**Coleg Gwent Cryptosporidium Outbreak 2016**

The report of the Outbreak Control Team

**Agencies:**
- Public Health Wales
- Torfaen County Borough Council
- Monmouthshire County Council
- Animal and Plant Health Agency

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**Purpose and Summary of Document:**
On 21st March 2016, the Environmental Health Department of Torfaen County Borough Council were notified of a confirmed case of *Cryptosporidium* who attended the working farm at Coleg Gwent Usk Campus. During initial investigation links were made to another confirmed case in a neighbouring local authority who also attended the farm. This document outlines the declaration of an outbreak, the investigation and the decisions made by the Outbreak Control Team.

**Work Plan reference:** Not applicable
COLEG GWENT CRYPTOSPORIDIUM OUTBREAK 2016 REPORT

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Summary

On Monday the 21st March 2016, the Environmental Health Department of Torfaen County Borough Council (CBC) was notified of a confirmed case of Cryptosporidium who attended the working farm at Coleg Gwent Usk Campus. The onset of their symptoms was 13th March 2016. Environmental Health Officers (EHOs) undertook a telephone interview with the case during which the EHO was informed that other people known to the case had identical symptoms and had also attended the farm. During the initial investigation links were made to another confirmed case in a neighbouring local authority who also attended the farm.

Monmouthshire County Council (CC) and Public Health Wales (PHW) were contacted by Torfaen CBC EHOs to advise that they had identified one confirmed case and were investigating a number of other suspected cases who all had associations to the farm.

Contact details for others with symptoms were provided by the index case and contact was made to establish details of other cases.

Interviews were undertaken by EHOs from Monmouthshire CC and sample pots were organised by Torfaen CBC EHOs. A site visit was made on Wednesday 23rd March 2016 and initial control measures were immediately recommended.

An Incident Management Team (IMT) meeting was convened on Wednesday 30th March 2016 after the bank holiday Easter weekend and an outbreak declared escalating the IMT to an Outbreak Control Team (OCT). PHW in discussion with LA EHOs had checked the college was closed over the Easter weekend meaning that there was no immediate risk to others. The OCT agreed a range of control measures for instigation at the farm alongside further avenues of investigation.

Extensive epidemiological, microbiological and environmental investigations were subsequently undertaken by Outbreak Control Team (OCT) members. In total, the full OCT met four times and a subgroup convened to specifically meet with representatives of Coleg Gwent in order to consider control measures and to discuss planned ‘open days’ where children from local primary schools would visit the farm.

At the initial OCT meeting on Wednesday 30th March, an additional control measure for the cessation of all sheep and lamb animal contact for students was agreed.

Sampling of animal faeces at the farm identified Cryptosporidium positive samples. Cryptosporidium DNA sequencing was used to obtain a molecular profile for both human cases and animals at the farm.
The profiles were identical indicating that cases had been exposed to the same source of infection, most likely the farm animals and/or their surrounding environment.

Monmouthshire County Council in collaboration with Torfaen County Borough Council worked with Coleg Gwent farm staff to control the hazard of Cryptosporidium infection at the farm supported by the Outbreak Control Team.

**Report recommendations**

When there is a strong suspicion that a cluster of cryptosporidium cases is linked to a specific setting, such as an agricultural college, an adapted version from the ‘Standard Cryptosporidium investigation questionnaires for sporadic cases’ is recommended to be used and should be implemented in the early phases of the outbreak. The adapted questionnaire would need to cover areas specifically relevant to farms in order to better capture some specific exposures, eg. Hand washing, nail biting, the use of PPE, etc.

**Recommendation 1:**

Develop a fit for purpose investigatory questionnaire specifically for use in farm related Cryptosporidium outbreaks.

Information collected on cases through questionnaires is commonly transposed to and summarised in a line listing and it can have two purposes:

1) case management  
   and  
2) epidemiological analysis.

For the latter, a line list must be an up to date database of cases which prepares data for descriptive analysis: each row is a case and each column pertains to question that ought to be analysed. Although questions in the database columns should be the same as in questionnaires, some can become two columns for example, when a question has actually a question and a date, while other question with multiple answers are combined into one column eg. “did you handle/contact/bottle feed lambs?”
**Recommendation 2:**

Provide training on how to build a line list from questionnaires for people who manage or contribute to line lists.

In this outbreak the awareness of the need to control the risk of zoonotic infections in a farm environment was limited. This may also be the case in other agricultural college farms in Wales.

**Recommendation 3:**

Investigate practices on agricultural college farms throughout Wales to ensure there is an awareness of the need for infection control in relation to zoonotic infections.

Having Animal and Plant Health Agency (APHA) colleagues visit the farm site and their subsequent involvement in the outbreak response was extremely beneficial in this outbreak. Their knowledge and expertise assisted in considering and agreeing control measures and remedial work needed at the farm.

**Recommendation 4:**

APHA colleagues should be asked to attend the farm site at the earliest opportunity to consider animal husbandry and to collect animal faecal samples.

The HSE should be notified early on in an incident where they are the Enforcing Authority for Health & Safety as is the case for Coleg Gwent. In this outbreak they were notified following the first OCT meeting; EHOs had already been to site keen to investigate the potential source of infection and instigate remedial action.

**Recommendation 5:**

Notify the HSE as soon as a cluster of cases is suspected to be associated with premises where they have enforcement responsibility.

Any future outbreaks of diarrhoea in animals on the farm or outbreaks of unexplained disease should be fully investigated with the farm veterinary surgeon, including laboratory investigation if appropriate. Any zoonotic infections identified should be immediately communicated to college management.
**Recommendation 6:**

Any future outbreaks of diarrhoea in animals on the Coleg Gwent farm should be fully investigated with results communicated to Coleg Gwent management.

