

# Toxic Chlorine Reaction Products...Problem solved

Dryden Aqua research on AFM water filtration of swimming pool water quality was supported by the European Commission as part of a 1.2 million Euro program to develop more efficient water treatment technology.

A huge amount of research has been on-going in Europe and the USA for many years with regards to trichloramines and THM's. While the consequences of exposure have not been fully quantified, we know that there is potentially a very serious public health issue. We should not be sitting on the fence adopting a wait and see attitude, the problem will not magically disappear unless we are pro-active in solving the issues.

There has been virtually no research on the mechanism of trichloramine production, and unless you understand how the reaction products are formed you can do little to solve the problem. Dryden Aqua are biologists, and it was discovered that the thin biofilm on the surface of sand and every component in contact with the water is the primary location of trichloramine production. If you eliminate the biofilm, you largely eliminate the problem. More than 95% of the wetted surface area in a swimming pool is the sand in the sand filters, by eliminating the sand using Active Filter Media, (AFM) you eliminate the biofilm. Simply by changing the sand to AFM makes a huge difference to water and air quality. More than 50% of the public swimming pools in Scotland are now either using AFM or will be using AFM next time their sand filters need a media change. Edinburgh Leisure has also adopted the technology for all the public swimming pools that they manage for the City of Edinburgh.

AFM works well with chlorine and will reduce chlorine demand by up to 80%, it also allows non chlorine based products to work much better. However with public municipal swimming pools it is essential that horizontal transmission of infection is prevented. According to German DIN standards, *Pseudomonas spp* bacteria should be killed within 30 seconds in the pool. At present only chlorine can achieve this task, by way of example copper based product may take up to 90 minutes. Cryptosporidium infection is also of major concern, however if you operate the filter bed at a flow rate below 20 cubm/hr/sqm and use a good flocculent this problem is largely solved. A flocculent is a chemical that changes the Zeta potential or electrical charge of particles and molecules. If you give the particles dissimilar charges then they will clump together and increase in size. This then allows the filters to remove organics and organisms such as the cryptosporidium from the water. However if the water flow rates are too high, you push a proportion of the flocculated solids through the filter bed. Dryden Aqua has also developed a flocculent called NoPhos which drops the Zeta potential of the water and makes it difficult for bacteria to grow. Indeed over a period of 6 weeks, biofilm on the pipes and tiles is almost eliminated.

The combination of AFM, slow filtration, flocculents and NoPhos provides a mechanism that reduces the chlorine demand by 80%. By way of example, it is now possible to operate a 25m public pool with 1000 visitors per day, at combined chlorine levels below 0.05mg/l, and turbidity is less than 0.01 NTU units. The problem of chlorine reaction products has been solved, and the solution was simple. All that it took was a realisation and an understanding what was happening in the water.

With an understanding of the mechanism, also comes a responsibility, not only for Dryden Aqua but for the swimming pool industry. For the pool industry, there is a duty of care for the public, a problem has been solved and proved over a period of 5 years. Dryden Aqua are now in discussions with the European Commission regarding the implications of the research. For Dryden Aqua there are other issues of water treatment technology and chemicals used in swimming pools. For example, we know that flocculation is essential if you are going to remove cryptosporidium and dissolved organics, however surfactant chemicals affect flocculation. Surfactants are used in many swimming pool products and pool cleaners, if the chemicals get into the water the performance of the filtration system will be compromised. With regards to equipment, ozone & UV irradiation will chop up and increase the level of volatile components, the systems will reduce combined chlorine but the air quality 50mm above the surface of the water deteriorates. There are many reports on the subject and there is increasing concern in Germany over the level of THMs in swimming pools.

In other situation, lessons have been learnt and then forgotten by the swimming pool industry. For example the use of Diatomaceous or Peralite filters. The equipment was developed in the 1940's by the US army as a low weight emergency filtration system for the removal of solids. The system can not be used with coagulants which means it can not remove dissolved components from the water. This in turn means that there will always be high levels of chlorine reaction products with DE and Peralite system.

There are many good swimming pool chemicals and products, and some products that should never be used in a swimming pool. There are also issues over combinations of chemicals and products and the way in which they inter-react. There is no easy answer to the question and no solution to the problem unless we have strict guidelines and legislation, such as Regulation 31 of the DWI. Dryden Aqua is endeavouring to make a start with new swimming manuals based on the German DIN standards. However for the time being our recommendation is the KISS principle, keep your water treatment system simple, use good equipment, slow down the run phase filter flow rates and use flocculation.

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