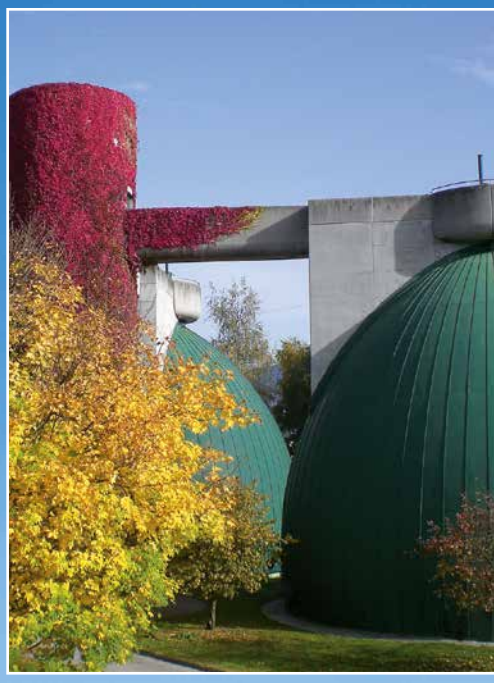


klar. rein. AIZ.

crystal clear, of course AIZ.

Abwasserverband AIZ

Achental - Inntal - Zillertal

All is nothing without clean water

The human body is composed of about 70% water. Water is, however strange it might sound to begin with, that which sustains life. It is the highest priority of the Achental – Inntal – Zillertal Wastewater Management Association (AV AIZ), which was founded in 1979 to ensure that drinking water of excellent quality is always available and that the man-made effluent be carefully treated without damaging the environment and then returned to the natural water cycle. We want to do our part in maintaining our stunning region's natural beauty and its recreational value.

Water constitutes the principle of all things! All things are from water and all things return to water!

Thales of Miletus, Greek philosopher (650–546 B.C.)

High performance from a qualified team

As a public body, we currently treat the sewage of 32 communities in the service of environmental protection and in order to prevent water pollution. This represents an area of 1,520 km^2 with about 53,000 inhabitants. The Wastewater Management Association AIZ, under the direction of its general manager, Josef Dengg, currently employs 17 staff members at the sewage treatment plant at its 55,000 m^2 site at Strass, where around 10 million m^3 of wastewater are treated each year. This amount of wastewater is equivalent to 1.6 times the contents of the Stillup Valley reservoir, or 4,400 swimming pools measuring 50 x 25 x 2 meters.

AV AIZ: A commitment to ecology and efficiency of cost

These Tyrolean valleys, Achental – Inntal – Zillertal, at the northern fringe of the Alps, are landscapes of outstanding natural beauty, popular with tourists, whose ecological resources must be preserved at all costs. In the Association‘s catchment area there are about 800 hotels, guest houses and restaurants with about 65,000 beds, with a total of about 8.5 million overnight stays a year. Added to that, there are currently about 53,000 permanent residents in the 32 communities currently belonging to the AV-AIZ district. It is the statutory duty of the AIZ Wastewater Management Association to ensure that wastewater collection and discharge, as well as the subsequent treatment of this wastewater are carried out in a manner which is environmentally friendly and economically sound. In this endeavour, we achieve an absolute level of excellence within the pan-European context, thanks to the most modern and advanced plant technology. Our goal: In the long-term, we aim to guarantee the future quality of both surface and ground water within the Association‘s district and to achieve improvements in the water network. All for the benefit of our region.

Milestones in the history of the AIZ Wastewater Management Association

30.10.1979	Founding of the Wastewater Management Association Mid-Unterinntal – Zillertal
1981-1990	Construction of the Inn-/Achental and Zillertal canals
1981–1984	7 further municipalities join the association and the name is changed to the Achental – Inntal – Zillertal Wastewater Management Association (AV AIZ), AIZ – Wastewater Association for short
1986	Start of construction of the ARA-Strass plant
1989	Operation of the ARA-Strass plant commences
1995	Adaptation of the ARA-Strass plant in accordance with the new “WRG-Novelle 1990” (Water Rights Act)
1999	Installation of an environment management system in accordance with EMAS regulations
2003-2012	Several times best in terms of economy when comparing commercial figures in operating costs to benchmark figures for sewage treatment plants > 100.000 EW
2004	Commissioning of the DEMON® System – autonomous energy supply from August onwards
2006	The ARA-Strass is awarded the EMASPREIS 2006
2008	Co-fermentation of biological waste – energy production = 124 -160% of energy consumption
2011	ARA-Strass presented worldwide as a showcase plant for energy efficiency
2012	AUVA Certification for Health and Safety Management

* The population equivalent is the usual reference value in water resources management, and indicates wastewater contaminant loads.