Awareness of the Code of Practice ‘Preventing or Controlling ill health from animal contact at visitor attractions’ at agricultural colleges, open farms and farm parks in Wales needs to be improved at Coleg Gwent. In particular, the requirement to review their risk assessment when circumstances change.

**Recommendation 7:**

Raise awareness of the Code of Practice, ‘Preventing or Controlling ill health from animal contact at visitor attractions’ within Coleg Gwent.

In this outbreak, faecal samples which were reported as negative at the local laboratory underwent more sensitive testing at the Cryptosporidium Reference Unit. Four additional cases were able to be microbiologically confirmed using the more sensitive test.

**Recommendation 8:**

Where deemed necessary, samples from probable cases should be referred by the local microbiology laboratory for specialist, more sensitive testing at the Cryptosporidium Reference Unit. This should be discussed and agreed with the Head of the Reference Unit on an outbreak by outbreak basis.
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<th>Recommendation</th>
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<td>1 Develop a fit for purpose investigatory questionnaire specifically for use in farm related Cryptosporidium outbreaks.</td>
<td>Communicable Disease Expert Panel</td>
<td>3 months</td>
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<td>2 Provide training on how to build a line list from questionnaires for people who manage or contribute to line lists.</td>
<td>Public Health Wales</td>
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<td>1 month</td>
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Background

Cryptosporidium

Cryptosporidium is a protozoan (single celled) parasite which, if ingested, can cause an illness called cryptosporidiosis. The main symptom in humans is watery diarrhoea, which can range from mild to severe and can persist for up to three to four weeks. It is often accompanied by stomach pain, nausea or vomiting, low-grade fever sometimes causing dehydration and weight loss. It is a leading cause of human gastrointestinal infection in the UK. Young farm animals can also suffer from Cryptosporidium diarrhoea.

A number of different Cryptosporidium species infect animals. In humans, illness is mainly caused by Cryptosporidium parvum and Cryptosporidium hominis. In livestock, illness is mainly caused by Cryptosporidium parvum.

Human infection occurs when Cryptosporidium oocysts (the hardy cyst stage of the parasite’s lifecycle) are ingested. The oocysts can survive in the environment and in water for long periods of time. Human infection may be acquired by a number of routes: it can be passed on from other people, from contact with infected animals and their faeces, and by ingestion of contaminated drinking water, recreational water and food.

Infection is frequently associated with foreign travel.

The incubation period ranges from 1 to 28 days between exposure and onset of diarrhoea, with a median of 4 to 7 days (Hawker et al 2005).

Coleg Gwent Usk Farm Campus

Coleg Gwent is the largest further education college in Wales. It operates from 5 campuses located at Newport, Cross keys, Ebbw vale, Pontypool and Usk. Coleg Gwent employs over 1,500 staff and provides further education to some 37,000 students. The college provides a wide range of further education courses and training programmes in a variety of settings that include practical workshops, laboratories and classrooms.

Usk campus is located in The Rhaydyr, Usk, Monmouthshire. It offers a number of further education opportunities including farm management where practical teaching sessions take place on the working sheep and cattle farm located on site.
The Usk campus farm is a working farm owned by Coleg Gwent, however, the animals are owned by private tenants. Farm animals on this farm at the time of the outbreak included approximately 220 dairy cows, 20 young calves and 90 ewes and their lambs. Other cattle are kept at another farm belonging to the tenants and all cattle calve down at the other farm.

**Introduction**

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Extensive epidemiological, microbiological and environmental investigations were subsequently undertaken by Outbreak Control Team (OCT) members. In total, the full OCT met four times and a subgroup convened to specifically meet with representatives of Coleg Gwent in order to consider control measures and to discuss planned ‘open days’ where children from local primary schools would visit the farm.
At the initial OCT meeting on Wednesday 30th March 2016, an additional control measure for the cessation of all sheep and lamb animal contact for students was agreed.

Coleg Gwent instigated all control measures and resumed student animal contact activities on Monday 18th April 2016. The outbreak was declared over on 28th April 2016.

This report is the record of the OCT’s activities and findings.

**Investigation**

**Epidemiological**

It was hypothesised early in the investigation that the cases were associated with the farm in Usk campus Coleg Gwent as this was the only common factor amongst the cases being investigated. Also, all primary cases had visited the farm in the days and weeks before onset of illness. Detailed descriptions of where each case had been and the animals they had contact with were obtained by Environmental Health officers.

The objective of the epidemiological investigation was to identify a common exposure of infection for *cryptosporidium* cases associated with the premises, in order to prevent further transmission and to make recommendations for:

- data collection methods
- data management of line list of cases
- underpin control measures

Cases were interviewed by Environmental Health officers (EHOs) through a combination of two questionnaires, the ‘Gastro Intestinal Illness Exposure Investigation form’ and part of the ‘Standard Cryptosporidium investigation questionnaires for sporadic cases’. The latter allowed for collection of more detailed and specific information in the context of an agricultural farm associated outbreak. Information was collected on demographics, symptom history, food and occupational exposures.

Analysis of responses to the questionnaires consisted of descriptive statistics where the epidemic curves by date of onset and median incubation period with range was calculated. Cases were described in terms of time and person, including a description of the prevalence of exposures associated with activities at the agricultural college. Data was entered into Epidata Entry software and analysed in Stata 14 and Excel.
There were 14 confirmed and 3 probable cases identified where:

a confirmed case was defined as “anyone who has worked at or visited Coleg Gwent Usk Campus farm since 01/03/2016 or is the close contact of someone who has and who has laboratory confirmed *Cryptosporidium parvum*”

and

a probable case was defined as “anyone who worked at or visited Coleg Gwent Usk Campus farm since 01/03/2016 or is the close contact with someone who has and had diarrhoea and other symptoms of infectious gastroenteritis lasting more than 48 hours”.

