



Treatment systems for the municipal water supply

Process: Oxidation with ozone and filtration
Problem: Ground water with high content of TOC, colour and manganese
City/country: Hønefoss/Norway



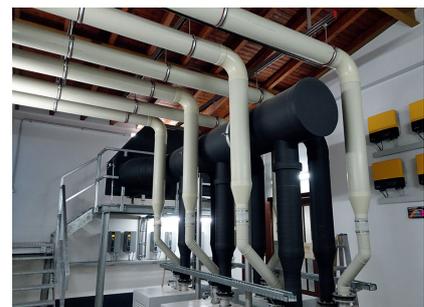
Project info:

Capacity: 920 m³/h
Number of plants: 10 plants
Process gas: Ozone from oxygen
Year of realisation: 2018
Specialities: Ozone biofiltration with additional UV disinfection



Treatment systems for the municipal water supply

Process: Iron and manganese removal, deacidification
Problem: Groundwater with iron and manganese
City/country: Baden-Baden/Germany



Project info:

Capacity: 810 m³/h
Number of plants: 6 plants
Process gas: Oxygen produced on site
Year of realisation: 2015
Specialities: Oxidation with oxygen and following rapid sand filter as well as deacidification and flat bed aerators



Treatment systems for the municipal water supply

Process: Softening with nanofiltration
Problem: Groundwater with high content of iron, manganese and water hardness
City/country: VG Edenkoben, Ortsgemeinde Venningen/Germany



Project info:

Capacity: up to 240 m³/h
Equipment: 2 x stainless steel pressure filter (Ø = 3500 mm, H = 3500 mm), nanofiltration plant, blending and physical deacidification via a high efficiency aerators, 2 x stainless steel tank (1000 m³), pressure boosting system
Year of realisation: 2015
Specialities: complete process engineering installation including electrical control system, stainless steel tanks (HydroSystemTanks®)





Treatment systems for the municipal water supply

Process: Filtration - removal of iron and manganese
Problem: Ground water with a slightly higher content of iron and manganese, temporarily low oxygen content
City/country: Oberdischingen/Germany



Project info:

Capacity: $Q = 36 \text{ m}^3/\text{h}$
Number of plants: 1 x TWK-L 40/36
Process gas: Oxygen, generated on site
Year of realisation: 2015
Specialities: Oxidation and filtration through a multilayer filter



Treatment systems for municipal water supply

Process: Ozone biofiltration
Problem: Ground water with high content of iron and manganese
City/country: Torpa/Norway



Project info:

Capacity: $Q = 10 \text{ m}^3/\text{h}$
Number of plants: 1 x TWK 20S/10
Process gas: Ozone from oxygen, generated on site
Year of realisation: 2015
Specialities: Delivery of pre-assembled compact filter system





Treatment systems for municipal water supply

Process: Ozone biofiltration and disinfection
Problem: Surface water with high content of colour and organic
City/Country: Øygarden Kommune (Alvheim)/Norway



Project info:

Capacity: $Q = 250 \text{ m}^3/\text{h}$
Number of plants: 5 x TWK 100/50
Process gas: Ozone from oxygen, generated on site
Year of realisation: 2015
Specialities: Expansion of the existing plant with 2 x TWK 100/50



Treatment systems for municipale water supply

Process: Ozon biofiltration with hardening and disinfection
Problem: Surface water with high organic content, high content of colour, turbidity and bacterial contamination
City/Country: Kvinnherad Kommune/Norway



Project info:

Capacity: up to 80 m³/h
Equipment: Raw water pumping station with 3 pumps (3 x 40 m³/h),
 1 x Dosage of carbonic acid,
 2 x Ozone systems (280 g O₃ 10% wt),
 2 x Contact columns (Ø = 1300 mm, H = 6000 mm),
 2 x Marble filter (Ø = 2500 mm, H = 4000 mm),
 2 x Biofilter (Ø = 3000 mm, H = 4000 mm),
 2 x UV disinfection (400 J/m²),
 Dosage of chlorine
Process gas: Ozone from oxygen, generated on site
Year of realisation: 2015
Specialities: complete process engineering installation including electrical control system





Treatment systems for municipal water supply

Process: Ozone biofiltration
Problem: Surface water with high content of organic, colour, turbidity and bacterial contamination
City/Country: Sund/Norway



Project info:

