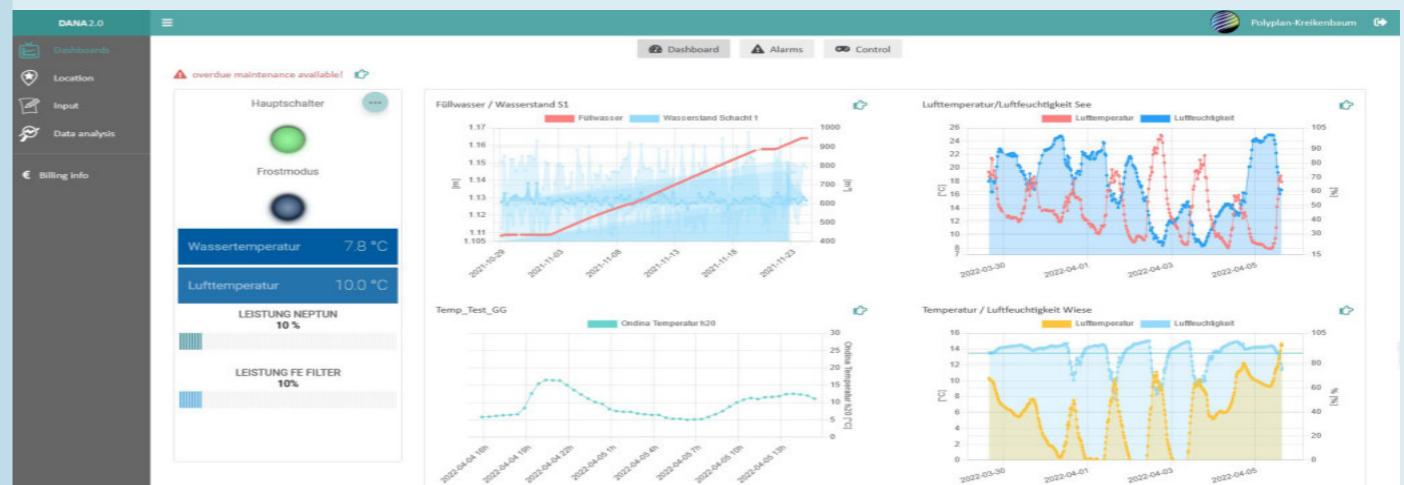
rating data as simple and effective as possible, the graphic interface of the data analysis is designed to be very intuitive and user-oriented. Available data from sensors, operating parameters or laboratory measurements can be sorted and displayed here using **various filter options** (basin types, measurement types, etc.) and/or the selection of specific time intervals. Particularly noteworthy at this point is also the **tabular summary of the most important calculations** such as mean values, limit value exceedances, minimum and maximum values, which are automatically generated and dynamically adapted to the set time intervals. Should the processing of the available data with proven tools in spreadsheet programs such as Microsoft Excel be desired, these can be easily exported as a CSV file and further processed externally. All data displayed can also be saved as **preconfigured sets** and permanently displayed on the dashboard. See graph 3: Data analysis

For the control of the facility, a highly secure **control interface** which can be customized to the facility is integrated into DANA 2.0. In addition to the display of live data of the most important operating

are directly visible in the database and historically stored, so that persons responsible for the site have a quick overview of the situation in the respective facility. Typical **alarm signals** here can be, for example, operating parameters such as shaft limits or pump failures, but also water-chemical or -biological limit value exceedances due to manual or laboratory measurements. It is also possible to define **alarm emails** for each location, to which an automatic message is sent when an alarm is triggered. See graph 3: Alarm Management

In addition to data entry, it is possible to create individual **maintenance plans** for specific **maintenance tasks** that are scheduled at repeated intervals or even once at specific points in the season (e.g. commissioning and decommissioning, on-site appointments or maintenance appointments with external companies). This displays upcoming and overdue maintenance tasks, so that operators and responsible persons are constantly informed.