**Environmental**

**Public Health**

Environmental Health Officers do not enforce Health and Safety legislation at working farms, this is the responsibility of the Health and Safety Executive (HSE). However, EHOs do have powers under public health legislation to investigate cases of infectious disease. It is under this remit that EHOs undertook their investigations.

The Usk campus farm was visited on the morning of Wednesday 23rd March 2016 and a visit was undertaken to the Pontypool Campus on Thursday 24th March 2016, which was the earliest opportunity following notification and identification of the linked cases associated with the farm. A further visit was made by EHOs accompanied by the HSE on Tuesday 12th April 2016.

An Incident Management Team (IMT) meeting was convened on Wednesday 30th March after the bank holiday Easter weekend and an outbreak declared escalating the IMT to an Outbreak Control Team (OCT).

It should be noted that this initial meeting took place within the Easter two week break from Friday 25th March to Sunday 10th April and there were no students on site at the farm for this two week period. Animal contact was undertaken by tenants only.

Members of the OCT met with Coleg Gwent representatives on Tuesday 5th April 2016 to discuss the outbreak and the planned open days at the farm.

**Animal Health**

Animal and Plant Health Agency Veterinary Investigation Officers visited the farm on Tuesday 5th April 2016, took samples and undertook an inspection of the farm facilities.
Lambs had already been implicated as the source of *Cryptosporidium* infection for the people diagnosed with cryptosporidiosis at the time of the visit as they were the only risk factor that was common to all cases.

**Microbiological**

**Cases**

Primary diagnosis was undertaken by microscopy at the microbiology laboratories in Cardiff (UHW) and Newport (Royal Gwent) using modified Ziehl-Neelsen and Auramine phenol microscopy stains respectively. Positive samples were sent to the national *Cryptosporidium* Reference Unit in Swansea for genotyping: species were identified by real-time PCR. *C. parvum* samples were further analysed by sequencing the gp60 gene. Samples from diarrhoea cases who had contact with the farm but were undiagnosed locally were also sent for specialist testing by immunofluorescence microscopy and PCR which are more sensitive than the local methods (Chalmers et al., 2011).

The guidance for the control of person to person spread from *Cryptosporidium* includes taking microbiological samples from close household contacts who are symptomatic (Anon 2004).

**Animal samples**

On Tuesday 5th April 2016, the farm was visited by APHA staff and a total of 23 animal faecal samples were collected. The samples were 8 floor faecal samples from the orphan (pet) lambs and 15 floor faecal samples from the lambs in the group of 30 ewes and approximately 50 younger lambs. The remaining ewes and lambs were at pasture and these older lambs were not sampled.

The 23 faecal samples were sent for Fluorescent antibody testing (FAT) (which is also known as immunofluorescence microscopy) for *Cryptosporidium* at APHA Weybridge as described by Pritchard et al (2007) – this test can be used to quantify oocysts on a scale of 0 (<1 \(x10^3\) oocysts per gram) to 5+ (>\(1X10^6\) oocysts per gram).

10 FAT *Cryptosporidium* positive faecal samples were submitted to the Cryptosporidium Reference Laboratory for confirmation and molecular typing by sequencing of the ssu rRNA gene.
Results

Epidemiological

30 cases were initially investigated. Of the original 30 cases investigated, the age range was from 16 to 56 years and the median was 18 years of age. 53% were female. However, 13 individuals subsequently did not meet any of the case definitions and were excluded from the investigation and analysis.

There were 14 confirmed and 3 probable cases. Analysis of the confirmed and probable cases showed the age range was from 16 to 45 years and median age was 18 years of age. 59% were females.

The first onset of symptoms was on Saturday 5th March 2016 and the last reported on Thursday 24th March 2016. The majority of onsets were between the 20-24th March 2016, see figure 1 below.

Figure 1: Confirmed and probable cases of cryptosporidium associated with Usk College farm by date of onset of symptoms
The table below illustrates the days when cases visited the farm (denoted by green blocks) and when then they became unwell (denoted by red blocks). Those with no farm visits are secondary cases.

| Case Number | 22/02/2016 | 23/02/2016 | 24/02/2016 | 25/02/2016 | 26/02/2016 | 27/02/2016 | 28/02/2016 | 01/03/2016 | 02/03/2016 | 03/03/2016 | 04/03/2016 | 05/03/2016 | 06/03/2016 | 07/03/2016 | 08/03/2016 | 09/03/2016 | 10/03/2016 | 11/03/2016 | 12/03/2016 | 13/03/2016 | 14/03/2016 | 15/03/2016 | 16/03/2016 | 17/03/2016 | 18/03/2016 | 19/03/2016 | 20/03/2016 | 21/03/2016 | 22/03/2016 | 23/03/2016 | 24/03/2016 | 25/03/2016 | 26/03/2016 | 27/03/2016 |
|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| 1           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           |
| 4           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           |
| 5           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           |
| 6           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           |
| 8           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           |
| 10          | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           |
| 14          | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           |
| 15          | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           |
| 18          | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           |
| 22          | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           |
| 24          | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           |
| 28          | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           |
| 29          | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           |
| 20          | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           |
| 26          | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           |
| 27          | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           | x           |

Table 1- Time map of Agricultural College visiting days. Green- visiting days; Red- onset date

Further information regarding symptoms was only available for a limited number of all cases. Based on a subset of 5 cases duration of symptoms ranged from 6 to 14 days with a median of 11 days. Based on a subset of 9 cases frequency of symptoms was: 9/9 diarrhoea (100%), 8/9 vomiting (89.9%), 8/9 nausea (89.9%), 2/9 bloody stools (22.2%), 8/9 abdominal pain (89.9%) and 4/9 fever (44.4%).