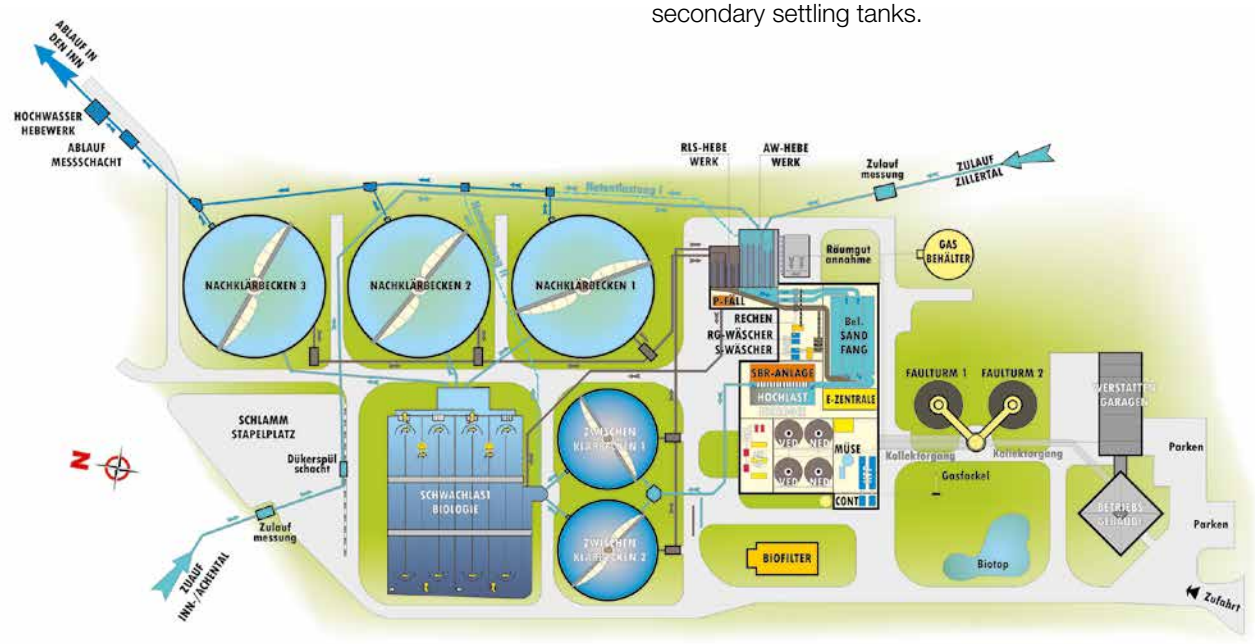
The wastewater‘s path

The wastewater is delivered to the sewage plant via a 161 km long network and 14 pumping stations distributed over the Association‘s district. In order to enter the sewage plant itself, it has to be pumped up 6m by means of a spiral pumping station. After about 27 hours in the sewage plant, and after passing through various stages of treatment, the water runs by force of gravity into the Inn river, having been treated in accordance to regulations. The treatment of the water is carried out, in simplified terms, in two stages

- mechanical treatment
- biological treatment

Mechanical treatment: Coarse grain contents are removed from the water using a automated screen system. After this, sand, grit and small stones are separated out. This is achieved by reducing water flow velocity so that the heavier materials sink. Then the wastewater passes through a grease trap.

Biological treatment: Naturally occurring micro-organisms, and others which have been introduced into the cycle, break down carbon, nitrogen and phosphorus compounds. The wastewater is enriched with oxygen, among other things, in order to activate the micro-organisms and enhance biological degradation processes. Additionally, phosphorus compounds are removed from the water by adding chemicals. The term for this is “chemical precipitation”. Finally, the ensuing sewage sludge is separated from the treated wastewater in so-called secondary settling tanks.



