



Application Note 5

Measurement of Coliforms and E. coli for cost savings in Slow Sand Filter operations.

Author: Derek Price Date: 23 Feb 2014

Background

Slow Sand Filters are used as part of the drinking water treatment process at many treatment works. These filters rely on the principle that untreated water percolates through a bed of porous sand which is supported by a layer of gravel after which the water is collected by a system of underdrains. A surface organic layer and microbial community known as a “Schmutzdecke” develops on top of the bed of sand allowing the filter to remove biodegradable material and destroy pathogenic organisms by bacteriological action. As the Schmutzdecke grows it increases in efficiency and becomes the dominant filtration process.

Slow Sand Filters are not backwashed so there is a requirement for manual cleaning at intervals of approximately three months due to clogging of the Schmutzdecke layer. During cleaning, the filter is removed from service and the top layer is removed in a process called skimming. Once skimmed, the filter is run to waste to allow the Schmutzdecke to regenerate during which time the filter produces poor quality water that cannot be used for consumption. While the filter is regenerating, regular samples are taken and measured for bacteriological content to determine when the Schmutzdecke is working effectively and the filter can be put back into service.

In order for Slow Sand Filters to be put back into service the samples taken during the regeneration process must satisfy criteria appropriate to the particular works. Typically this will include a reduction of Coliforms or E. coli passing through the filter to very low levels, sometimes over consecutive days.

Speedy Breedy® is a rapid portable contamination test device that be used to:

- ✓ Test for Coliform and E. coli breakthrough in Slow Sand Filters on-site without sending samples to a laboratory.
- ✓ Reduce time that Slow Sand Filters are off-line and running to waste after skimming.
- ✓ Reduce energy cost, carbon emissions and operational costs associated with bringing filters on-line more quickly.
- ✓ Reduce chemical usage.
- ✓ Improve efficiency for reduced selling price of water to the customer.





The longer a Slow Sand Filter is out of service the greater the cost to the business while well run SSF sites use fewer chemicals in the treatment process and produce water at a lower unit cost.

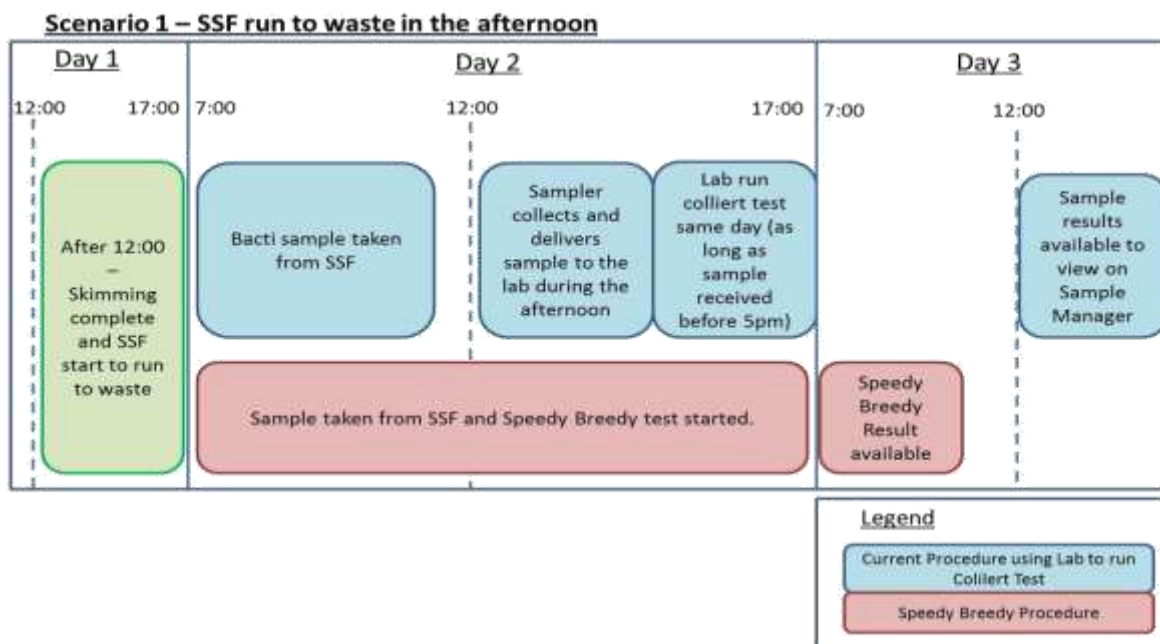
Speedy Breedy® testing of Slow Sand Filter skimming and regeneration

Speedy Breedy® can be used to measure the regeneration of Slow Sand Filters following skimming by testing Coliform and E. coli breakthrough as the filters regenerate. Tests can be performed on-site so there is no loss of time to obtain results meaning that filters may be put into service more quickly.