Information collected through the ‘Gastro Intestinal Illness Exposure Investigation form’ was only available for a subset of 9 cases. Exposures were analysed with the following results: 8/9 owned a pet (88.9%); 7/9 had contact with farm faeces at Usk campus farm (77.8%) and 6/9 reported they were in an outdoor activity with contact with soil, mud or water at Usk campus farm (66.75%).
Information on farm specific exposures, collected through part of the ‘Standard Cryptosporidium investigation questionnaires for sporadic cases’ highlighted the following: 15/17 cases (88%) had contact with lambs, 8/17 cases (47%) had contact with calves, 12/17 cases (70%) washed their hands after animal contact, 14/17 cases (82%) washed their hands before eating, and 5/17 cases (29%) bit their nails. When stratified by sex 3/7 males (42%) and 2/10 females (20%) cases reported biting their nails.

The epidemic curve (figure 1) and time map (table 1) are suggestive of a continuing source outbreak as cases present over a period of time and are not clustered around the same period of days as you would expect in a point source outbreak. This means that there was a continued source of infection to which cases were exposed. This is likely to be via the farm animals and the farm environment but also potentially via person to person in close contacts.

Results from ‘hand washing’ questions do not seem to reflect the hygiene standards in which hand washing took place at the farm. The vast majority of cases reported washing their hands after having animal contact however the efficacy of their hand washing technique cannot be assessed. In addition, some cases reported verbally when interviewed by EHOs, by-passing hand washing facilities at busy times due to the limited number of wash hand basins available.

The results on exposure data suggest that the most likely environmental source was having contact with lambs. Nonetheless, figures should be interpreted with caution given the small numbers. Although it was not possible to identify the definitive source of the outbreak, given all available information the most plausible source was the lambs with diarrhoea and transmission is likely to have been facilitated by poor hygiene standards and facilities.

The onset dates of illness following farm visits are compatible with the working farm at Coleg Gwent Usk Campus being the source of the outbreak.

**Environmental**

**Public Health**

Environmental Health Officers identified a number of deficiencies during their visit which are outlined below:
A suitable and sufficient risk assessment had not been undertaken in relation to zoonotic infections, such as *E. coli* O157 and *Cryptosporidium*, arising from farm-related activities carried out by teaching staff and student groups, particularly visiting student groups (e.g. those on the Integrated Living Skills (ILS) course).

There had been no comprehensive review of the management responsibilities of Farm, ILS and Corporate Health and Safety departments with regards to the instruction, training and supervision of teaching staff and student groups, some of which may be considered potentially vulnerable to infection.

Teaching staff and students were not suitably instructed, trained and/or closely supervised to ensure that the necessary control measures (e.g. hand washing) were consistently implemented to prevent the risk from zoonotic infection. Staff and students needed to be reminded of the increased risk of handling animals that have diarrhoea or are unwell and the importance of isolating such animals that are unwell.

Farm management were not aware that zoonotic organisms, in particular *Cryptosporidium*, are common in farm animals, regardless of obvious symptoms or known illness. Diarrhoea was considered common place in lambs that have been overfed and therefore the associated risk of *Cryptosporidium* within diarrhoea (regardless of other obvious illness) appeared to be underestimated by farm management.

Information regarding the risk from zoonotic infections, such as *E. coli* O157 and *Cryptosporidium* had not been provided to all teaching staff, students and other groups who worked at or visited the farm. No information was provided to parents, guardians and group organisers especially those in a vulnerable group or with underlying health conditions which may make them more susceptible to infection.

There were a number of practices, which were not likely to have been subject to risk assessment and were not monitored by farm management. These practices are likely to have placed students, who are not enrolled on an agricultural or animal-based course, at risk of contracting *Cryptosporidium* (and other infectious diseases). For example, the removal of potentially contaminated boots and overalls in the car park (after hand washing has taken place) and the consumption of snacks following the removal of boots and overalls on the minibus itself.

The use of boot cleaning equipment needed review as there was a risk of contamination of student overalls, hands and faces due to spray of faecal matter/ aerosols following boot cleaning, particularly when the activity is unsupervised and/or the facility is not properly used by students.
Diarrhoeic lambs (i.e. those with diarrhoea) were housed separately in a designated pen within the barn at the time of the outbreak. However, all students have the same access to those lambs that are isolated and those that are not isolated and do not have diarrhoea. Due to the increased risk to staff or students from contracting Cryptosporidium or other zoonotic infections whilst lambs have diarrhoea, isolated lambs should have been kept in a separate area and access restricted to suitably trained and/or supervised individuals.

The external provision of hoses for cleaning farm equipment, tools etc. adjacent to Workshop 1, needed review. At the time of the visit, these were lying on the ground and as a result contaminated with mud and potentially faecal matter.

There were limited hand washing facilities available within the Boot Room i.e 2 wash hand basins, leading to students bypassing the hand washing facilities entirely, particular during busy times. It was also noted that the automatic hand dryer was defective.

The water to the wash hand basin in the Male Toilets (located near the Boot Room and Car Park) was far too hot to promote thorough and effective hand washing.

The automatic hand dryer in the Shower Room (located near the Boot Room and Car Park) was not working.

The male and female toilet facilities (located near the Boot Room and Car Park) were in need of upgrading in line with other toilet facilities around the farm eg non hand operated taps.

A no eating/drinking policy was in place within the farm. However, a conflicting policy which promotes student hydration and related health benefits has resulted in a number of drinking water fountains being provided at various locations.

