

Veolia provides uncompromised solution for nitrate removal from Kfar Saba's drinking water

CASE STUDY | Municipal

WATER TECHNOLOGIES



EDR delivers nitrate compliance without sacrificing recovery



Figure 1: Veolia's EDR system installed at Kfar Saba

| Challenge

Nitrate contamination of groundwater is a common result of agricultural fertilization. The Kfar Saba municipality in Israel has several nitrate-contaminated wells. In the summer of 2013, the municipality issued a public tender for a 10-year DBOT (Design, Build, Operate, Transfer) nitrate removal water treatment facility for one of its wells. The tender did not specify a specific water treatment technology but had the following requirements:

- Inlet capacity: 150 m³/h
- Nitrate reduction from 136 mg/l to ≤ 45 mg/l
- Water recovery ≥ 94%
- Energy consumption ≤ 0.7 kWh/m³
- Minimal chemical dosing and Total Dissolved Solids (TDS) addition to the process

This last requirement to limit TDS addition to the process results from a sewer discharge TDS regulation for the plant, which Kfar Saba and other Israeli municipalities face when dealing with groundwater treatment. Therefore, the water treatment technology should allow for both minimal waste stream volume as well as low TDS concentration in the waste.



| Project Summary

End-user: City of Kfar Saba

Location: Kfar Saba, Israel

Commissioned: 2015

Application: Drinking water

Technologies: Electrodialysis Reversal (EDR), cartridge filters

Capacity: 3,400 m³/day (0.9 MGD) effluent

Factors impacting technology selection:

136 ppm nitrate feed water as only contaminant above regulations; end-user provided detailed list of requirements including low energy consumption, low chemical consumption, and high recovery

Operational Results: 94+% recovery; 70+% nitrate removal; met comparative requirements on low energy and low chemical consumption

Winning value proposition: high recovery; targeted removal; low chemical consumption; low energy consumption; low lifecycle cost

Keywords: municipal; drinking water; high recovery; groundwater; nitrate; DBOT (design, build, operate, transfer); electrodialysis reversal (EDR)

| Solution

The winning engineering systems provider chose Veolia's EDR technology after considering reverse osmosis (RO) and ion exchange because the EDR solution optimally met the user requirements without compromise. The structure of DBOT contract encouraged the bidder to focus on the best technology and low lifecycle cost, a specific advantage of Veolia's EDR.

A Veolia EDR 2020 4L-2S (4 lines 2 stages) system with a total of 8 stacks is now installed on site. The system is designed for excess nitrate removal versus the requirement to allow for future load increases, with the TDS managed by tuning the voltage or through a blending option. With respect to the TDS discharge requirement, the concentrate stream is circulated and designed to bleed 9 m³/h to waste with a concentration of approximately 10,300 mg/l TDS.

| Results

The EDR system in Kfar Saba demonstrates excellent water quality results, which comply with and, if desired, even exceed the required nitrate removal (Table 1) of 45 mg/l. The Kfar Saba municipality is now considering expanding the plant to treat a neighboring well.

Table 1: Water quality for the Kfar Saba plant

Parameter	Well Water	Blended Product ¹
pH	7.8	
Conductivity (µS/cm)	1,364	474
Nitrate (ppm as NO ₃)	136	34
Sulfate (ppm as SO ₄)	105	
Chloride (ppm as Cl)	192.6	
Total Hardness (ppm as CaCO ₃)	487.1	
Sodium (ppm as Na)	82	
Magnesium (ppm)	32	
Calcium (ppm)	142	
Barium (ppm as Ba)	0.128	
Total Dissolved Solids (ppm)	911	

¹Tested on December 24, 2015

Table 2: Summary comparison of the technologies evaluated

Requirement	Electrodialysis Reversal (EDR)	Reverse Osmosis (RO)	Ion Exchange (IX)
Nitrate reduction from 136 mg/l to ≤ 45 mg/l	(+) Tune nitrate removal to a set point and balance TDS between product and concentrate.	(+) Broad spectrum TDS removal would be combined with a blending option	(+) Targeted and capable but inflexible to respond to variabilities
Water recovery ≥ 94%	(+) Achievable with standard operations	(-) Only achievable with costly advanced process design and chemical additions	(+) Achievable with standard operations
Energy consumption ≤ 0.7 kWh/m ³	(o) Electrically driven separations	(o) High pressure pumping energy demand	(+) Low pressure and non-electrical process
Minimal chemical dosing and TDS addition to the process	(+) No chemical dosing during operation and self-cleaning polarity reversal technology	(-) Chemical dosing needed to achieve 94% recovery	(--) High chemical demand and TDS addition to discharge
Low lifecycle cost	(+) Higher capital costs from 2020 EDR model offset by lower operating cost	(-) Moderate capital cost made worse by high operating cost.	(-) Low capital cost made worse by high operating cost

If you would like to learn more about how Veolia can provide an EDR solution for your drinking water needs, please visit our website.