

## ENVIRONMENTAL TECHNOLOGY VERIFICATION



### ETV Verification Statement

<b>TECHNOLOGY TYPE:</b>	Dead-end membrane filtration	
<b>APPLICATION:</b>	Treatment of water re-circulating over swimming pools	
<b>PRODUCT NAME:</b>	AquaSolution Elements (AQS-144-800-(2*2) 3 micron)	
<b>COMPANY:</b>	CoMeTas A/S	
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Verification and test of a dead-end membrane filtration element for treatment of water from swimming pools was conducted by the Danish Center for Verification of Climate and Environmental Technologies (DANETV).

DANETV was established in 2008 by four independent Danish research and technology organizations and supported by the Danish Agency for Science, Technology and Innovation under the Danish Ministry of Science, Technology and Innovation to provide environmental technology verification for vendors of climate and environmental technologies. Information and DANETV documents are available at [www.etv-denmark.com](http://www.etv-denmark.com).

The verification and tests were performed by DHI, as DANETV Water Center, and were designed to satisfy the requirements of the ETV scheme currently being established by the European Union (EU ETV).

## VERIFICATION AND TEST DESCRIPTION

The test of the AquaSolution Elements was conducted as a field test at Gladsaxe Svømmehal, Vandtårnsvej 55, DK-2860 Søborg, and the test plant was provided by Provital A/S (Joint venture between CoMeTas A/S and Løkken Spa & Pool) and equipped with CoMeTas ceramic filters (Model AQS-144-800-(2\*2)-3 micron). Gladsaxe Svømmehal has a pool area equipped with a warm water pool and a paddling pool (32-34°C). The pool water from the warm water pools is re-circulated and passes sand filters designed for removal of suspended particles. The pool water used for the test was a side stream of re-circulated pool water from the warm water pools. CoMeTas A/S provided data concerning the filters and Provital A/S provided a description of the filtration plant. Before the test, instruction about the operation of the plant was given by Provital A/S. The operation of the test plant was supervised by DHI staff and operated with help from staff from Provital A/S. DHI produced the plan and report documents with input from an external and an internal technical expert. DHI also prepared this verification statement.

### Test plan and test conditions

The flux through the test plant and the pool water quality was influenced by the blocking and the back wash frequency of the permanent installed sand filter running in parallel to the AquaSolution Elements. The consequence of this was that the pool water quality depended on both the operation of the permanent installed sand filters and the operation of the filtration plant.

The testing included parameters that describe the filtrate water quality produced by the product, as well as operational parameters that are important for the user. The operational conditions during the verification testing were decided by the vendor (planned operational range). Those data are summarized in Table 1 together with the operational conditions measured during the test.

Table 1 Planned range of operational conditions of the AquaSolution Elements and detected average values for operational conditions during verification testing.

Operating parameter	Unit	Planned operational range	Average during test
Run length	day:hours	18:00	17:16
Temperature	°C	32-33	32.9
Flow online	m <sup>3</sup> /h	20-60	27
Specific flux (before bw)	m <sup>3</sup> /h·m <sup>2</sup> ·bar	10	10.1
Specific flux (after bw)	m <sup>3</sup> /h·m <sup>2</sup> ·bar	10	16.0
Flow ratio Provital/GS	%	50	34
Back washes	Number/day	1	1.6
Back wash duration	minutes	7-9	7
Back wash volume per filter	l	70-80	80
Transmembrane pressure	bar	0.3	0.12

The pool water quality during the 17-days verification testing are summarised in Table 2.

Table 2 Feed water quality analysed during verification testing. For TOC concentrations and total microbial count the table includes information about quality of produced water. Requirements come from the Danish Announcement on swimming pools, etc. and these qualities.

Parameter	TOC (in) mg/L	TOC (out) mg/L	Total microbial count (in) count/mL	Total microbial count (out) count/mL	Hardness Total °dH	Sum THM µg/L
Requirement			<10		-	<50
Number	12	12	6	6	10	4
Minimum	2.9	3.0	<5	<5	0.6	25
Maximum	4.4	3.2	10	18	4.5	30
Average	3.3	3.0	4.6	12	2.6	28
Std.dev.	0.5	0.08	2.9	7	1.6	2.2

## Quality Assurance

DHI provided internal review of documents. An external technical expert reviewed the plan and the report documents. This statement reflects the verification results after performing quality assurance.

## TECHNOLOGY AND PRODUCT DESCRIPTION

The following description of the AquaSolution Elements and the Provital filtration plant is based on information provided by the vendor and does not represent verified information.

### AquaSolution Element

The product verified was the CoMeTas AquaSolution Element AQS-144-800-(2\*2) 3 micron designed for removal of suspended solids from solutions and is designed for dead-end operation. The membrane elements were placed in housing that in future might be changed from the current used housing. For that reason the product verified is the membrane (AquaSolution Element) without the housing.

### Provital filtration solution

However, the documentation of the operation of the filtration equipment that surrounds the AquaSolution Elements is important when assessing the filtration. The current filtration equipment was equipped with an automatic operation system. Three modules in parallel were verified during the current test. The flow and pressure at inlet and outlet were measured continuously (one-minute-intervals) and the back wash cycle was set to start once every 24 hours. During the whole test, forced back wash cycles were used. Figure 1 shows a photo of the filtration plant on the test site.



*Figure 1 Provital filtration plant tested in Gladsaxe Svømmehal.*

## VERIFICATION RESULTS

Filtrate quality in form of particle concentration within defined size intervals was measured from the mature filters installed two days before the 17-days testing started and the particle size distribution was measured in samples taken at following time intervals after a back wash cycle had taken place : 0.5, 1, 2, 4, 22 and 23.5 hours. Six back wash cycles were monitored.

At the test site (indoor water complex) the filtration plant was tested on a side stream. The remaining volume of the re-circulated pool water passed the permanent installed sand filters. Testing on a side stream meant that it was not possible to evaluate the long term effect of the filtration on the pool water quality and thereby to document that the AquaSolution Element is capable of fulfilling the Danish Announcement on pool water quality.

The test conditions and results are described and discussed in details in the test report and verification report prepared in relation to this verification. The documents are available from [www.etv-denmark.com](http://www.etv-denmark.com).

### Performance parameters

The performance of the CoMeTas AquaSolution Elements is summarized in Table 3 as number of particles per ml in feed water and produced water. The percentage of removed particles within the particle size intervals: 1.5-4.99 µm, 5-10.32 µm and 10.33-20.39 µm were respectively 64%, 79% and 89%.

Table 3 Verified performance.

	Feed water			Produced water		
	1.5-4.99 µm	5-10.32 µm	10.33-20.39 µm	1.5-4.99 µm	5-10.32 µm	10.33-20.39 µm
Number of countings	66	66	66	65	65	65
Average Number/ml	116	17	26	42	3.6	2.8
Std.dev.	80	12	18	27	3.2	3.3
Min. Number/ml	43	4	4	17	0	0
Max. Number/ml	540	81	103	210	24	25
95% confidence interval	96-135	14-20	22-31	35-48	2.9-4.4	2.0-3.6
Percentage removed				<b>64</b>	<b>79</b>	<b>89</b>

Original signed by Bodil Mose Pedersen  
2010.07.14  
 Test responsible, DHI

Original signed by Mette Andersson  
2010.07.14  
 Verification responsible, Head of DHI DANETV Water  
 Center

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