A review of cleaning and disinfection chemicals, procedures etc. was needed in conjunction with Bespoke Cleaning company in order to determine what the cleaning procedures entail and the effectiveness of chemicals used. Chemicals used for cleaning and disinfection should be effective (and where appropriate meet British Standards) in killing Cryptosporidium and other zoonotic organisms, such as E. coli O157. Most common commercially available disinfectants are not effective against Cryptosporidium.
Routine checks of all toilets and hand wash facilities were not being carried out at appropriate intervals throughout the day to ensure that they are fully operational and replenished as appropriate.

Milk was noted in the same refrigerator where animal vaccines were stored (located near the Boot Room and Car Park). Miscellaneous crockery was also noted in the open room where the washing machine is currently located.

There was little or no provision of hand washing reminders or hand washing rub techniques throughout the farm.

Potentially contaminated overalls were being laundered in the washing machine located within the ILS Staff Kitchen/Student Cooking/Food preparation area at Pontypool Campus posing a risk of contamination.

Potentially contaminated overalls were being taken home by students increasing the risk of wider spread of zoonotic infection.

Coleg Gwent staff and students were returning to work/study whilst suffering from sickness and diarrhoea leading to a risk that infection may be spread to other students and members of staff.

**Animal Health**

Information was collected from the Farm Manager using a questionnaire administered by an APHA Veterinary Investigation Officer. Lambing started on 22\textsuperscript{nd} of February 2016 and finished at the end of March 2016. It was reported that affected students may have been involved in such tasks as cleaning out lambing pens, moving lambs into pens and feeding pet (orphan) lambs. It was reported that students wear wellingtons and overalls and use gloves when lambing. Hand sanitizers are not effective at removing or killing *Cryptosporidium* oocysts and should not be used as an alternative to hand washing.

Cryptosporidiosis had been diagnosed in calves on the farm several years earlier and a preventative treatment (halofuginone lactate) was given to all calves to control disease and the pens disinfected after use. There have been no problems identified with diarrhoea in the calves since these measures were introduced. There is no licensed treatment for cryptosporidiosis in lambs or goats.

At the time of the visit, the lambs all appeared bright apart from one orphan (pet) lamb that was recumbent a lot of the time and one other lamb that was bright but had diarrhoea. Diarrhoea was noted about halfway through lambing with lambs affected from a few days of age up to 14 days of age and persisting for about a week. All the pet lambs had been affected.
The diarrhoea resolved without treatment and it was assumed that the diarrhoea was nutritional.

All animals including healthy animals may shed zoonotic pathogens from time to time. Risk mitigation measures, such as personal protective equipment (PPE), hand washing and advice, must be provided to students having contact with the animals. Diarrhoeic animals are an increased risk as diarrhoea may be due to zoonotic pathogens and there is more potential for contamination of hands and PPE e.g. overalls with faeces. Sick animals should be isolated and risk assessments should be reviewed and additional measures considered for handling and feeding animals that are sick or have diarrhoea.

*Cryptosporidium* infection causes diarrhoea in young farm animals, so it is possible the diarrhoea in the lambs was, at least in part, due to *Cryptosporidium* infection. *Cryptosporidium* oocysts may also be shed in large numbers by healthy animals including lambs. If bottle feeding of pet lambs occurs in future years, bottle-feeding behind pen gates is likely to reduce the contamination of PPE and hands.

The *Cryptosporidium* oocysts may survive in the environment from one year to the next. The current building used for the sheep is not easy to clean as the floor is not solid and the sides of the building corrugated sheets. Once the sheep have been removed from the building, it was recommended the building is thoroughly cleaned out and hurdles thoroughly cleaned and then preferably steam cleaned. The *Cryptosporidium* oocysts in bedding should be destroyed by the normal composting processes. The building should be then left empty of animals for as long as possible. Consideration should be given to improving the animal accommodation for calves and sheep so that it is easier to clean effectively.

As well as Coleg Gwent students using the farm for training, there are a large number of other visitors to the farm, including farming connect training meetings, project launches and in previous years, visits from primary school children for the ‘countryside experience’. For these visitors, the industry code of practice for ‘preventing or controlling ill health from animal contact at visitor attractions’ applies which is available at [http://www.visitmyfarm.org/component/k2/339-industry-code-of-practice/339-industry-code-of-practice](http://www.visitmyfarm.org/component/k2/339-industry-code-of-practice/339-industry-code-of-practice).

The farm, as seen at the time of the visit, fell far short of the standards described in the code of practice. The areas of the farm premises used for such visits should fully comply with the code of practice before such events, such as school visits, take place at the farm.
There was effluent, standing water and some straw and manure on the roadways, particularly outside the cattle cubicles, around the sheep shed and silage pits. This is likely to cause contamination of wellingtons of those walking around the farm. It was recommended measures are taken to improve the roadways and prevent effluent leaking onto the roadways on the farm.

There were two small signs on entering the farm advising that ‘eating and drinking are not permitted’ and ‘please ensure you wash your hands before leaving the farm’. It was recommended that these are rigorously enforced and further signage added around the farm to act as a reminder, including signage on zoonotic risks in appropriate places.

The tenant farmer had a farm health plan written by their veterinary surgeons. It is important this includes all animals (including the sheep) and should be regularly reviewed to help reduce the risk of zoonoses.

Taking protective equipment off-site for cleaning at students homes or for use on other farms poses a bio-security risk as well as a zoonotic risk to those handling the contaminated overall e.g. when washing. It was recommended protective clothing (wellingtons, overalls) are not taken home for cleaning and that alternative safe arrangements for cleaning overalls are considered.