Facts and figures for the ARA-Strass

quantity of water processed daily: 27.400 m³

water consumption: 186 l per inhabitant per day

energy generated in the CHPs: approx. 4.9 million kWh

feed volume in dry weather: approx. 490 l/s

feed volume with rainfall: approx. 1,400 l/s

yearly volume of wastewater 2012: approx. 10 million m³

sewage sludge: 7.800 t/a

yearly operating costs (including canal network):
2,1 million euros

debt servicing: 1,85 million euros

total construction costs of the ARA-Strass facility and the wastewater treatment facilities: 69,3 million euros

A small example illustrates the comprehensive scope of our wastewater treatment. The 27.400 m³ daily wastewater volume adds up to a yearly volume of 10 million m³. If this was filled into 1 liter drinking water bottles, each with a diameter of 8 cm, and if these were lined up in a row bottle to bottle, this line would circle the globe at the equator 22 times.

Technische Universität Wien (Vienna Technical University), Institute for Water Quality, Resources and Waste Management, 1040 Karlsplatz 13/2261

The ARA-Strass facility's component parts

- Mechanical treatment with pumping station, screen system und aerated grit chambers/grease traps.
- First or high contaminant biology with intermediate treatment
- Second or weak contaminant biology with secondary settling
- Sludge treatment with anaerobic mesophilic digestion and sewage gas utilization in cogeneration units
- Digested sludge dewatering by means of centrifuges and intermediate sludge storage
- Separate biological treatment of internal water flows proceeding from sludge treatment by means of SBR plant and one-week reservoir and the DEMON® process

ARA-Strass purification performance

In previous years of operation, the ARA-Strass achieved purification performance levels over and above the legal requirements laid down by the general Wastewater Discharge Regulations (AEVk – Abwasseremissionsverordnung). The parameters BOD (biochemical oxygen demand) and COD (chemical oxygen demand) reflect organic contamination levels. The parameters Tot. N (total nitrogen) and Tot. P (total phosphorus) provide information about nutrient levels in the effluent water.

The results from the year 2012 are illustrated in the following table:

Parameter	BOD	COD	Total N	Total P
Input [t/y]	3.185	6.378	439	86
Output [t/y]	56	326	94	4,5
Efficiency WWTP [%]	98,3	94,8	78,6	94,7
Requiered Eff. lt. AEVk *) [%]	95,0	85,0	70,0	1,0 mg/l (≙ > 85% Eff.)

*) General Wastewater Discharge Regulations

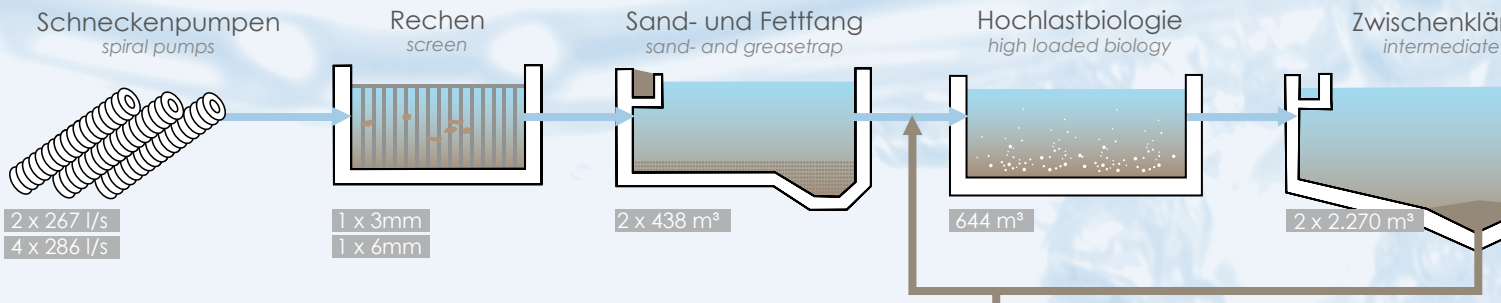
Funktionsschema
functional diagram of the wa

