

Application of a basic monitoring strategy for *Cryptosporidium* and *Giardia* in drinking water

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ABSTRACT

Despite the health risks associated with exposure to *Cryptosporidium* and *Giardia*, there is no uniform approach to monitoring these protozoan parasites across the world. In the present study, a strategy for monitoring *Cryptosporidium* and *Giardia* in drinking water was developed in an effort to ensure that the risk of exposure to these organisms and the risks of non-compliance to guidelines are reduced. The methodology developed will be applicable to all water supply systems irrespective of size and complexity of the purification works. It is based on monitoring procedures proposed by the US Environmental Protection Agency, the Drinking Water Inspectorate, Australia and New Zealand, as well as the risk-based procedure followed by Northern Ireland. The monitoring strategy developed represents a preventative approach for proactively monitoring *Cryptosporidium* and *Giardia* species in drinking water. The strategy consists of 10 steps: (i) assessment of the monitoring requirements, (ii) description and characterisation of the source water types, (iii) abstraction of source water, (iv) assessment of the water purification plant, (v) water quality monitoring, (vi) cryptosporidiosis and giardiasis outbreak, (vii) risk assessment, (viii) sample collection and laboratory processing, (ix) data evaluation, interpretation and storage, (x) process evaluation and review. Proper implementation of this protocol can contribute to the protection of drinking water consumers by identifying high-risk source water, identifying areas of improvement within the water treatment system, and also preventing further faecal pollution in the catchments. The protocol can also be integrated into the Water Safety Plans to optimise compliance. Furthermore, this methodology has a potential to contribute to Blue Drop certification as it should form part of the incident management protocols which are a requirement of Water Safety Plan implementation.

Keywords: *Cryptosporidium*, *Giardia*, monitoring, risk score, drinking water

INTRODUCTION

Cryptosporidium and *Giardia* are intracellular protozoan parasites that infect the gastrointestinal tract of vertebrate animals including mammals, birds, reptiles, and fish (Carmena, 2010). They enter surface waters such as lakes, ponds and dams as environmentally resistant cysts and oocysts in the faeces of infected people or animals. *Cryptosporidium* and *Giardia* can cause human cryptosporidiosis and giardiasis, respectively, which are the most common causes of protozoal diarrhoea worldwide (Cacciò et al., 2005). The transmission of *Cryptosporidium* and *Giardia* occurs mainly through the faecal-oral route by direct contact with contaminated faeces and by exposure to contaminated food and water (Carmena et al., 2012). The water exposure routes include ingestion of water during recreational activities (swimming, canoeing, and skiing), and drinking untreated and treated tap water contaminated with *Cryptosporidium* and *Giardia* oocysts.

Monitoring of *Cryptosporidium* and *Giardia* is done throughout the world and the data obtained have been used for conducting risk assessment, for evaluation of water treatment system reliability and also to assist with waterborne outbreak investigations (Bentacourt and Rose, 2004). However,

different approaches for *Cryptosporidium* and *Giardia* monitoring are used in different countries (US EPA, 2006; DWI, 2008; NZ Ministry of Health, 2008; NI Department for Regional Development, 2007). In the USA the log-reduction method is used (US EPA, 2006), while risk-based approaches are commonly applied in the United Kingdom and New Zealand (DWI, 2008; NZ Ministry of Health, 2008). In South Africa, *Cryptosporidium* and *Giardia* monitoring in drinking water supply systems is not pervasive. In the few systems where it is performed, the focus is mainly on the final treated water.

From the preceding, it is evident that there is no uniform strategy for monitoring these protozoan parasites in drinking water supply systems. Hence the overall objective of the study was to develop and apply a methodology that can be used by drinking water utilities to monitor *Cryptosporidium* and *Giardia*. The test site used was a small potable water treatment plant using surface water abstracted from the Vaal River Barrage, Gauteng Province as source water. It must be stressed that this methodology is based on monitoring procedures proposed by the US Environmental Protection Agency (USEPA) (2006), the Drinking Water Inspectorate (DWI, 2008), Australian Drinking Water Quality Guidelines (NHMRC, 2004), Drinking Water Standards New Zealand (NZ Ministry of Health, 2008), and especially on the risk-based procedure followed by Water Supply Water Quality Regulations Northern Ireland (NI Department for Regional Development, 2007).

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