**Microbiological**

**Cases**

There were 14 confirmed cases in this outbreak. All were confirmed at the Cryptosporidium Reference Unit (CRU).

Of the 10 local diagnostic laboratory confirmed cases, all were *C. parvum* and nine were gp60 subtype IIaA15G2R1 (one did not amplify with the gp60 PCR primers).

Of 12 case samples that were negative locally for *Cryptosporidium*, four were confirmed and were *C. parvum* at the CRU. Two amplified with the gp60 primers and were subtype IIaA15G2R1.
<table>
<thead>
<tr>
<th>CRU Reference</th>
<th>Local Lab Result</th>
<th>CRU Specialist testing</th>
<th>Species</th>
<th>gp60 subtype</th>
</tr>
</thead>
<tbody>
<tr>
<td>43616</td>
<td>positive</td>
<td>n/a</td>
<td>C. parvum</td>
<td>IIaA15G2R1</td>
</tr>
<tr>
<td>43588</td>
<td>positive</td>
<td>n/a</td>
<td>C. parvum</td>
<td>Did not amplify</td>
</tr>
<tr>
<td>43573</td>
<td>positive</td>
<td>n/a</td>
<td>C. parvum</td>
<td>IIaA15G2R1</td>
</tr>
<tr>
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<td>C. parvum</td>
<td>IIaA15G2R1</td>
</tr>
<tr>
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<td>n/a</td>
<td>C. parvum</td>
<td>IIaA15G2R1</td>
</tr>
<tr>
<td>43526</td>
<td>positive</td>
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<td>C. parvum</td>
<td>IIaA15G2R1</td>
</tr>
<tr>
<td>43525</td>
<td>positive</td>
<td>n/a</td>
<td>C. parvum</td>
<td>IIaA15G2R1</td>
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<tr>
<td>43481</td>
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<td>IIaA15G2R1</td>
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<tr>
<td>43460</td>
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<td>IIaA15G2R1</td>
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<tr>
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<td>n/a</td>
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<td>IIaA15G2R1</td>
</tr>
<tr>
<td>43571</td>
<td>negative</td>
<td>positive</td>
<td>C. parvum</td>
<td>Did not amplify</td>
</tr>
<tr>
<td>43542</td>
<td>negative</td>
<td>positive</td>
<td>C. parvum</td>
<td>IIaA15G2R1</td>
</tr>
<tr>
<td>43537</td>
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<td>positive</td>
<td>C. parvum</td>
<td>IIaA15G2R1</td>
</tr>
<tr>
<td>43504</td>
<td>negative</td>
<td>positive</td>
<td>C. parvum</td>
<td>Did not amplify</td>
</tr>
</tbody>
</table>

Table 2: Results for human cases

**Animals**

23 floor faeces samples were collected and tested by the FAT for *Cryptosporidium* oocysts in faeces. All sheep were in the same building. 10 of the samples taken were positive for *Cryptosporidium*.
<table>
<thead>
<tr>
<th>Location</th>
<th>Number of sheep present</th>
<th>Number of samples collected</th>
<th>Number of samples positive</th>
<th>Number of samples negative</th>
<th>FAT result (number positive)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pen 1</td>
<td>3 orphan lambs</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>1+ (1)</td>
</tr>
<tr>
<td>Pen 2</td>
<td>4 orphan lambs</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Pen 3</td>
<td>1 orphan lamb</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>3+ (1)</td>
</tr>
<tr>
<td>Pen 5</td>
<td>30 ewes and 50 lambs</td>
<td>15</td>
<td>8</td>
<td>7</td>
<td>3+ (1), 2+ (1) 1+ (6)</td>
</tr>
</tbody>
</table>

Of the 10 lamb faecal samples sent to the CRU, Cryptosporidium was not confirmed in two, three were C. parvum gp60 subtype IIaA15G2R1, 1 was C. parvum subtype not identified, two were C. xioai (a species found in sheep that is not pathogenic to humans) and two contained both C. parvum (subtype not identified) and C. xioai. The subtype confirmed in animal samples was identical to the subtype confirmed in the human case samples.

**Communications**

Communication was discussed at every meeting of the OCT and a variety of communication methods were used to warn and inform the public and stakeholders of the outbreak.

**Communication with the media**

It was agreed that the Public Health Wales Communications Officer would lead on communication with the media on behalf of the OCT.

At the initial OCT meeting on 30th March 2016 it was agreed that a proactive press release was not needed at that time and it was agreed that PHW communications team would draft a broad reactive statement in case press enquiries were received. This decision was made on the basis that there was no ongoing risk due to the college being closed to students and there being no benefit of having a press release.

However, on the evening of the 30th March 2016 a twitter account tagging local press asked publicly about the outbreak. On the 31st March 2016 a press release was issued and there were three more subsequent press releases issued on 6th, 15th and 28th April 2016.

A total of four press releases were issued on behalf of the OCT by the Public Health Wales Communications Team.
All press releases were agreed by OCT core members before distribution to the media. Press updates were published on the Public Health Wales website.

**Communication with health professionals**

A letter was sent to all General Practitioners (GPs) in Gwent along with the GP out of hours service on 31st March 2016 to advise them of the outbreak and to request that they consider cryptosporidiosis as a diagnosis if anyone associated with Coleg Gwent presented to them with compatible symptoms. A copy of the letter is reproduced in Appendix 1.

**Communication with stakeholders**

In order to prepare NHS Direct Wales for a possible increase in calls on *Cryptosporidium*, the Public Health Wales Health Protection Team informed them of the outbreak and the issuing of press releases.