Abwasserbehandlung *wastewater treatment*

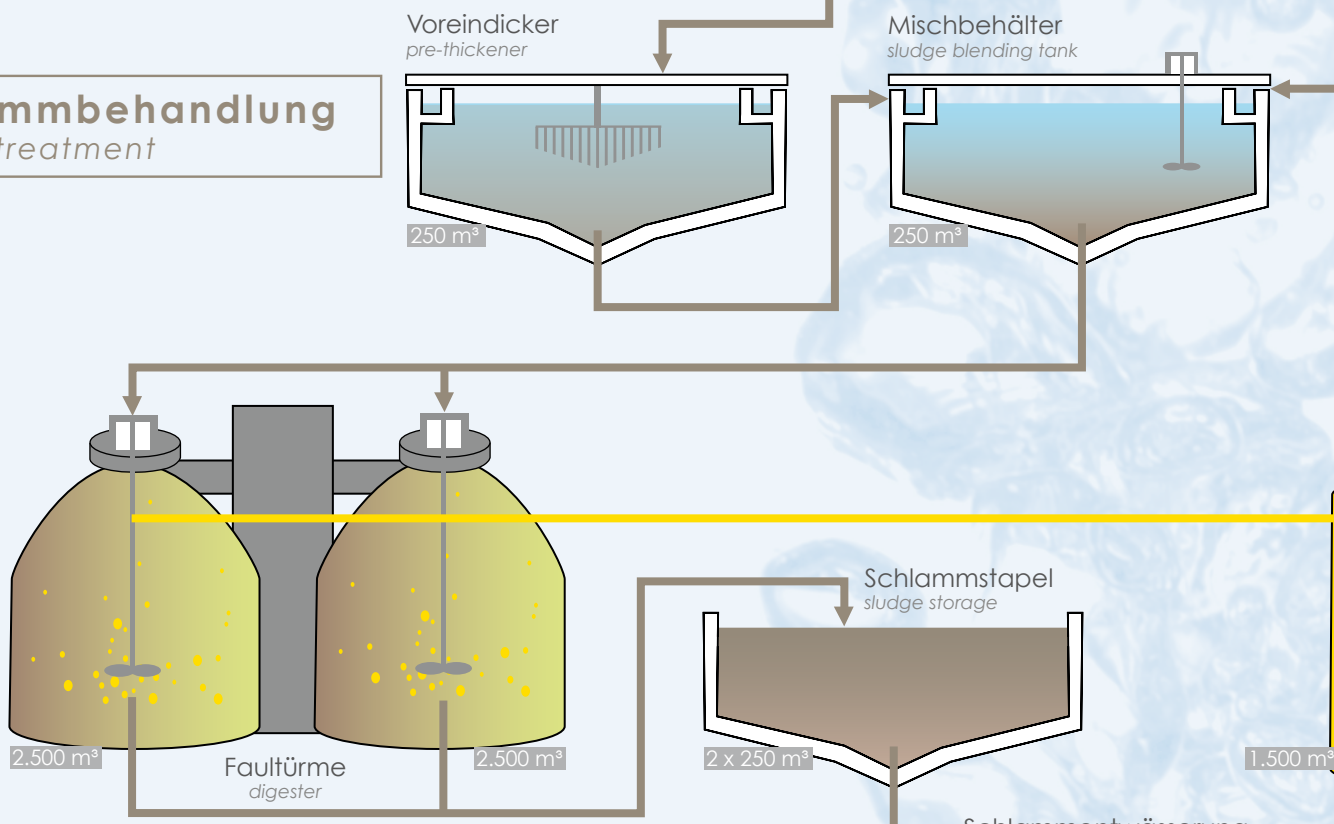
Abwasserhebewerk
wastewater pumping station

Mechanische Reinigung
mechanical treatment

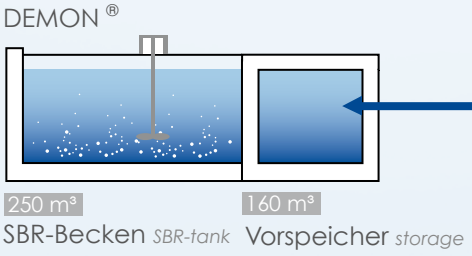
1. biologische Stufe
1st biological stage