Speedy Breedy® tests are very simple and can be started anytime of the working day by process technicians with results available in the morning of the following day. This is convenient for the process technicians because it is more versatile than conventional testing, particularly when there are sampling difficulties due to incidents in the plant that take priority. Speedy Breedy® increases the chance of a sample being taken on days when priorities clash.

Speedy Breedy® tests can start immediately that samples are taken so there is no loss of time sending samples to the laboratory and waiting for results to return. This attribute can be integrated into the working day and shift patterns with good effect. Two scenarios are outlined below:

Both scenarios result in the Slow Sand Filter technician having data available much earlier in the day so that they can make a judgment whether the filter is sufficiently regenerated and ready to put back into service. Significant savings are possible.

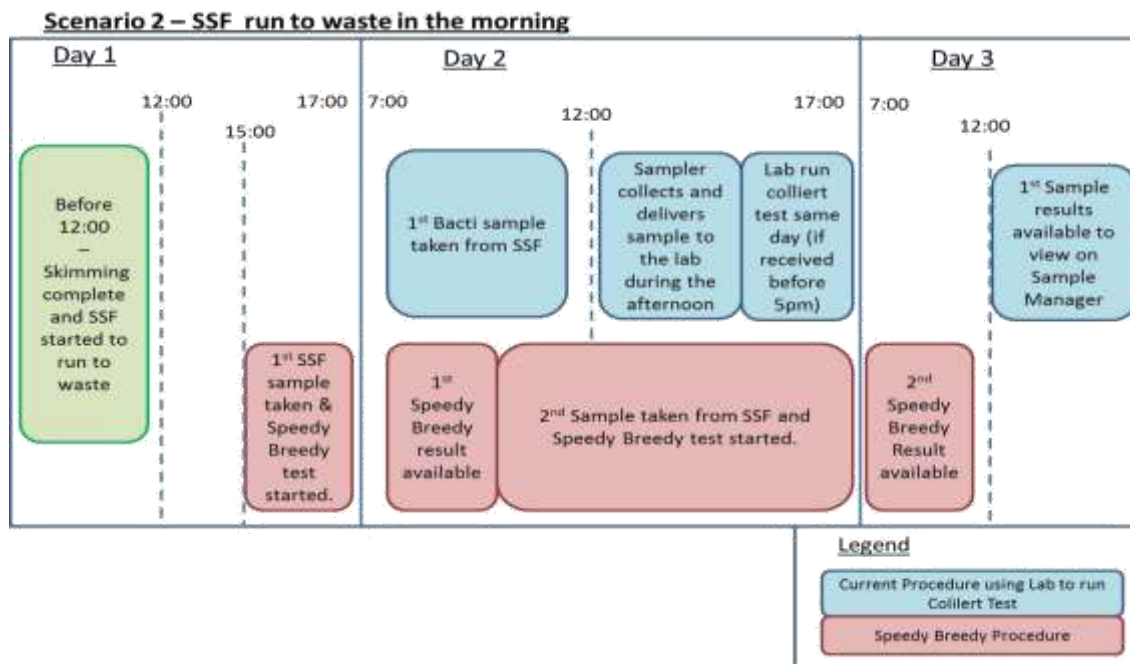


In scenario 1 (above), samples can be taken at any time of the day with results available early the next day. This can save more than 4 hours of water wastage.

In ongoing UK trials, users said that Speedy Breedy® offers the opportunity to reduce the length of time SSFs are run to waste by a minimum of 4-5hrs and offers the potential saving of 28-29hrs for each SSF skimming. It produces a result significantly faster than conventional laboratory methods and is easy to use, easy to interpret the results, and is portable.



In a second scenario (below) the sample can be taken at the end of the working day, thereby providing up to an extra 8hrs for the Slow Sand Filter to regenerate. This is important as it can significantly increase the chances of contamination levels falling to acceptable levels and a filter passing the break-through test. Speedy Breedy® may indicate a ‘safe’ result, when the conventional method would have indicated a “fail” because the sample was taken at a different time of day. Many filters might be put into service a day earlier than with conventional tests, saving time, cost, energy, and carbon emissions.



During winter months when contamination levels are very low, a Speedy Breedy® sample can be taken at 17:00 on the day the SSF is set to run to waste after skimming. This can potentially save an extra day (see scenario 2). UK trials in December and January indicated no E. coli and <10 Coliforms in the output water on the first sample day (the day after the SSF started running to waste). It is therefore possible that a sample taken at the end of the day, on the day the SSF has started running to waste, may provide a safe result and mean that the filter can be put back onto service immediately.

How Speedy Breedy® works

Speedy Breedy® is a portable two chambered microbial contamination test instrument that can be used on-site, removing the time taken to send samples to a laboratory.

