ANNEX A

# STANDARD OPERATING PROTOCOL

# FOR THE MONITORING OF *CRYPTOSPORIDIUM* OOCYSTS

# IN TREATED WATER SUPPLIES

## Part 1 - Sampling and Transportation of Samples

**MARCH 2007**

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# 1 INTRODUCTION TO THE STANDARD OPERATING PROTOCOL

1.1 This Standard Operating Protocol (SOP) provides guidance from the DWQR on the sampling and analysis requirements associated with the *Cryptosporidium* Directions.

1.2 This Standard Operating Protocol is published in four parts:

- Part 1 Sampling and Transportation of Samples.
- Part 2 Laboratory and Analytical Procedures.
- Part 3 Validation of New Methods or Parts of Methods for Sampling and Analysis.
- Part 4 Requirements for the Inter-laboratory Proficiency Schemes.

1.3 Wherever the terms *Cryptosporidium* or *Cryptosporidium* oocysts, or oocysts are used in this Standard Operating Protocol, it refers to all species (active or inactive) of this organism within the size range 4-6µm, *Cryptosporidium* spp.

1.4 Any proposed deviation from the requirements contained in parts 1 and 2 of this Standard Operating Protocol will require a full laboratory appraisal to be carried out in accordance with part 3 and 4 of this Standard Operating Protocol being published by DWI. Results of such appraisal must be submitted to the DWQR for consideration of approval. This approval must be obtained in writing before any changes are made to the relevant sections of the Standard Operating Protocol.

1.5 This part of the Protocol provides guidance on the design and installation of approved sampling equipment. It also details the security requirement for the sample as well as the collection and transportation of the samples.

## 2 SAFETY

2.1 On Water Treatment Works Sites

2.1.1 Where contractors are used for sampling or the maintenance of monitoring equipment they must ensure that they are familiar with the relevant legal and other regulations and observe any health and safety or other rules or recommendations of the water company whose premises they visit. Contractors must be made aware of these obligations by the company and the potential risks involved in entering industrial (Water Treatment Works) premises for the purpose of sampling or maintenance. Company employees involved in sampling, maintenance or analysis must observe the company's safety procedures.

2.1.2 Every attention must be given to ensure that water treatment works operations are not in any way compromised by the sampling process.

# 3 SAMPLING EQUIPMENT

3.1 Care must be taken when installing the sampling equipment to ensure that the drain line from the equipment is free flowing and cannot be blocked or kinked as this could result in an excessive build-up of pressure within the sampling unit. It is recommended that no valves be fitted on the drain line from the sampling unit.

3.2 If at the time of changing the collection device a high inlet pressure (greater than 8 bar) is indicated on the pressure gauge without a corresponding high headloss (greater than 7 bar) the inlet pressure-reducing valve may be defective. In such cases it is recommended that after taking the inlet pressure and headloss pressure readings the pressure be relieved on the isolating valve outside the sampling cabinet and closing the valve. The control switch should then be switched to the "off" position before the sampling device is disconnected. If the pressure-reducing valve is suspected of being faulty the valve should be serviced and/or replaced as soon as possible. Once the company is satisfied that the pressure-reducing valve is functioning correctly sampling should be recommenced.

3.3 If the sampling line is connected to a high pressure main (greater than 8-bar pressure) an additional pressure-reducing valve may be fitted immediately downstream of the tapping-off point on the main as an additional safeguard against excessive pressure build-up within the sampling cabinet. A pressure gauge may either be fitted on the downstream side of this valve or immediately upstream of the isolating valve outside the monitoring cabinet to facilitate adjustment of the valve and correct operation of the valve. A bursting disc or pressure relief valve with a pressure rating no greater than the maximum operating pressure of the pressure reducing valve fitted within the sampling cabinet may also be fitted on the sample line.