Schlammbehandlung *sludge treatment*



Filtratwasserbehandlung *sludge liquor treatment*



der Kläranlage AIZ

stewater treatment plant AIZ

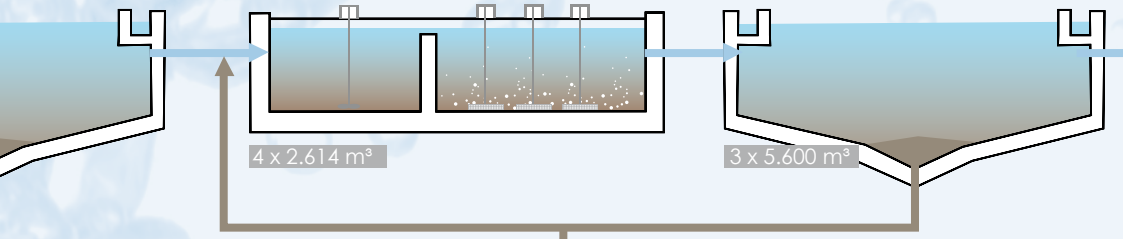
2. biologische Stufe
2nd biological stage

Ablauf ▶ INN
effluent > river INN

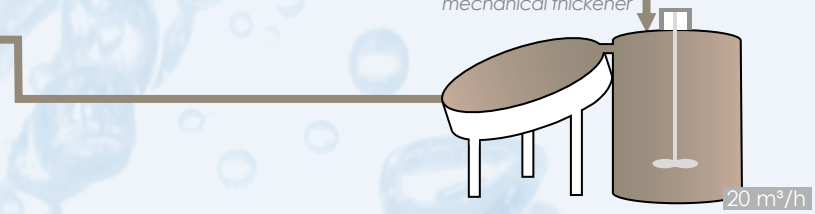
rbecken
clarifier

Schwachlastbiologie
low loaded biology

Nachklärbecken
secondary clarifier



MÜSE
mechanical thickener



Blockheizkraftwerk
cogeneration system (CHP)

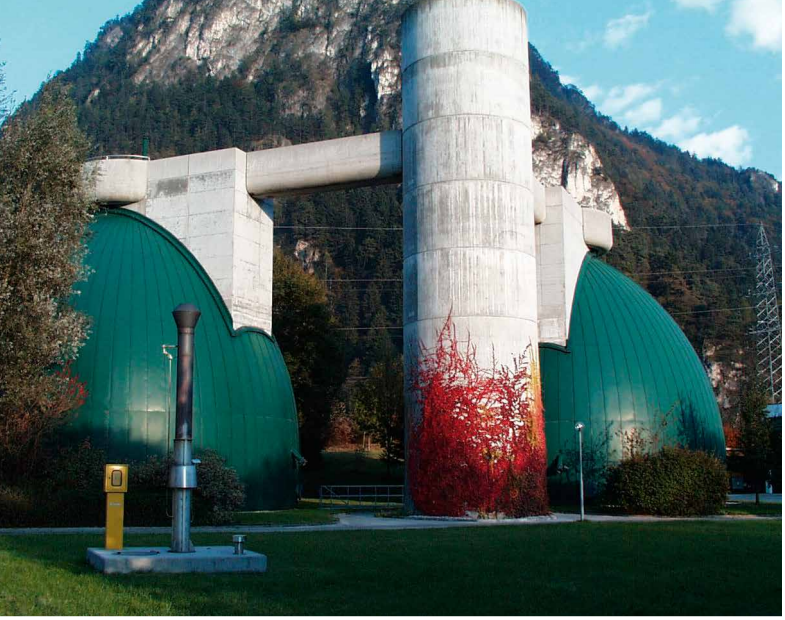
Gasspeicher
gas storage

1 x 320 KW elektr.
1 x 640 KW elektr.

▶ **Strom** *electricity*
▶ **Wärme** *heat*

Klärschlamm *biosolids*

Abwasserverband AIZ
Achental - Inntal - Zillertal



Sludge digestion

The surplus activated sludge, which results from high-load and low-load biological treatment, is statically and mechanically thickened and then mixed with the contents of the grease traps and co-substrates (food waste) in mixing basins. Each day, 176 m³ raw sludge with total dry residue of 6 % is pumped from these mixing basins into both digestion towers. The sludge remains in these digestion towers for approximately 30 days. During this time the digestible matter is broken down. This process, during which the sludge is heated to a temperature of 38°C, produces digester gas under anaerobic conditions (without oxygen). The digester gas consists of 60 – 65 % methane, which is then converted into primary energy in the cogeneration units.

Sludge dewatering and disposal

The digested sludge must be dewatered for further utilization. This dewatering process is carried out using flocculants and centrifuges and produces approx. 7,800 tons of sewage sludge per year. The dry residue achieved lies at approx. 28 %. The sewage sludge is either composted at a composting plant along with other organic components, such as garden waste, where it decays into compost, or it is incinerated straight away.