The maintenance tool allows the definition of facility-specific maintenance tasks with regard to the maintenance point (location of the facility), the responsible group of people and the time period or



Graph 1: Facility Dashboard

parameters and modes, it is possible to modify **facility parameters** such as the facility load correction of various filters and to **adjust certain parameters remotely**. This makes it possible for the first time to conveniently set operating parameters that would have required on-site intervention in the past. The control interface can currently be accessed flexibly from a PC or laptop and in the future probably also from a smartphone.

As regards **alarm management**, measured variables (e.g. essential operating parameters) can be individually declared as alarms in DANA 2.0. These

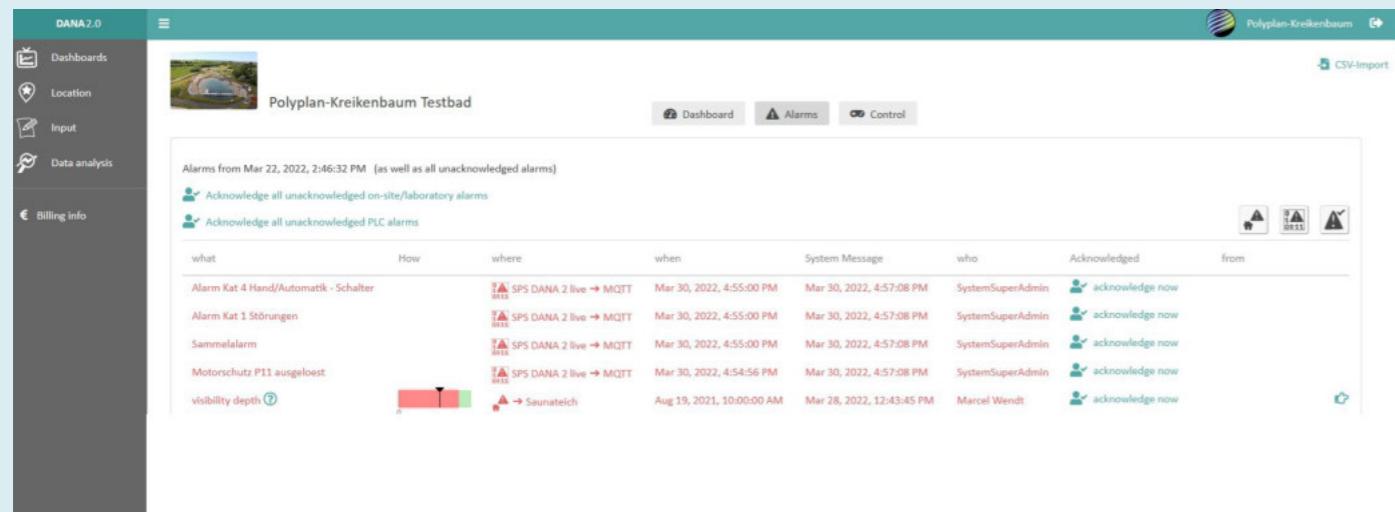
maintenance interval. Once maintenance has been completed, it can be confirmed and optionally commented on. This enables organized processes and a consistent documentation of the operational management. See graph 4: Maintenance Tasks.

In short: **DANA 2.0** provides the operator with the possibility of recording the **operating status** of a natural swimming pool **at a glance** on a daily basis and taking necessary **measures** - if required, also via direct access to the **pool control system** (SPS).