Capacity: $Q = 220 \text{ m}^3/\text{h}$
Number of plants: 3 x TWK N- 100/54, 1 x TWK 120S/60
Process gas: Ozone from oxygen, generated on site
Year of realisation: 2015
Specialities: Expansion of the existing plant with 1 x TWK 120S/60





Treatment systems for the municipal water supply

Process: Ozone biofiltration and disinfection
Problem: Ground water with high content of organic, colour, turbidity and bacterial contamination
City/Country: Eidfjord Kommune (Sysendalen)/Norway



Project info:

Capacity: Q = 80 m³/h
Number of plants: 3 x TWK 30/18-27
Process gas: Ozone from oxygen, generated on site
Year of realisation: 2014
Specialities: Expansion of the existing plant with 2 x TWK 30/18-27

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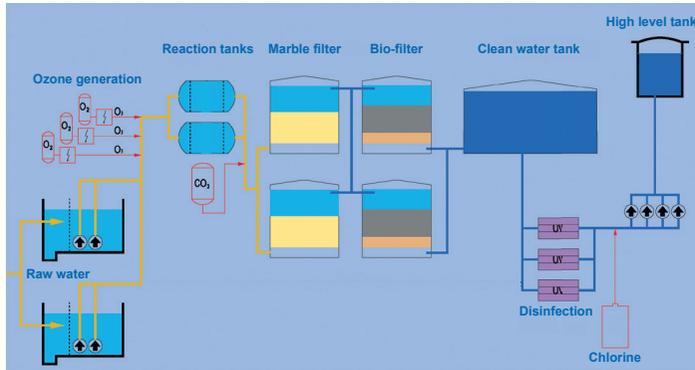
Problem

Treating of surface water to potable water in an amount of up to 680 m³/h for the water supply of the Norwegian municipality Bamble (approx. 12,000 people).

Raw water data

Colour 15-25 mg Pt/L Alkalinity <0,1 mmol/L
 pH 6,3-6,8 UV_{T1} 71-84%
 Bacterial counts (enterococci, coliforms, E-coli, clostridium)

Treatment process



Dimensioning data

Capacity	Q _{norm} = 480 m ³ /h	Q _{max} = 680 m ³ /h
Ozone dose at 10% (wt)	D _{norm} = 3 g O ₃ /m ³	D _{max} = 4,4 g O ₃ /m ³
Ozone reaction time	t _{min} = 10 min	
Filter contact time	Alkaline filter	EBCT _{norm} = 15 min
	Bio-filter	EBCT _{norm} = 30 min
Filter velocity	Alkaline filter	v _{max} = 15 m/h
	Bio-filter	v _{max} = 10 m/h
Disinfection with UV	UV _{Dose} ≥ 400 J/m ²	



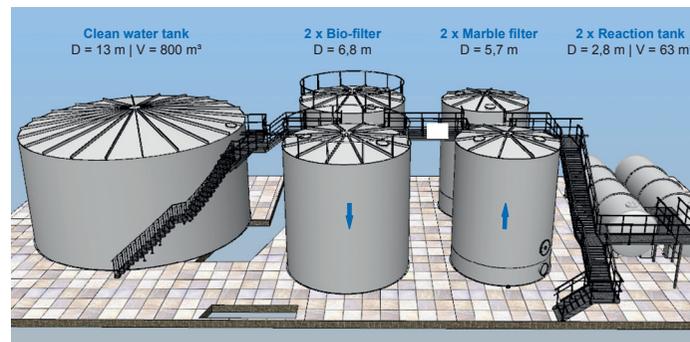
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Solution

- Build up of a new water treatment plant to reduce colour and DOC/TOC, to increase pH and alkalinity and to ensure hygienic safety.
- Installation of an effective plasma ozone production system.
- Installation of low pressure horizontal reaction tanks made of stainless steel 316 Ti with distributor plates inside to achieve a uniform plug flow.
- Adding of carbonic acid to the water after it is discharged from the contact tanks, before marble filters.