Increasing efficiency – optimizing energy

After commencing operations and adapting to the latest engineering standards, the ARA-Strass has continually put measures into place to increase efficiency and conserve energy. As can be seen in the following diagram, it was possible to lower the total energy consumption of the sewage plant from the year 2003 onwards, and this in spite of increasing demand. Through these improvements, the specific energy consumption in kWh per inhabitant and year was reduced from an initial figure of 30 kWh to approx. 20 kWh. Currently, this value of 20 kWh/EW* constitutes an optimum in energy consumption within the context of municipal wastewater treatment.

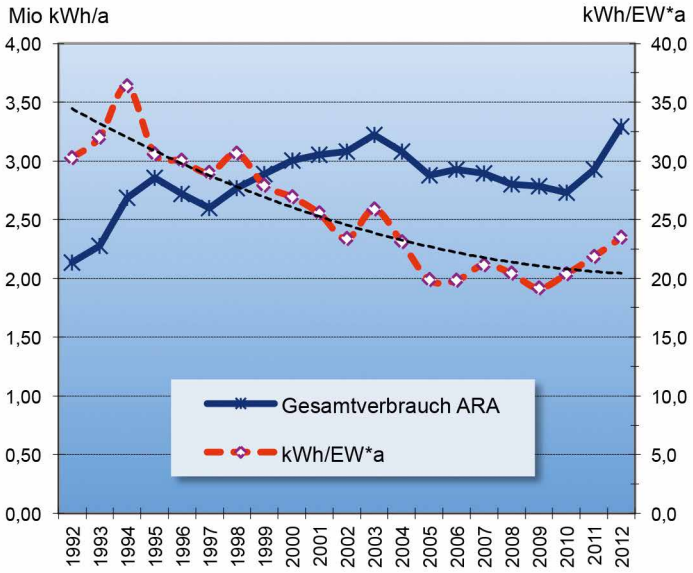


Abb.: Spezifischer- und Gesamtenergieverbrauch

The AIZ Wastewater Association produces electricity and thermal energy

Approximately 4.9 million kWh of electricity are generated in the cogeneration units each year. This is a quantity which would supply approx. 1,000 average households with electricity for a whole year. But as we require electricity for the wastewater treatment process – 8,900 kWh daily –, this total amount of green electricity is not fed into the public power supply system, but rather a figure in the region of 2 million kWh. Be that as it may, the AIZ Wastewater Management Association is still proud to be an energy-autonomous operation thanks to their optimization of technical operation processes. Furthermore, the complete heating requirements of the sewage treatment plant and digesting towers are covered by the additional waste heat produced by the cogeneration units.

Energy balance pro capita

When one considers the energy balance broken down into individual person units, then we see the following picture: each year approx. 9.1 m^3 digester gas can be produced, on average, from the wastewater produced by one person and the activated sludge resulting from it. In modern cogeneration units this digester gas can be converted, into approx. 23 kWh electricity or about 27 kWh of thermal energy. This quantity of electricity could, for example, power a 40 watt light bulb for a total of 550 hours, or the thermal energy could heat 2 liters of tea 137 times from 10 to 95° C.

Cogeneration units guarantee optimal waste processing

So-called biomass is produced during the organic treatment processes of wastewater purification. This biomass, as surplus activated sludge, is utilized for the production of methane gas with the aid of micro-organisms in hermetically sealed digestion towers. Cogeneration units (BHKW) are powered by this gas. A cogeneration unit functions according to the principle of power-heat coupling, which means that electricity and heat are produced at the same time and with an efficiency of up to 90 %. That is to say that 90 % of the methane gas's primary energy is converted into thermal energy and electricity. The cogeneration unit basically consists of a combustion engine, which burns the gas and drives an electric generator and also a heat exchanger. The purpose of the latter is to take up the radiant heat from the engine and generator and make it available for hot water supply or heating.