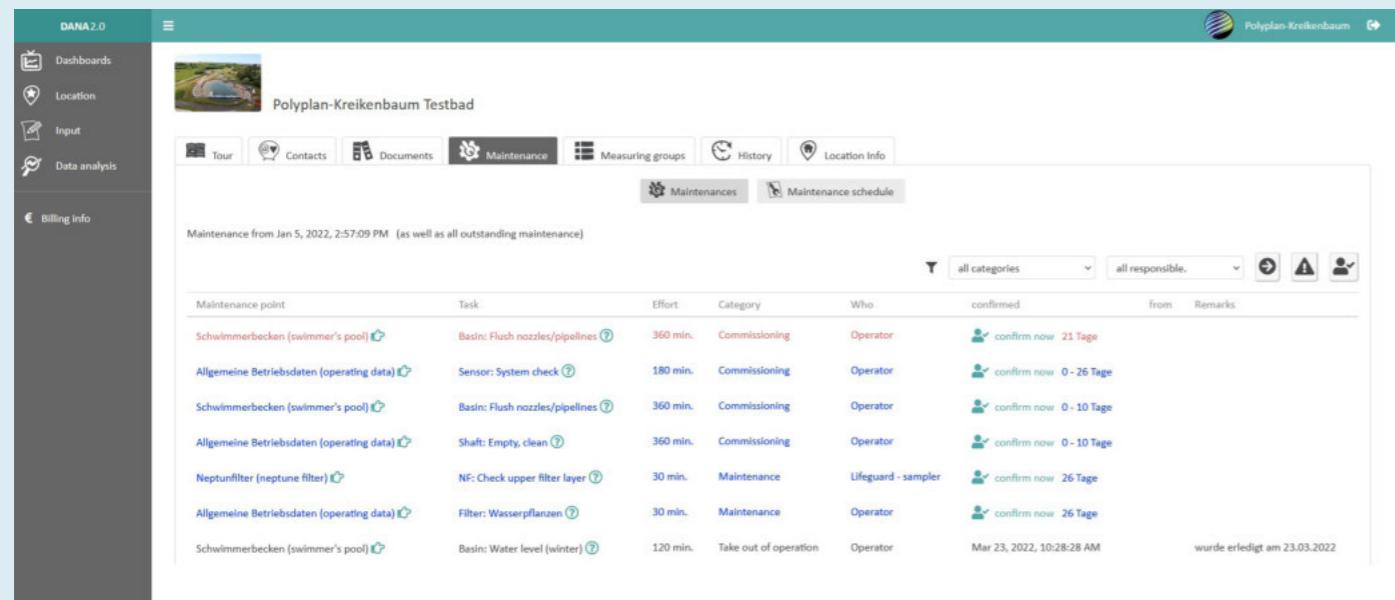
[PK]



Graph 2: Data Analysis



Graph 3: Alarm Management



Graph 4: Maintenance Tasks

Biology

Germ-Elimination using Zooplankton

A factor which should not be underestimated

In swimming and bathing ponds, as in a lake, natural processes of germ reduction take place directly in the water body. In addition to UV light, these include the sinking of particles to the bottom of the water (sedimentation), certain milieu conditions, competition pressure and feeding by macrozoobenthos (invertebrates living on aquatic surfaces). However, zooplankton (free-floating, faunal microorganisms in water) also play an important role in bacterial elimination, as they feed largely on bacteria and algae.

The most abundant groups of zooplankton in freshwater are Flagellata (flagellates), Ciliata (ciliates), Rotatoria (rotifers), Cladocera (water fleas), and Copepoda (copepods). A majority of zooplankton feed on bacteria (bacteriovorous) and/or phytoplankton (herbivorous). These zooplankton have different feeding behaviors and are categorized as vortex feeders, filterers, or grabbers (Image 1).

Zooplankton Group	Filtration rates [ml / individual / day]		
	Minimum	Maximum	Average
Ciliata	0.012	0.163	0.0875
Rotatoria	0.007	16.992	8.500
Copepoda	0.048	129.600	64.824
Cladocera	0.096	66.480	33.288

Table 1: Experimentally determined filtration rates of zooplankton

However, not only the composition of the zooplankton plays a decisive role in the filtration performance, but also the density of individuals.

In a swimming and bathing pond, one assumes a medium to maximum filtration performance of the zooplankton due to the low trophic level and the lack of food. The lower the food supply, the more the zooplankton have to filter to obtain food. Within the framework of water ecological monitoring according to FLL by KLS Gewässerschutz, it was determined that at high individual densities, assuming a maximum filtration performance, the entire

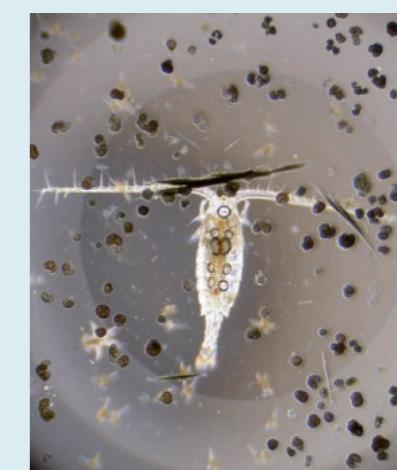


© Fotos KLS, Inga Eydel

Rotifer *Brachionus*, representing „vortex feeder“.