3.4 The IDEXX filter holder is tested to a pressure of 14 bar before leaving the factory. No holders have been known to fail in this test. In addition filter holders returned to the factory have been subjected to a further pressure test in which none, including those having star fractures around the end fittings, have failed at a pressure less than 17 bar. At 17 to 18 bar failures have occurred where the threads between top and base of the filter holder have stripped causing the two sections to blow apart. On the basis of this information it is deemed unlikely that small surges in pressure within the filter holder above 8 bar but less than 12 bar would cause the failure of the filter holder. However, if a company requires an additional safety measure to protect against a possible surge in pressure then a pressure relief valve or burst disc with a pressure rating of between 8 and 12 bar may be fitted within the sampling cabinet immediately downstream of the pressure reducing valve within the sampling unit**.**4

## 4 MONITORING LOCATIONS

4.1 A sample line must be fitted to each main leaving a treatment works (or after all barrier treatment processes) unless the main divides after all treatment processes (excluding disinfection and final pH adjustment) when a sample line is required on only one of the mains. The sample line or lines shall be located so as to ensure that the water sampled is representative of the treated water supplied (excluding chlorination and final pH adjustment) and must be used solely for monitoring under the Direction.

4.2 The sampling line should preferably be of 15 mm copper (or other approved material). The sampling line must be of as short a length as is practicable. The sampling line must be fitted with a stop valve as close to the point of connection to the main as is practicable, and must also terminate in a stop valve with a G½ (½ inch BSP) fitting appropriate for connection to the sampling cabinet on the outlet side.

4.3 Where the sampling line may be subject to freezing, it must be adequately insulated or wrapped with a heating tape controlled by a suitably located thermostat to prevent water freezing in the sampling line.

4.4 Where mains power is available on site, a suitable 110 or 220 volt electrical supply point must be available within 0.5 metre of the control/display cabinet. This point should be of a waterproof design. If an isolator switch is fitted at this point it is recommended that it be housed within a break-glass box and/or suitably labeled to ensure that it is not switched off accidentally.

4.5 It is recommended that no valves are fitted on the drain line from the sampling unit. The line should be installed such as to ensure the free flow of sampled water to a suitable drainage point. If installed in plastic material the drain line must be fitted such that it cannot be kinked. Care must be taken to ensure that the drain line cannot be blocked as this could lead to excessive build-up of pressure within the sample unit or prevent the taking of the required sample.

## 5 APPROVED SAMPLING EQUIPMENT

5.1 The equipment must comprise of the following items:

Upstream of collection device

(i) pressure reducing valve set for an inlet pressure of 1.5 bar; if, see (iii) below, the pump is omitted from the specification then the pressure reducing valve must be set for an inlet pressure of 5.5 bar. On installations where the inlet pressure is consistently at or below 1.5 bar this pressure reducing valve may be omitted from the specification.

(ii) Non return valve if required

(iii) pump designed for continuous use to give a minimum outlet pressure of 5.0 bar at a flow rate of 40 litres per hour, suitable type ShurFlo Model 8005-952-899 (24 volt); at treatment works where the inlet pressure to the sampling cabinet is always in excess of 5.5 bars the pump may be omitted from the specification.

(iv) connection hose - pressure hose with a 304 high tensile stainless steel braid fitted with Swagelok™ Quick-Connect body on outlet end (SS-QC6-B-4MS.

(v) collection device holder – IDEXX or other DWQR approved collection device holder, uniquely numbered, fitted with Swagelok™ Quick-Connect stems, double-end shutoff with G¼ (¼ inch BSP) male thread at both inlet and outlet ends, SS-QC6-D-4MS.

(vi) collection device module - IDEXX or other DWQR approved filtration device module uniquely numbered;

Downstream of collection device

(vii) connection hose - pressure hose with a 304 high tensile stainless steel braid fitted with Swagelok™ Quick-Connect body on inlet end (SS-QC6-B-4MS)

(viii) pressure sensor - located after filter device, heavy duty, to operate over pressure range of 0 to 10 bar, connected to local digital display to give differential pressure in combination with inlet pressure sensor;

(ix) water meter - suitable for use at flow rates of up to 60 litres per hour (Kent PSM cold potable water meter PL10-115 or other meter designed for use at flows of 60 litres per hour and meeting BS5728 (ISO 4064) Class C specification). If required a water meter meeting the above specification but with the facility to provide a remote read-out may be fitted;

(x) flow restrictor - to give 1 litre per minute over an inlet pressure range of 1 to 10 bar, type: Maric G½ (½ inch BSP) brass F/F or approved alternative;

(xi) heating element or other suitable heater to prevent unit freezing up and to minimise condensation (24 volt); and

5.2 The sampling unit must be arranged so that the filter unit and water meter are below the water outlet from the cabinet. The typical layouts of a sampling unit is shown in Appendix A.

