Advice on the response from public and environmental health to the detection of cryptosporidial oocysts in treated drinking water

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Summary: *New water quality regulations in the United Kingdom (UK) will lead to the regular sampling of water supplies for the presence of cryptosporidial oocysts. It is likely therefore that consultants in communicable disease control (CCDCs) and environmental health officers (EHOs) will be informed of the presence of oocysts in water supplies rather more often. These guidelines were developed, by an ad hoc working group of the PHLS Advisory Committee on Water and the Environment, to help CCDCs and EHOs respond to such reports. The implications for public health of oocysts in treated water supplies is still not fully understood. Nevertheless, on the basis of the available evidence, these guidelines suggest an approach to planning, to deciding what information is required on initial contact, and an approach to health risk assessment. The guidelines also suggest possible strategies for managing such situations. It is accepted, however, that the vast majority of reports of positive samples will require no intervention. It is essential that CCDCs and EHOs work well with their colleagues in the water companies in undertaking a health risk assessment and responding appropriately.*

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Background

The Water Supply (Water Quality) (Amendment) Regulations 1999[1] came into force in June 1999. These regulations require water companies to carry out risk assessments to establish if there is a significant risk of cryptosporidial oocysts getting into finished water supplied from each of their water treatment works. If such a risk is established, water companies must use a process for treating the water to ensure that the average number of cryptosporidial oocysts is less than one per 10 litres (L) of water. To verify compliance with this requirement water companies must ensure that the water leaving the relevant treatment works is continuously sampled and analysed daily for cryptosporidial oocysts. It will be a criminal offence to supply water that contravenes the standard. Further information is available in a letter from the Drinking Water Inspectorate (DWI)[2].

The monitoring arrangements required by the regulations will be installed during 2000 in a programme agreed between the water companies and DWI. The first installations will be in place early this year. From that time local health authority consultants in communicable disease control (CCDCs) and local authority environmental health officers (EHOs) can expect to be informed by water companies more often than has been the case to date about the detection of cryptosporidial oocysts in water supplies.

This document sets out brief advice to CCDCs, EHOs, and others on the action they should consider if informed of the detection of oocysts in their communities' drinking water supplies. These guidelines were developed by an ad hoc working group of the PHLS Advisory Committee on Water and Environment and are intended for use in England and Wales. The committee is convened by the director of the PHLS and its remit is to advise the PHLS, Department of Health, Department of the Environment Transport and the Regions, and others on the human health aspects of water and environmental microbiology.

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Public health implications of oocyst counts

The statutory limit is a water treatment standard, chosen on operational rather than public health grounds. It does not differentiate between viable and non-viable oocysts, or between different species of cryptosporidium, some of which may not be infectious to humans. The relationship between oocyst counts in treated water and the health risk to those who drink the water is not known. CCDCs and EHOs should also be aware that the new sampling method for cryptosporidial oocysts required by the regulations[1] is more sensitive than that used previously and is likely to lead to the detection of more oocysts.

Oocysts have been detected in water supplies in association with several outbreaks of cryptosporiosis, but in all but one case they were detected after the outbreak was identified[3-5]. The relationship between these oocyst counts and the count in the water during the event that caused the outbreak is unclear. In the one outbreak that followed the detection of oocysts in the water supply, the count was 34 oocysts / 10 L[6]. On the other hand, high counts of cryptosporidial oocysts have been isolated from drinking water on numerous occasions without a subsequent increase in human cases[2,7]. Consequently it is difficult to relate reported counts to health risks.

The actual risk to health from cryptosporidium in water supplies is probably related to the count, the species or type, whether the oocysts are alive or dead, and the level of immunity in the exposed population[3-5,8]. In any community, however, young infants and children are less likely to have had prior infection with cryptosporidium than adults. It is likely that the risk of subsequent cases increases with the number of viable oocysts identified. It also seems reasonable that the risk of subsequent illness will be greater in populations not exposed to cryptosporidium before. Recent results of human infectivity studies indicate that previous cryptosporidium infection confers only partial resistance to reinfection and that this resistance can be overcome by a larger infectious dose[9].

Planning for incidents

All CCDCs and environmental health departments should have regular contact with the staff of water companies that serve their areas. They should also maintain an up to date list of out-of-hours contacts for these water company staff.

CCDCs and EHOs should meet regularly with their local water companies to agree appropriate strategies for communication to be used if routine monitoring identifies cryptosporidial oocysts in water supplies. In particular CCDCs and EHOs should agree with their water companies a protocol for urgent communication of positive results, indicating which positive results should be communicated urgently and which can be given the next working day. Agreeing such a protocol will raise the question of what oocyst count should trigger urgent reporting. Given that low oocyst counts are often detected in some treated water supplies using current methods, the level for urgent reporting will depend on the history of a given supply. The new methods are more sensitive than former ones, so results of tests performed under the new regulations should be interpreted with caution until substantial data have accrued.