Water flea *Daphnia*, representing „filterers“



Copepod *Eudiaptomus*, representing „grabbers“

Intensive research in aquatic ecology and microbiology has been carried out for decades in order to better understand the food web and material fluxes in aquatic ecosystems. The **feeding and filtration capabilities** of many zooplankton organisms are now well known and demonstrate the potential for the targeted use of zooplankton in wastewater treatment and germ elimination.

The filtration rate of an individual indicates the volume of water in which the amount of food eaten was present. Whereas the ingestion rate indicates how many food particles or how much food mass an individual eats per unit time.

There are significant differences in filtration rates across the zooplankton groups (Table 1).

water body of the swimming and bathing pond is filtered through by the zooplankton **3 to 11 times per day** (mean filtration performance = 2 to 5 times per day) (KLS, 2008).

These data show, on the one hand, the influence of zooplankton on germ elimination and, on the other hand, the importance of qualitatively and quantitatively recording the population of zooplankton during aquatic ecological monitoring in swimming and bathing lakes.

[KLS]

Additional Literature:

EYDELER & SPIEKER (2010): Keimelimination durch Zooplankton – Wasserreinigung in Schwimm- und Badeteichen. In: Der Hygieneinspektor, Infektionsschutz, Trinkwasser, Badewasser, Umwelthygiene

Biology

,USOs' – Unidentified Swimming Objects in outdoor swimming pools

What can be found in the natural pool water

An outdoor swimming pool is not only a habitat for planktonic organisms living in the free body of water, which include phyto- and zooplankton and bacterial communities. Many organisms are substrate-bound (benthic), meaning they are found on the walls, on the bottom, or in the filtration systems. These communities of organisms are similar to the benthos of a swimming pond, although here too a distinction is made between animals (zoobenthos) and plants (phytobenthos). The latter include filamentous algae, which were introduced in Naturbadinfo 01/2020. However, there are a variety of zoobenthic organisms that are less well known. They include diverse invertebrates such as sponges, Cnidarians, Bryozoans, Flatworms, Threadworms, Oligochaete, Leeches, Snails, Mussels, Crayfish, Water Bugs, Water Beetles, and larval stages of many insect groups. Some species found in outdoor swimming pools will be briefly presented here (Image 1).



Organisms at the edges of a natural swimming pool - Source: KLS, A. Kakuschke

Insects (Insecta) > Black flies (Simuliidae) and Chironomids (Chironomidae)

Black flies and chironomids belong to the insect group Diptera (two-winged insects) and to the suborder of Midges (Nematocera).

More than 2,000 species of black flies have been identified, including more than 50 species in Germany. In the adult stage they resemble flies and are

2 to 6 mm long. They pass through several larval and one pupal stage. As larvae, they have a characteristic club-like shape and usually adhere onto stones and plants with an adhesive disc, in natural pools they do the same, in this instance, on the edge of the pool, spillways or other fixed structures. They are easily identified by a large and small fan on both sides of the head, which are used for filtration. The larvae are 6 to 15 mm long. After a brief pupal phase, black flies are immediately capable of flight and swarm primarily from April to May. The adult females of some species suck blood. This blood meal is used to form the ovipositor. In doing so, they lacerate a small wound with their mouthparts and suck the blood that emerges from the capillaries. The bite can be quite painful, bleed for a long time, cause itching and swelling, and in the worst case, transmit pathogens. After a bite, one should cool, disinfect, not scratch and, depending on the symptoms, consult a doctor. The larvae of black flies, on the other hand, feed on minute water organisms and are completely harmless to humans.