Special filtrate water treatment helps lower costs

The wastewater resulting from dewatering the anaerobically digested sludge has a very high nitrogen concentration, which cannot be allowed to remain in the wastewater in that form. About 15 to 30 % of the nitrogen contamination of a sewage plant is produced in this way. The conventional purification of this wastewater is raw material and energy intensive. A technique, developed by the AIZ Wastewater Management Association and the University of Innsbruck, has come to the rescue: the DEMON® filtrate water treatment system. Its use not only produces excellent purification performance but also

- a reduction of operational costs by a massive 80 %
- reduction of aeration energy by more than 60 %
- complete avoidance of external addition of carbon

This is how the DEMON® filtrate water treatment works

In normal circumstances, a reduction in harmful wastewater nitrogen concentrations is usually achieved using an organic treatment. Through the use of micro-organisms the ammonia present in the wastewater is converted through oxidation processes, first of all into nitrites and then into nitrates and finally denitrified. This is what the process is called when the nitrogen bound in nitrates is released into its molecular gaseous state. During the DEMON® process not all the ammonia nitrogen in the wastewater is oxidized into nitrite, but only about 50 %. Subsequently, the remaining ammonia is oxidized with the aid of nitrite bound oxygen and then reduced to gaseous nitrogen. This makes it possible to save about 60 % of the energy normally necessary for this process. Additionally, the DEMON® process considerably reduces or makes superfluous the external addition of carbon usually necessary for denitrification. Since the supply with external carbon sources, for example methanol, is one of the most cost-intensive factors in sludge water treatment, a considerable savings potential can be realized here.

The environmental, health and safety management of the AIZ

In 1999, an Environmental Management System (EMS) was installed at the ARA-Strass. This EMS assists in recognizing optimization potentials and implementing the corresponding steps for reducing the environmental impact and improve the ecological status. Thanks to this permanent optimization, the ARA-Strass team has managed to minimize requirements for energy, heating and various auxiliary materials and, at the same time, to increase the treatment performance of the plant. A health and safety management system from the Austrian Social Insurance for Occupational Risks (AUVA) was introduced and certified in 2012. This means that all production areas which could affect the safety and health of employees are being analyzed and documented systematically and proactively.

Many provisions for the promotion of health and safety can be recognized and implemented in this way. A founding principle of the Association is business in harmony with nature, the environment and society. For this reason, environmental protection as well as health and safety at work are integral to our Association‘s philosophy. In order to meet economic and ecological demands, we put great emphasis on

- development and deployment of innovative techniques
- rigorous internal controls
- transparent processes in public relations
- an emergency management system that can deliver
- diligent adherence to compliance standards
- regular staff training

AIZ – A model business

The AIZ Wastewater Management Association was founded as a public body in 1979, in accordance with the Water Rights Act, for the purpose of preventing water pollution and protect the ground water in the Association‘s drainage basin, as well as the permanent improvement of the receiving water systems (Inn river, the Danube, the Black Sea). In order to implement its aims, the Association employs a total of 17 staff; 4 of whom are employed in administration and 13 in plant operations. A special concern of the association is to expose their staff members to and train them in new developments and techniques in the subject of wastewater technology by having them attend courses and professional seminars. Furthermore, a great deal of attention is paid to training in the optimization and maintenance of applied technology. In addition to these employees, the most up to date technologies, machines and equipment are deployed in order to meet environmental protection targets whilst preserving resources and conserving energy. Through innovative procedures, like, for example, the Demon® process for filtrate water treatment, developed in collaboration with the University of Innsbruck, it was even possible to reduce energy consumption, with the result that in 2005, the ARA-Strass was the first sewage treatment plant in Austria to be operated with an autonomous power supply. The Association‘s efforts in the areas of energy efficiency and resource conservation have led to the presentation of the ARA-Strass as a showcase project and model facility, not only in central Europe but also in Canada, the USA and South East Asia, and it receives visits from international specialist groups for field studies.

Did you know...?*

...that the catchment area of the Achental – Inntal – Zillertal Wastewater Management Association comprises 32 municipalities and a total area of about 1,520 km²?

...that the Association's canal network is approx. 161 km long and has 16 pumping stations and 12 storm water retention facilities?

...that each inhabitant in the Association's area utilizes, on average, approx. 186 l of water per day?

...that the Strass wastewater purification plant feeds 1,7 million kWh energy per year into the grid and is thus one of the few sewage plants which produce more electricity than they consume?

...that ARA-Strass treats the wastewater of about 53,000 inhabitants and 8.5 million overnight visitors?

...that the volume of the sewage tanks is 31,000 m³, and that, as a consequence, the daily wastewater remains in them for an average retention time of 27 hours?

* All data are based on the business results of the year 2012.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