5.3 At treatment works where the supply is intermittent, and the main is not kept fully charged when the supply is off, sampling should not commence until the main is charged. This delay is to ensure that introduction of air into the sampling unit is minimised.

# 6 COLLECTION OF SAMPLES

6.1 This section details the requirements for changing the collection unit.

6.2 Sampling must only be carried out by a suitably trained person. The training records of all samplers must be open for inspection during audits by DWQR or DWQR approved agents.

6.3 The sampler must:

(i) Ensure that where appropriate the access key to the sampling cabinet remains secure at all times whilst in his/her possession. The following operations must be carried out by the designated sampler.

(ii) Check that the "use by" date on the filter has not expired.

(iii) Check that the inlet pressure displayed on the Control/Display cabinet is not in excess of 8 bar. If at the time of changing the collection device a high inlet pressure (greater than 8 bar) is indicated on the Control/Display cabinet without a corresponding high headloss (greater than 7 bar) the inlet pressure-reducing valve may be defective (see iv below).

(iv) Unlock the control/display cabinet and move the control switch on the panel to the off position.

Note: If the inlet pressure recorded at the end of the sampling run was greater than 8 bar and the headloss reading was less than 7 bar it is possible that the inlet pressure-reducing valve may be defective.

(v) Note the reading on the water meter and record the reading. Check that the entered reading is not less than that recorded at the start of the sampling period (if necessary check water meter).

(vi) Note the reading date and time of start. Check that the entered reading is not less than that recorded at the start of the sampling period.

(vii) Disconnect the filter unit from the connecting hoses by means of the quick release connections. NB: there is no need to shut off the water supply as the filter unit holder is fitted with double shut-off valves and the inlet valve will be in the closed position after the control switch has been switched to the off position; however for safety reasons it is advisable to disconnect the inlet fitting prior to disconnection of the outlet fitting to ensure that there is no excessive build-up of pressure within the filter holder.

(viii) Write his/her name and enter all the required information on the log sheet and seal in the Sample Collection Envelope. Seal the envelope by removing the foil strip to reveal the adhesive patch. Place the filter in the bag such that the label is accessible through the envelope.

(ix) Take the replacement collection device and connect it to the hoses inside the cabinet, the quick fit connections are both key, and the outlet end colour coded, to ensure the flow direction will be correct. For safety reasons it is advisable to connect the outlet fitting prior to connection of the inlet fitting to ensure that there is no excessive build-up of pressure within the filter holder. The sampler must note the water meter reading and timer readings together with the time and date in the appropriate boxes alongside "Start of Sampling Period" on the log sheet and should check that these values agree (or are greater if maintenance work has entailed starting the unit) with those entered for finish of sampling run on the logsheet for the removed filter (if necessary re-check water meter).

(x) Switch on the control switch and where appropriate close and lock the door of the cabinet.

(xi) Check that the water meter is registering the flow and the flow meter is reading 1 litre per minute. He/she should then note the differential ("headloss") pressure and record this in the appropriate box of the logsheet as appropriate.

(xxi) Close and lock the cabinet as appropriate.

6.4 Any irregularities with sampling line, sampling equipment, sample filter or locks must be reported to the designated person within the Scottish Water who must inform the DWQR designated contact of the matter within the agreed time scale.

# 7 TRANSPORTATION

7.1 The transportation of samples under the Direction must either be carried out by Scottish Water, or a designated courier or a representative of the approved laboratory.

7.2 The transportation of the sample from end of sampling to receipt by the DWQR approved laboratory must be carried out as soon as reasonably practical to ensure that results of the analysis are available as required by the Directions. Analysis must take place within 3 days of removal for final waters and 5 days for raw waters.

7.5 A designated courier service if using transport boxes may have an electronic logging system in place to allow the journey of the transport container to be followed at all times, if this is the case, the requirement for paper receipts at all stages of the transportation of the samples can be waived.

7.8 The water company must keep all records, either or both hard copy receipts and electronic records of the shipment for a period of not less than twelve calendar months from date of shipment. All records on paper or the evidence bag must be made in ink using a ball-point pen. All records must be open to inspection by the DWQR or DWQR approved agent.

7.9 Samples may be transported at ambient temperatures or refrigerated but must NOT be frozen. During transportation under winter conditions, samples may be subject to ambient temperatures below freezing, under such conditions care must be taken to ensure that the samples do not freeze.

# Appendix A – Schematic of a Sampling Cabinet