Insects (Insecta) > Köcherfliegen (Trichoptera)

Caddis flies also belong to the group of insects. The

duce threads for the production of catching nets, living webs, for the construction of caddis and pupa cases. A distinction is made between caterpillar-shaped (eruciform) larvae, whose head is directed downward, and campodeid larvae, whose head is directed forward. Caddis flies are completely harmless to humans.

Ringworms (Annelida) > Leeches (Hirudinea)

Leeches, like earthworms, belong to the phylum of annelids (Annelida). Of the approximately 300 species, most live in freshwater. They are characterized by the division of their body into 33 segments, some of which are swollen into a girdle in the front third of the body. The leeches have two suction cups at the front and rear ends, which enable them to crawl in a stealthy, peeper-like manner. However, they can also swim quickly through open water, using their strong longitudinal muscles. All leeches feed exclusively on animal matter: Either they live predatorily on insect larvae, worms and other small animals, or they suck blood. The 25 species native to Germany can be classified into four families of leeches: The fish leeches (Piscicolidae), which latch onto fish; the cartilaginous and flattend leeches

branches or within aquatic plants. The Roll leech is a very good swimmer and predator. It devours small aquatic animals such as worms, small crustaceans and insect larvae. The Roll leech itself is in turn eaten by fish and aquatic birds, and is completely harmless to humans. The Roll leech grows up to 60 mm long, has a relatively soft body and when endangered, secretes a lot of mucus as a defense mechanism.

Crustaceans (Crustacea) > Acquatic Isopods (Asellus aquaticus)

The species-rich group of crustaceans is grouped with the arachnids, millipedes, and insects into the phylum of arthropods (Arthropoda), which is characterized by body segmentation, limb segmentation, and an exoskeleton. Aquatic isopods are higher crustaceans and belong to the Isopoda (equipods). The species *Asellus aquaticus* is the only native species in terrestrial aquatic environments, there are however other invasive species. The aquatic isopod lives between rocks, fallen foliage, and aquatic flora. Its food consists mainly of detritus, but also of living plant material and in turn, itself serves as food for larger fish. An aquatic isopod can live up



Collected animals from another swimming pool - Source: KLS, I. Eydeler

to two years and grow between 8 to 12 mm long. The female aquatic isopod engages in brood-care. It forms a brood chamber using its front pectoral legs, in which it lays 100 to 200 eggs, which the male fertilizes. [KLS]

Additional Literature:

Spieker & Eydeler (2005) Was lebt im Schwimmteich - Teil 3: Zoobenthos: Krebse, Schnecken, Muscheln, Egel, in DER SCHWIMMTEICH 2/2005

Current news on Natural Pools

Indoor swimming pools with biological water treatment ... and it works!

An insight into indoor facilities and experiences linked to them

Swimming pools with biological water treatment are becoming **increasingly popular** among swimmers. At the same time, through 20 years of operation with extensive experience of the **hygienic performance**, extensive knowledge of this type of water treatment has been gained both nationally and internationally. At the international IOB congress in Portugal Albufeira in 2021, we gave a presentation for the first time about experiences with **indoor facilities**. The following model swimming pools were showcased:



Indoor Pool Wellnessdüne 6 - Source: PK

Results:

- This facility currently runs hitch-free.
- It shows stable hygienic parameters.
- Temperatures of up to 29.8 °C do not lead to a deterioration of the standard hygienic parameters.
- Further data collection as part of a research project on the following parameters: Legionella, Norovirus, Cryptosporidia, Zooplankton & Algae should be carried out.

Pool 2: Badeteich Modoux

Unfortunately, no hygienic data exist for this temporarily sealed facility yet.

Results:

This facility is an attractive campsite indoor swimming pool. Approximately 100 to 200 guests use the pool daily, both in summer and winter. The bath features a submerged soil filter, located below the pool enclosure.