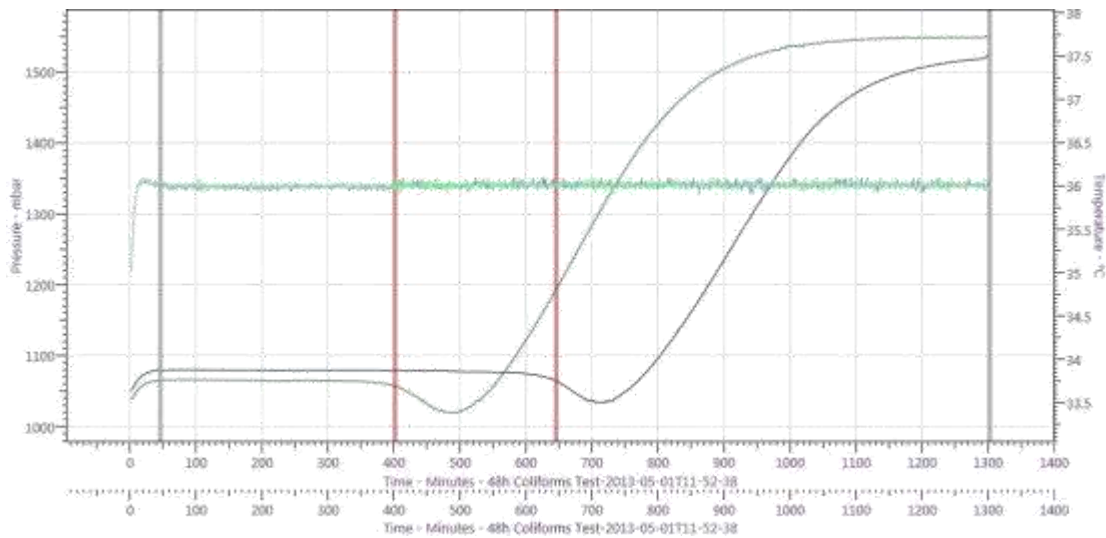
Speedy Breedy® measures the net gas exchange associated with microbial respiration within a closed culture vessel containing a selective nutrient medium. Organisms rapidly grow from small numbers, reaching a critical mass where exponential growth and rapid respiration mean that there is a significant, detectable pressure event. Speedy Breedy® automatically detects this event using an internal algorithm.

Speedy Breedy® can be used in almost any location as it operates on 12 volts or mains adapter and weighs just 2.75 kg. It requires no special facilities or microbiology training.

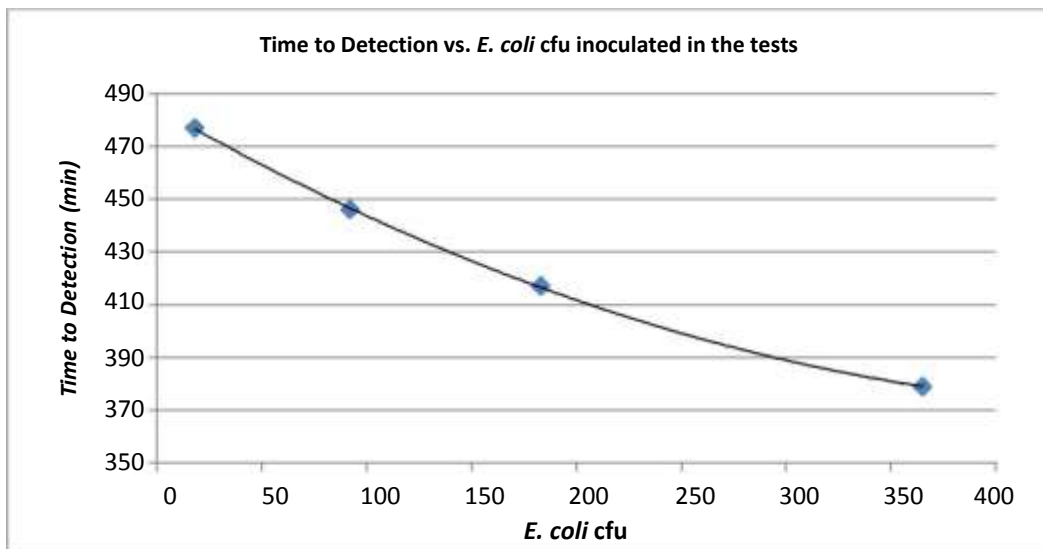
Speedy Breedy® is a stand-alone device however software supplied with the instrument can be used to visualise the growth curves and determine the number of organisms present in the sample.



Typical curves for E. coli: Red lines indicate automatic contamination detection in chamber 1 and 2.



The Time To Detection (TTD) represented as red lines in the graphs above is indicative of the number of organisms in the original sample since more contaminated samples will grow to this critical mass in a shorter time. Speedy Breedy® can detect single CFU's.



Speedy Breedy® is supplied with a set of standard protocols suitable for detecting particular organisms such as Coliforms, E. coli, Pseudomonas, Enterococci, Clostridia and many others. Speedy Breedy® software can also be used to create bespoke protocols and has the facility to set up standard curves for particular organisms or sample types and from these can automatically calculate the contamination level in the original sample. Media filled culture vessels are available for all of the organisms listed above.