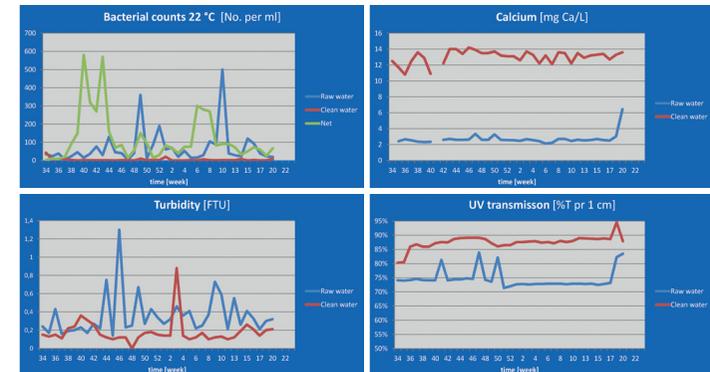


- Manufacturing of all main process equipment (made of stainless steel in Duplex quality), see figure below, because of
 - shorter construction period,
 - easy achievable high standard of design and safety,
 - on-site production of the tanks and the filters inside the building during the severe Norwegian winter.



- In the process hall all system components necessary for the operation can be safely accessed from the operator platform.

Clean water data



Colour 5-7 mg Pt/L
 pH approx. 7,5

Alkalinity approx. 0,5 mmol/L
 UV_{T1} 87-90%

Conclusions

- Ozone biofiltration can be a powerful process for treating surface water to potable water.
- DOC/TOC reduction is limited by the ozone dose and the EBCT in the bio-filters.
- Discolouration is a main task for the ozone biofiltration process.
- Hygienic safety of the treated water is constantly ensured.



Treatment systems for municipal water supply

Process: Ozonation, filtration and disinfection
Problem: Groundwater with higher levels of manganese, radon and colour
City/Country: Hjartdal kommune/Norway



Project info:

Capacity: Q = 60 m³/h
Number of plants: 2 x TWK 30/50N
Process gas: Ozone from oxygen, generated on site
Year of realisation: 2012
Specialities: Ozonation, filtration via multi-layer filter, degassing of radon and UV disinfection



Treatment systems for municipal water supply

Process: Oxidation, flocculation and filtration
Problem: Groundwater with higher levels of iron and manganese
City/Country: Jettingen-Scheppach/Germany



Project info:

Capacity: Q = 90 m³/h
Number of plants: 1 x TWK 120 L
Process gas: Oxygen, generated on site
Year of realisation: 2011
Specialities: Oxidation and filtration via multi-layer filter



Treatment systems for municipal water supply

Process: Ozone biofiltration and disinfection
Problem: Surface water with high content of humic substances (DOC), colour and bacterial contamination
City/Country: Brattvåg/Norway



Project info:

Capacity: $Q = 360 \text{ m}^3/\text{h}$
Number of plants: 6 x TWK 120S
Process gas: Ozone from oxygen, generated on site
Year of realisation: 2011
Specialities: Ozonation, filtration via multi-layer filter and UV disinfection



Treatment systems for municipal water supply

Process: Ozone biofiltration and disinfection
Problem: Groundwater with higher levels of iron, manganese and hydrogen sulfide
City/Country: Jimbolia/Romania



Project info:

Capacity: Q = 200 m³/h
Number of plants: 3 x TWK 80
Process gas: Ozone from oxygen, generated on site
Year of realisation: 2011
Specialities: Degassing (H₂S), ozonation, filtration via multi-layer filter and disinfection





Treatment systems for municipal water supply

Process: Ozone biofiltration and disinfection
Problem: Deep well water with high content of iron
City/Country: Dieterskirch/Germany



Project info:

Capacity: Q = 100-140 m³/h
Number of plants: 2 x TWK 100
Process gas: Ozone from oxygen, generated on site
Year of realisation: 2009
Specialities: Flocculation, ozonation, filtration via multi-layer filter and disinfection



Treatment systems for municipal water supply

Process: Ozone biofiltration with neutralisation and disinfection
Problem: Groundwater with high level of iron, manganese and CO₂
City/Country: Bø kommune/Norway



Project info:

Capacity: Q = 300 m³/h
Number of plants: 3 x TWK N-120
Process gas: Ozone from oxygen, generated on site
Year of realisation: 2007
Specialities: Neutralisation, ozonation, filtration via multi-layer filter and disinfection



Treatment systems for the municipal water supply

Process: Ozone biofiltration and disinfection
Problem: Ground water with high organic contamination
City/Country: Svene/ Flesberg kommune/ Norway



Project info:

Capacity: Q = 100 m³/h
Number of plants: 2 x TWK50
Process gas: Ozone from oxygen, generated on site
Year of realisation: 2018
Specialities: Groundwater treatment,
removal of organic components