The Public Health Wales Communications Team shared all press releases prior to publication with Communication Officers in Torfaen and Monmouthshire Councils, Aneurin Bevan University Health Board including the Director of Public Health, the Public Health Wales Board, Public Health Wales Chief Executive and the Director of Public Health Services for Public Health Wales. The OCT also provided officials in Welsh Government with updates after each OCT meeting.

Updates on the outbreak were also included in the weekly Public Health Wales staff e-Bulletin.

PHW also liaised with Coleg Gwent and offered support and information in order for the college to write to affected students.

**Communication with cases**

All cases had conversations with EHOs during the early stages of the investigation. A letter updating cases on developments was sent on 11th April 2016 and a concluding letter was sent on 3rd May 2016 once the outbreak had been declared over.

**Conclusion**

*Cryptosporidium in a farm setting*

The risk of *Cryptosporidium* associated with farms is well documented with a number of outbreaks occurring such as an earlier outbreak in the Gwent area associated with Greenmeadow Community Farm.
Two research papers also highlight the risk of infection from animals (Chalmers & Giles 2010 and Gormley, Little et al 2009).

Many animals carry Cryptosporidium in their gut and so farms will always have the potential to be a reservoir of infection. However effective interventions such as physical barriers, educational material and hygiene measures are capable of controlling the risk of infectious diseases within the farm environment. The importance of hand washing prior to eating cannot be overstated.

Since the Godstone farm E. coli 0157 outbreak, comprehensive operational guidance for PHE staff and an industry code of practice have been published along with a summary document.

**Surveillance**

The surveillance system in place allowed the cases to be identified and the food and movement histories of these cases to be gathered by EHOs although food being a possible exposure was quickly ruled out. Excellent communication between local authorities allowed the link between cases to be made. The excellent communication demonstrated in this outbreak response is underpinned by effective local liaison arrangements between local authority Lead Officers and Public Health Wales.

**Control measures**

EHOs visited the farm on 23rd March 2016 where they made a number of verbal recommendations which were followed up in writing. Photographs of the farm were taken and these together with photographs of remedial measures can be found in Appendix 2.

Following an OCT meeting held on the afternoon of 30th March 2016 at which time there were 3 confirmed cases and 8 other cases under investigation, the OCT agreed some initial control measures which were;

- Reinforce 48 hour exclusion rule for staff and students;
- Provide a report to Coleg Gwent in relation to actions necessary to minimise the risk of transmission of bacteria between animals and students/staff;
- Ascertain what the open days planned by the college immediately after the Easter break entailed.

The OCT at this inaugural meeting also agreed an additional control measure, that is, the cessation of all sheep and lamb animal contact for students. This was implemented immediately and was in place when students returned to college following their Easter break.
On Tuesday 5th April 2016 a subgroup of the OCT met with Coleg Gwent staff and discussed the open country adventure days that they had planned. The days entailed over 300 local primary school children visiting the campus and being shown around including the working farm area. Following discussions regarding the need to ensure that there was no risk to the children, Coleg Gwent staff made a decision to indefinitely postpone the planned open country adventure days.

Following the institution of comprehensive control measures the sub group of the OCT determined that any ongoing risk of illness associated with the farm had been minimised.

**Learning Points**

The ‘Gastro Intestinal Illness Exposure Investigation form’ is the standard form that has been used since 2015 to collect exposure information on gastrointestinal cases. While it aims to capture information on various types of gastrointestinal related exposures it does not allow for more detailed investigations in some particular settings, such as in an agricultural college farm outbreak. As a result, the ‘Standard Cryptosporidium investigation questionnaires for sporadic cases’, which was used in a previous outbreak in a similar context, was also used to complement the first questionnaire.

This method generated two main issues:

1) not every individual was interviewed with the two different forms and while one doesn’t go into specific details the other one doesn’t collect data on basic demographic and disease data

and

2) it is more cumbersome and time consuming to administer and analyse data from two questionnaires. Together these two factors led to an incomplete and heterogeneous dataset that may have hindered the identification of the source of the outbreak.

In order to facilitate data analysis a few operational elements could be improved such as:

- Ensuring that the box is crossed/ticked even when the answer is negative, otherwise it is not clear whether the questions were not asked or if there was a negative response;
- Any comments to closed questions should be added on the ‘officer notes’ section;
- When a ‘no’ option is ticked ‘if yes details’ should not be filled in;
When filling in dates (eg. college visiting dates) it is preferable to write the exact dates instead of the days of the week.

This outbreak highlighted the importance of involving the data analyst/epidemiologist early on in the Outbreak Control Team, for clear understanding of data collection methods and procedures, operational definitions (case definitions, exclusion criteria) and thus a prompter analysis. Likewise it is crucial to establish early and direct communication channels between the person who updates the line list and data analyst. It is important to define at the beginning of the outbreak who is responsible for maintaining and updating the line list of cases in order to avoid duplication of work and to ensure that no case form (and case information) is missed out and so that analysis can be easily updated.

Faecal samples were initially tested in local diagnostic laboratories using methods specified in the national SOPs and referred for specialist testing in the Cryptosporidium Reference Unit (CRU). The reason for this was that reference tests are more sensitive and therefore can identify cases that had previously tested negative at the local laboratory. However, all tests have a limit to sensitivity so even samples that also tested negative at CRU, especially if submitted during or after recuperation, do not rule out infection in cases, especially when there is an epidemiological link.

References


Chalmers RM, Campbell BM, Crouch N, Charlett A, Davies AP. Comparison of the diagnostic sensitivity and specificity of seven Cryptosporidium assays used in the United Kingdom. J Medical Microbiol 2011; 60, 1598–1604


Glossary

**Confirmed case:** Anyone who has worked at or visited Coleg Gwent Usk Campus Farm since 1st March 2016 or is the close contact of someone who has and who has laboratory confirmed *Cryptosporidium parvum*.