Technical data:

- Pool size: 200 m²;
- Pool volume: 240 m³
- Circulation rate: >8h
- Water treatment area: 30 m²



Indoor Pool Wellnessdüne 6 - Source: PK



Indoor Pool Hövelhof - Source: PK

Pool 3: Hotelanlage Hövelhof

This object is an attractive small hotel indoor swimming pool. Approximately 50 guests use the bath daily, both in summer and winter. The bath has a submerged soil filter, which is located below the pool enclosure.

Technical data:

- Pool size: 60.1 m²;
- Pool volume: 25 m³
- Circulation rate: >3h
- Water treatment area: 11.5 m²

Hygiene Experience

Hygiene parameters were collected for the first time in 2017; in the first few years, *Pseudomonas aeruginosa* exceedances occurred repeatedly. The sources of the problems were found and

counts occur with respect to *E. coli* and *enterococci*. An exception is the *E. coli* value in 07/2021, for this we have no conclusive explanation.

Results:

- This facility currently runs hitch-free.
- It shows stable hygiene values.
- Temperatures of up to 26 °C do not influence / lead to a deterioration of the standard hygiene values.

Summary

The existing facilities do not meet the requirements of today's regulations, but many years of operating experience have shown that they run perfectly and even possess the **advantage of light limitation** compared to outdoor facilities. From a structural-physical perspective, the facilities are operated with a humidity of >70%; mold growth

eliminated as part of a remediation plan by Polyplan GmbH. Nowadays, the pool is running stably, the exceedance frequencies are in the lower range of the expected value of approx. 6% - over all surveys, the exceedance frequency for *P. aeruginosa* is 12%. These frequencies are also commonly found at outdoor facilities as an annual average¹. **Compared to outdoor facilities, the pool has an extremely low cleaning requirement**, which can evidently be attributed to light limitation. Pool water temperatures were limited to below 25°C in the first years. Since 2017, pool water temperatures have been regulated at 25 to 26°C. Similarly, no increased bacterial

and corrosion are absent. The absence of chlorine reduces the need for ventilation and greatly simplifies the use of recirculating air heat exchangers, so that **massive energy savings** can be expected here compared to conventional indoor pools. The pump technology operates with upstream pressures of less than 3 mWs, which suggests potential electrical energy savings of about 60%.

Based on these results, we have already established contact with indoor pool operators and pool companies to plan a public pilot facility for the first time. We hope to be able to report further on this shortly. [PK]

Filtration technology

Phosferrum

Patented granules for phosphorus binding in outdoor swimming pools

The control of the phosphorus content in a natural outdoor pool remains the most important chemical parameter for the control of algae growth. The lower the phosphorus content, the lower the algal growth rate.

In order to increase the phosphorus binding capacity of soil filters, Polyplan developed an iron-based coating for filter granules in 2003. This has been further developed since 2018 and registered with the European Patent Office.

The patent was finally granted in 2022. In the meantime, more than **200,000 tons** of the material with the improved formulation have been **successfully installed** in various soil filters. The many changes in the formulation have now also been incorporated into a new name: **Phosferrum**.

Research is currently underway to adapt the material so that it can also be **used in phosphate**



Phosferrum - Source: PK



Grey-coloured wooden deck made from recycled plastic, Natural Pool Bassum - Source: PK

adsorbers in the future. The use in phosphate adsorbers would lead to a cost reduction compared to conventional processes. In addition, phosphate adsorbers can be integrated into existing systems for performance optimization with minimal effort. [PK]

Current news on Natural Pools

Wooden decks in outdoor pools

Alternative materials for wooden decks

The design of walkways in outdoor swimming pools has long proven to be a major challenge. Domestic woods often degrade quickly if left untreated, and start to splinter and rot after a certain period of time. The weathering process can be counteracted by a well-thought-out deck construction and constructive wood protection, but even considering this improvement, a life cycle of more than 10 years can hardly be achieved for a deck made of larch wood. Tropical woods such as Bangkirai are of course much more durable, but for reasons of sustainability these are generally not our preference.

In the past year, we have been primarily concerned with two new possible decking materials: The pre-treated wood material called **Kebony** (www.kebony.com/de), and **recycled plastic** from the Hahn Company (www.hahnkunststoffe.de). Both materials show promise in terms of durability.

and gray. In Bassum, we decided on a gray implementation, matching a light gray film made of FPO on PE basis.

