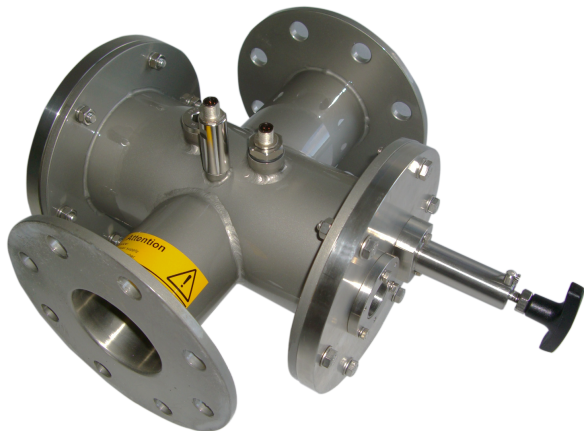


# Comparison of two UV lamp technologies for treatment of swimming pool water

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## General

Use of ultraviolet (UV) light for treatment of chlorinated swimming pool water is becoming increasingly popular. Medium-pressure UV lamps are favoured for reduction of chlorinated disinfection by-products (DBPs). The use of medium-pressure UV lamps is supported by theoretical and practical research work in Belgium (2003) The Netherlands (2007) and Denmark (2009). In addition to research, thousands of medium-pressure UV systems are in use in swimming pools all over the world effectively disinfecting pool water and reducing chloramines (chlorine smell).



Compact design and easy to install AlfaLine UV with medium-pressure UV lamp. Photo courtesy: bestUV

## UV lamps, comparison

	MEDIUM-PRESSURE LAMP	LOW-PRESSURE LAMP
UV light spectrum	200 - 400nm	254nm
Effects on monochloramine	yes	yes
Effects on dichloramine	yes	no
Effects on trichloramine	yes	no
Disinfection	yes	yes

## Trichloramine

The most problematic health-related component of bounded chlorine is trichloramine (TCA). TCA is 250x more irritating than monochloramine and escapes abt. 1000x more easily into pool air. Thus, breaking down trichloramine is the primary goal in pool water treatment by UV.

Reference: Trichloramine in the air of German indoor pools, Dr. Stottmeister, March 2005

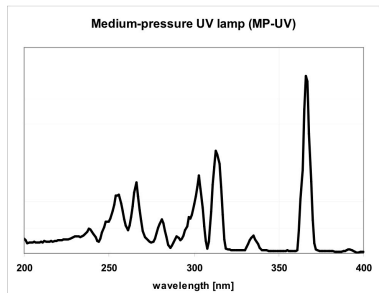
## Health impact of trichloramine

Research work by the University of Leuven, Belgium showed a relationship between childhood asthma and indoor swimming pools. The most suspected component causing childhood asthma is trichloramine.

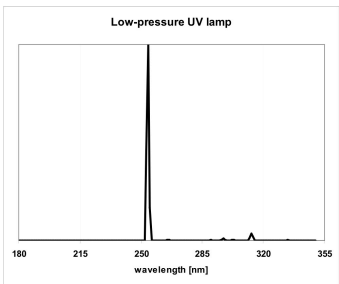
Reference: Lung hyperpermeability and asthma prevalence in schoolchildren: unexpected associations with indoor pools, Prof. Bernard, Univ. Leuven, Occ Env Medicine, 2003, Vol. 30, 2003

## Medium-pressure UV lamps

Low-pressure UV lamps emit a single wavelength (254nm) able to break down monochloramine. They are not able to break down the di- and trichloramine, the most irritant chloramine. Medium-pressure UV lamps emit wavelengths between 200 and 400 nm, which are able to break down the three components of bounded chlorine: mono-, di-, and trichloramine.



Emission spectrum medium-pressure (MP) UV lamp



Emission spectrum low-pressure (LP) UV lamp

### Theoretical survey The Netherlands (2007)

In 2007 the Ministry of Health conducted research involving the protection of human health in the presence of chlorinated disinfection by-products such as trichloramine.

Of 11 techniques, the most promising technology for disinfection pool water is medium-pressure UV lamps in combination with hypochlorite. It is to expect that this technique effectively disinfects pool water while producing the lowest amount of DBPs.

Reference: Oriënterend onderzoek naar desinfectietechnieken voor zwembadwater, KWR 07.023, may 2007



AlfaLine UV medium-pressure 'in-one-line'-UV system in therapy pool. Courtesy: bestUV

### Germany

The lowest levels of combined chlorine (0,2 ppm) are required and achieved in Germany. During the past 10 years, medium-pressure UV lamp systems have efficiently produced disinfected pool water with lowest levels of combined chlorine in German pools.

### Practical full scale test in Denmark (2009)

In 2009 a group of European researchers tested the possibilities for improvement of pool water and air quality. Four different technologies were tested in comparable situations. Two technologies were based solely on photolysis by direct UV light, two other technologies were based on oxidation (TiO<sub>2</sub> and ozone) by indirect UV light.

Of the 4 techniques, the medium-pressure UV light showed efficient control of combined chlorine while low-pressure was less efficient.

Reference: Full scale test of UV-based water treatment technologies at Gladsaxe Sport Centre - with and without advanced oxidation mechanisms, Swimming Pool & Spa Conference 2009, Paper 4.1

### Advantages of medium-pressure (MP) UV lamps

- 5,5 times less energy to reduce bounded chlorine
- at least 7 times less UV lamps needed
- effective breakdown of mono-, di- and trichloramines

### Conclusions

Medium-pressure UV lamps are favoured for reduction of chlorinated disinfection by-products (DBPs) such as combined chlorine (chloramines) in pool water and air. Low-pressure UV lamps emit only one single wavelength, which performs well for disinfection but is much less effective in photolysis of disinfection by-products.

Breaking down trichloramine is a primary goal, as it is linked to health-related problems and it is volatile and irritating.

Researchers concluded that medium-pressure UV lamp systems have technological advantages over low-pressure UV lamps.

Medium-pressure UV lamp systems need less energy, use fewer UV lamps and units are compact in size with little headloss in cases of 'in-one-line'-construction.

Thousands of swimming pools confirm the findings of research work and use medium-pressure lamp technology to ensure safe and pleasant swimming pool water.