Ozone biofiltration for drinking water treatment

Process: Ozone biofiltration with softening and UV disinfection
Problem: Surface water with high content of humic substances (DOC), colour, bacterial contamination and too low hardness
City/Country: Narvik/Norway



Project info:

Capacity: $Q = 2-4 \text{ m}^3/\text{h}$
Number of plants: 1 x TWK-S 5/2-4
Process gas: Ozone from oxygen, generated on site
Year of realisation: 2019
Specialities: Delivery of the factory-made compact filter system by Hydro-Elektrik GmbH, start-up by Hydro-Elektrik AS in Norway



Ozone biofiltration for drinking water treatment

Process: Ozone biofiltration via activated carbon filter and UV disinfection
Problem: Surface water with high content of humic substances (DOC), colour and bacterial contamination
City/Country: Torvik/Norway



Project info:

Capacity: $Q = 7,2 \text{ m}^3/\text{h}$
Number of plants: 1 x TWK 15S
Process gas: Ozone from oxygen, generated on site
Year of realisation: 2019
Specialities: Delivery and start-up of the factory-made compact filter system with on-site installation



Treatment systems for municipal water supply

Process: Oxidation with ozone and filtration
Problem: Groundwater with bacterial contamination
City/Country: Allensbach/Germany



Project info:

Capacity: Q = 20 m³/h
Number of plants: Upgrading of the existing plant
Process gas: Ozone from oxygen, generated on site
Year of realisation: 2020
Specialities: Upgrading the ozone generation to the new state of technology



Ozone biofiltration for drinking water treatment

Process: Ozone biofiltration via multi-layer filters and final deacidification
Problem: Spring water with high DOC content and temporary contamination
City/Country: Roth/Germany



Project info:

Capacity: Q = 25 m³/h
Number of plants: 1 x TWK 30
Process gas: Ozone from oxygen, generated on site
Year of realisation: 2020



Ozone biofiltration for drinking water treatment

Process: Flocculation, ozonisation, filtration via multi-layer filters, hygienisation
Problem: Lake water with organic substances (DOC), colour and eventual bacterial contamination
City/Country: Immenstaad/Germany



Project info:

Capacity: Q = 50 m³/h
Number of plants: 2 x TWK 30
Process gas: Ozone from oxygen, generated on site
Year of realisation: 2020
Specialities: Replacement of the treatment plant, drinking water from Lake Constance water





Treatment systems for municipal water supply

Process: Degassing, ozonisation, filtration via multi-layer filters, hygienisation
Problem: Groundwater with contamination and too low O₂ content, high iron and manganese content
City/Country: Timisoara/Romania



Project info:

Capacity: Q = 320 m³/h
Number of plants: 4 x TWK 120/86 S
Process gas: Ozone from oxygen, generated on sit
Year of realisation: 2020
Specialities: Treatment of groundwater with higher temperature (approx. 18 °C)



Ozone biofiltration for drinking water treatment

Process: Ozone biofiltration and UV disinfection
Problem: Surface water with high content of humic substances (DOC), colour and bacterial contamination
City/Country: Furusjøen/Norway



Project info:

Capacity: Q = 36 m³/h
Number of plants: 2 x TWK 30
Process gas: Ozone from oxygen, generated on site
Year of realisation: 2021
Specialities: Treatment of water from Lake Furusjøen



Treatment systems for municipal water supply

Process: Degassing, ozonisation, filtration via multi-layer filters, hygienisation
Problem: Groundwater with contamination and too low O₂ content, high iron and manganese content
City/Country: Dudestii Vecci/Romania



Project info:

Capacity: Q = 42 m³/h
Number of plants: 1 x TWK 60
Process gas: Ozone from oxygen, generated on site
Year of realisation: 2021
Specialities: Treatment of groundwater with high temperature (approx. 23 °C)



Ozone biofiltration for drinking water treatment

Process: Ozone biofiltration via activated carbon filter, physical deacidification
Problem: Groundwater from freshwater lens under the island with high content of humic substances (DOC)
City/Country: Juist/Germany



Project info:

Capacity: Q = 90 m³/h
Anlagenzahl: 3 x TWK 60/30
Process gas: Ozone from oxygen, generated on site
Year of realisation: 2021
Specialities: Treatment of groundwater from the freshwater lens under the North Sea island