CCDCs should also be aware of the stool examination policy in their local medical microbiology laboratories and, if necessary, consider requesting the implementation of standardised testing and reporting procedures. The PHLS standing operating procedure for the investigation of faecal specimens states that all specimens from symptomatic individuals should be examined for cryptosporidium[10]. CCDCs will need to ensure that all positive stool specimens are reported to them without delay. CCDCs will also be aware of the chief medical officer's current advice concerning the need for people with certain immune deficiencies to boil all drinking water and will want to assure themselves that appropriate medical staff have also been made aware of this advice.

For water supplies to large areas that cover more than one health and local authority, it may be appropriate to identify lead CCDCs (or regional epidemiologists) and EHOs to undertake early health risk assessment and action.

Information required on initial contact

A CCDC / EHO / regional epidemiologist informed about the detection of cryptosporidial oocysts in treated water needs several key pieces of information in order to contribute to an adequate health risk assessment with the water company.

- When and where the sample was taken.
- The number of oocysts detected per 10 L and the results of any viability testing.
- The source and treatment of the affected water supply (groundwater / surface water / full chemical treatment / filtration only / no filtration).
- The distribution area of the water supply and size of population supplied. Many water distribution systems are now integrated and it may not be possible to obtain precise information immediately. Nevertheless, the local water quality manager should be able to provide provisional and indicative information.
- Whether any problems with the supply, such as treatment failure or high turbidity, have been identified.
- Whether there have been any recent changes in the source and / or treatment.
- How fast water travels through the distribution area (is it likely that any of the contaminated water is still in the distribution system?). Again, precise information may not be immediately available, but provisional information should be available.
- The history of cryptosporidium sampling for this supply and whether there have been similar detections in the past.

- Whether waterborne outbreaks of cryptosporidiosis have been associated with this supply in the past.

Possible action

Having been informed about the detection of cryptosporidial oocysts in drinking water and having completed a health risk assessment, the options available to the CCDC / EHO include: taking no action, releasing advice to special groups, enhancing surveillance for human cases, requesting the water company to provide an alternative source of water, and issuing advice to boil water.

- If the water company has not already done so, it should be asked to expedite the examination of any further samples already taken from the affected water treatment works and distribution system.
- If a low oocyst count has been identified in a supply in which oocysts are frequently detected, and no previous outbreaks of waterborne disease have occurred, no further action is likely to be necessary.
- If the oocyst count is unusually high based on historical data for the particular supply, or if there are other indicators of treatment failure, an incident management team (IMT) may be called. This should include representatives of the water company, the CCDC, EHOs and, for supplies affecting more than one health authority, a regional epidemiologist. The director of the local public health laboratory may also be included.
- By the time the IMT meets, the results of further analyses should be available. If subsequent samples are negative or counts are low, further action is unlikely to be necessary. The issuing of advice to boil water in these circumstances is unlikely to be beneficial. Little research has been conducted on the public health benefits and disadvantages associated with boil water notices (see appendix and pages 56-9)[12].
- Advice to boil water may be issued if the health risk assessment indicates a continuing risk to health that outweighs the risks of a boil water notice (accepting that there is little hard evidence on which to make these judgments). Such circumstances are likely to be uncommon. Much research is needed, but it seems reasonable to suggest that the following factors indicate an increased risk of a subsequent outbreak:
  - A history of waterborne outbreaks associated with the same source
  - High oocyst counts in consecutive samples
  - Other evidence of treatment failure
  - A relatively high turbidity in treated water for that supply
  - A groundwater source
  - Demonstration of oocyst viability

If advice to boil water is issued there should be a clear understanding at the outset about the criteria necessary for it to be removed.

BOX Sources of further advice

Further advice can be obtained from the director of your local public health laboratory or regional epidemiologist. Advice can also be obtained from:

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Appendix

Public health advantages and disadvantages of boil water notices

Very little research has been published on the health gain associated with issuing boil water notices. Boil water notices can reduce the risk of subsequent disease only if they are imposed while the drinking water contains viable pathogenic organisms and if people act on the advice contained in them.

The incubation period of cryptosporidiosis is such that outbreaks are usually detected some weeks after the episode that led to the infection[3]. In many such outbreaks the infectious material is likely to have been flushed out of the system. There is also evidence that many people do not fully comply with the advice[11,12]. Well over 50% of people in target areas have either ignored the advice or engaged in some risky behaviour[11,12]. Both of these factors make it very difficult to define the public health benefits of boil water notices.

In addition boil water notices are not without danger[13]. At the least, a boil water notice causes inconvenience and some cost – either of heating water or buying bottled water. It has been suggested that the issuing of a boiled water notice may lead to increased burns and scalds. The psychological impact of boiled water notices has not been investigated. People who receive a boil water notice may lose confidence in their water supply, even after the notice has been lifted. This loss of confidence may cause anxiety and increase future inconvenience and costs.

Given the current state of knowledge, it is not known whether there would be any health gain from imposing a boil water notice following the detection of cryptosporidium oocysts in drinking water. Indeed it is possible that the issue of such a notice might have a negative effect on health. Nevertheless, if the health risk assessment indicates a need to issue a boil water notice, public health personnel should ensure that the notice is issued as quickly and as effectively as possible.