The original plan was to install a walkway made of larch with steel girders as a substructure. Due to supply shortages of the wood and the increasingly critical view of the **rapid deterioration of larch planks** during the planning process, we switched at the last minute to the recycled plastic design, including in the substructure.

Both us and the city of Bassum are very satisfied with the result. Perhaps one has to get used to the feel of the material somewhat. However, considering that this is **100% recycled material**, the very robust planks do not splinter and are expected to have a very **long life cycle**, this building material will definitely remain an option for us looking forward.

In two of our pools, a new deck made of Kebony wood is either about to be implemented or in the middle of planning. In the natural swimming pool in Murg, a deck made of Kebony wood has already been installed, which has led to **great satisfaction** both on the part of the operators and the users. When held in hands, the material appears velvety soft and smooth, which quickly raises the question of slip resistance. The planks also have no grooves, unlike the larch planks. Nevertheless, material tests have shown that a slip resistance class of R11 can be guaranteed. The cost of implementing Kebony wooden deck is currently around **€450/m²**, slightly higher than recycled plastic.

Summary

For us, the two materials **Kebony** and **recycled plastic** are currently the most promising materials for



Newly cladded wooden deck made from kebony wood - Source: kebony.com



Weathered wooden deck made from kebony wood - Source: kebony.com

Wooden decks made from recycled plastic

In the natural swimming pool in Bassum, we decided to construct a **new deck made of recycled plastic** in close consultation with the client (city of Bassum). The cost for this amounted to about **390€/m²**. The material is mainly available in brown

Wooden decks made from Kebony

We already presented the product Kebony wood in the 2021 edition of Natural-Pool-Info. Kebony is a modified coniferous wood which, as a result of being soaked in alcohol, achieves the **properties of tropical wood** in terms of **hardness and durability**.

deck construction. While the recycled plastic is **less expensive**, the Kebony wood results in a **higher quality appearance**. Whether both materials live up to their promises in terms of durability remains to be seen. We plan to report on this in a few years. [PK]

Urbane Gewässer

'Sponge City' meets Natural Swimming-Pond

Rainwater utilization with a difference

In the light of climate change and the problem of **temporary heavy rainfall events** in alternation with longer dry periods, as well as uncertainties regarding the long-term availability of local groundwater reserves with good water quality, **rainwater management in urban areas** is playing an increasingly crucial role - keyword "**Sponge city**".

What could be more obvious than to try to link this concept with **swimming in public spaces?**

The discharge of untreated rainwater is illegal in Copenhagen. Against this background, the pilot project **Courtyard "Straussvej"** a collaboration between Lars Juncker (Junckerhaven <https://www.junckerhaven.dk/>) and Polyplan Kreikenbaum, last year developed the idea of **rainwater treatment** and the creation of a **socially usable waterscape** in the central part of Copenhagen. The result is the centerpiece of the new Straussvej courtyard.

In the courtyard rainwater from the rooftops and sidewalks is collected and pre-treated via nature-like soil passages. The water then runs into a **soil filter** located underneath the green area. This cleans the water and directs it into the **swimming pond**. Surface water in the swimming pond is drawn off via skimmers and pumped back into the bottom filter treatment section. This creates a **closed cleaning cycle**, the volume of which can be increased by incoming rainwater or decreased by evaporation. Due to the degradation performance per soil filter passage of 1-3 log stages, even rainwater contaminated with E. coli can be introduced into the system without exceeding the limit value of 50 CFU/100 ml. [CFU / ml (colony-forming units per millilitre) is the English translation of the German measurement unit: KBE / ml (koloniebildenden Einheiten pro Milliliter)]

Finally, this is an **example of the "Sponge City" concept** being implemented with temporary aquatic spaces, with water which can be utilized in wet periods, and disappears in long dry periods. This project idea **can be replicated** in urban areas in a variety of ways. [PK]



Rainwater-fed swimming pond, Straussvej Courtyard, Copenhagen, DK - Photos (4): PK