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## Managing spas: design and operation

**With the help of specialist camera technology Robbie Phillips has spent a great deal of time inspecting the pipework of commercial spas from the inside. Sometimes the picture revealed is one of potentially life-threatening flaws in spa design and operation.**

As an established consultant that frequents commercial overflow spas, I have regularly used camera technology to investigate the condition of spa pipes during visits. There has long been suspicion that infections in spas can be traced back to the condition of pipes and research shows that there are three major concerns in the design and operation of spa facilities.

Spas present an operator with specific problems that contribute to a high-risk facility: low volume, relative high bathing load per volume of water, nutrient in the form of cosmetics, body fats, high temperature and water as a transmission agent. As a consequence, there is the potential for bacteria to multiply rapidly if the chemical parameters are not adhered to constantly and precisely.

The reality of this situation is that if these parameters are being compromised – perhaps as a result of the automatic dosing system not operating correctly or the plant operator not being given the training required to detect and recognise a problem – the spa could be endangering its clients through organic contamination.

Research into organic contaminations

Using Dart Systems camera technology, we have now been able to further investigate the condition of pipes and, together with 3M Biotrace bio-swabbing for real-time contamination detection, whereby water and surfaces can be quickly tested for organic contamination, we can show the results of poor maintenance and testing.

Images captured in fully functioning, operational spas [see pictures] reveal debris in interconnecting pipes, a spa's corrugated pipes and biofilm, and blocked spa pipes. We can also demonstrate what a clean spa pipe should look like!

The major faults

There are three major faults:

Gravity-fed pipes from the spa tank to the balance tank. In many cases this is a set of short-length pipes that are subject to relatively low flows. It is my contention that these low-flow pipes by gravity alone are ideal sites for biofilm. A biofilm is like a tiny city in which microbial cells, each only a micrometre or two long, form towers that can be hundreds of micrometers high. The 'streets' between the towers are really fluid-filled channels that bring in nutrients, oxygen and other necessities for live biofilm communities. At precise times they release massive quantities of pathogenic (ie disease-producing) bacteria.

Corrugated pipes with undulating surfaces where biofilm can be protected and thrive away from the water flows and disinfectant.

Blockages in pipes, which can be caused by system failure or deliberate [www.theleisurereview.co.uk](http://www.theleisurereview.co.uk)

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customer action; these will have a similar impact to little or no flow and disinfectant on the colonisation of pipework.

### Recognising the signs of biofilm

While camera images and bio-swabbing can give definitive evidence, there can be telltale signs that often indicate the presence of biofilm. These can be present individually or in combination:

cloudy water

ribbon-like strands of matter in the spa tank

marked increase in disinfectant use

musty smells in and around the spa and plant

inconsistent bacterial results that cannot be traced back to operational failures.

### Pipe solutions

There are many psychological, physiological and therapeutic benefits associated with soaking in warm-water spas but we want to keep it this way by ensuring correct maintenance and management.

The following solutions are based on practical observations and must be conducted in line with appropriate risk assessments and safe risk controls. They should be applied together alongside the relevant best practice advice from the Swimming Teachers' Association, the Pool Water Treatment Advisory Group (PWTAG) and the Health Protection Agency (HPA, now part of Public Health England).

Wherever possible always use pipe that is not corrugated in all areas of installation. If possible replace such pipe.

Install pipes that can be easily disconnected, checked and cleaned.

Regularly clean pipes with soft brushes, pressure-hosing or specialised methods. We often use a combination of methods after identifying suspect pipe runs.

As a part of the spa's regular maintenance, physically clean and super-chlorinate the system. The HPA comment on the functionality of pipes that can be broken down to facilitate inspection and cleaning.

Consider the use of chlorine dioxide-based chemicals periodically, when the spa is not being used, to prevent the formation of biofilm. We find this a powerful procedure.

Ensure your spa safe operations procedure is robust and accounts for any predictable risks with suitable risk controls.

Ensure the spa is tested, with suspect results reacted on, in relation to recommended bacterial testing.

Make sure your spa plant operators are fully qualified and trained, and are regularly kept up to date with industry best practice.

**Robbie Phillips is the STA's pool plant expert and is a regular contributor to the Leisure Review.**

**Details of the STA's pool plant management courses and best practice guidance can be found online at [www.sta.co.uk](http://www.sta.co.uk)**

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