**Case Definition:** A list of criteria that must be fulfilled in order to identify a person as a case of a particular disease. It is used in outbreaks of illness to identify who should be included on a list of cases. The criteria can include the symptoms of the illness, laboratory test results, the time and place of illness.

**Communicable Disease:** Any disease that can be passed from one person to another.

**Consultant in Communicable Disease Control (CCDC):** A fully trained doctor in a branch of medicine that is responsible for the prevention and control of communicable disease in the community.

**Control:** Any person that does not have the illness that can be compared to a case in an analytical epidemiological study.

**Cryptosporidium:** A parasite (a tiny organism) that causes an infection called cryptosporidiosis affecting people and farm animals.

**Cryptosporidium**

**Descriptive Epidemiology:** Describing the characteristics of cases i.e. time, place or person characteristics such as date of onset of illness, place of residence, age or sex.

**Environmental Health Officer (EHO):** An individual fully trained in environmental health issues such as housing, sanitation, food, clean air, noise and water supplies. Responsibilities include inspecting restaurants and other food premises and investigating cases of food and waterborne disease.

**Epidemiology:** The study of the patterns, causes, and control of disease in groups of people.

**Epidemiological link:** Cases linked by close social, household or work contact.

**Microbiological Screening/Sampling:** Taking a sample e.g. stool (faeces) and testing it to see if the infectious agent is present.
**Microbiologist**: A doctor who specialises in the diagnosis, treatment and control of infectious agents e.g. bacteria, viruses and fungi.

**Outbreak**: An increase in the number of people with an illness or disease that is above what you would normally expect in the population at that particular time, or two or more linked cases with the same illness.

**Outbreak Control Team (OCT)**: A team of people from different, usually public, bodies, brought together, according to official guidance primarily to control the spread of disease during an outbreak. This is done through assessing the range and extent of the outbreak; identifying the source of the problem if possible, implementation of prevention and control measures and communication.

**Phage type**: A system of sub-classifying certain species of bacteria according to whether they are susceptible to infection by panels of different viruses that infect bacteria ("bacteriophages" literally, "bacteria-eaters").

**Primary case**: The first individual within a group or family to get the disease. There may be several primary cases in a group if they are exposed to the same source around the same time.

**Probable case**: Anyone who worked at or visited Coleg Gwent Usk Campus Farm since 1st March 2016 or is the close contact of someone who has and had diarrhoea and other symptoms of infectious gastroenteritis lasting more than 48 hours.

**Protozoa**: Any of various minute unicellular organisms formerly regarded as invertebrates of the phylum Protozoa but now usually classified in certain phyla of protoctists.

**Regional Epidemiologist**: A doctor specialising in communicable disease epidemiology in a population, working at the all Wales level.

**Secondary case**: A secondary case is a person that has caught the disease from a primary case.
Appendix 1

Copy of letter to General Practitioners

IN STRICT CONFIDENCE

To: GPs in Gwent

Gwent Out-of-Hours Service

31 March 2016

Dear Doctor

Re: Cryptosporidium cases associated with Coleg Gwent (Usk Campus)

This is to inform you that we (Public Health Wales and the Environmental Health Department, Monmouthshire County Council and Torfaen County Borough Council) are investigating an outbreak of cryptosporidiosis in people who attend the Usk Campus of Coleg Gwent.

There have been three positive cases to date. The exposure appears to relate to contact with young lambs.

As you know the symptoms include watery diarrhoea, abdominal cramps, vomiting, mild fever and loss of appetite. Symptoms can be prolonged, with a duration of around 2 weeks but they can persist for up to a month.

Please would you inform either my office on the telephone number above, or the relevant Environmental Health Department (Torfaen 01633 647261 or Monmouthshire 01633 735497) of any cases of suspected gastrointestinal infection in people who say they have attended Usk Campus, and ask them to provide a faeces sample for microbiological investigation.

Out of hours, the telephone number for health care professionals to contact the On Call Public Health Team is 0300 123 9324.
Infection can be caused by very low numbers of oocysts, so good hand hygiene is essential to prevent transmission – **please note that alcohol gels are not effective against this parasite**. Exclusion from work or school is recommended until 48 hours after diarrhoea and / or vomiting have stopped. Patients should be advised not to use swimming pools until two weeks after their diarrhoea has stopped. This is because oocysts are relatively resistant to chlorination.

Yours sincerely,

Heather Lewis

Consultant in Health Protection
# Appendix 2

## Appendix 2: Photographs of Working Farm, Usk Campus, Coleg Gwent

<table>
<thead>
<tr>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Photo 1" /></td>
<td><img src="image2.png" alt="Photo 2" /></td>
</tr>
</tbody>
</table>

**Photo 1:** Drinking Water Fountain – issues regarding location, cleaning & disinfection. Provision conflicts with a no eating/drinking Policy within the College Farm

**Photo 2:** Drinking Water Fountain removed
**Photo 3:** E004 Changing room/boot room. Hand wash facilities inadequate for throughput of Students. Hand dryer defective

**Photo 4:** E004 Changing room/boot room. New hand dryer & automatic soap dispenser installed (provision of further wash hand facilities refer to photo 6)
Photo 5: E004 Changing room/boot room.

Photo 6: E004 Changing room/boot room. Additional hand wash facilities & automatic soap dispenser installed
Photo 7: External boot wash station. Inadequate cleaning/maintenance

Photo 8: External boot wash station. Serviced/cleaned.
**Photo 9:** Male WC hot water supply too hot to promote through & effective handwashing, lack of signage.

**Photo 10:** Automatic mixer tap, automatic soap dispenser and hand washing signage installed.