VTEC/*E. coli* O157 – ACTION PLAN FOR SCOTLAND 2013 – 2017

healthier scotland
SCOTTISH GOVERNMENT

CONTENTS

Front cover organism image courtesy of D. Marshall and D.W. Gregory, University of Aberdeen.

I.

FOREWORD

VTEC/*E. coli* O157 is an important public health challenge in Scotland. It has the potential to cause large outbreaks, and its effects can be devastating. It is now more than 10 years since the Scottish *E. coli* O157 Task Force reported to Scottish Ministers, but in that time the number of annual cases has remained stubbornly stable, and the incidence of *E. coli* O157 in Scotland is the highest within the UK.

In 2010, Scottish Ministers decided to convene a multidisciplinary VTEC/*E. coli* O157 Action Group. The group's main remit has been to produce an Action Plan for Scotland. The group brought together all relevant agencies with expertise and regulatory responsibilities in controlling potential sources of human infection.

The Action Plan aims to reduce the number of infections with VTEC/*E. coli* O157 through 86 recommendations attributed to key agencies. The Action Group adopted a new approach, using a systematic logical framework to describe each stage in the pathways of transmission of the organism from animal to human case. This has provided strategic direction for the wide range of key partners to collaborate on the implementation of practical recommendations that aim to reduce the risk of infection based on current evidence of effectiveness. It also provides a comprehensive framework that will be used by the Action plan Group to monitor compliance with and effectiveness of interventions to control VTEC/*E. coli* O157.

I am grateful for the support of all participating agencies, in particular Health Protection Scotland, who co-ordinated the drafting of the report, for their efforts. I have accepted those recommendations which fall on the Scottish Government to carry out, and I will be looking to the other agencies involved to ensure that consistent and effective action is taken to deliver those actions for which they are responsible.

Michael Matheson MSP
Minister for Public Health

II.

EXECUTIVE SUMMARY

Since 2006, laboratory identifications of *Escherichia coli (E. coli)* O157 infection in Scotland have remained stubbornly stable at around 240 culture positive cases annually, despite the publication in 2001 of the joint Scottish Executive/Food Standards Agency (Scotland) *E. coli* O157 Task Force Report and its 104 recommendations. During the same period (i.e. 2006-2012), on average an additional 27 cases of infection with verotoxigenic *E. coli* (VTEC) of non-O157 strains, were identified each year by the Scottish *E. coli* O157/VTEC Reference Laboratory (SERL).

Following annual reviews of compliance with Task Force recommendations from 2002 onwards, including extensive reviews in 2007 and 2008, Scottish Ministers decided to convene a multidisciplinary VTEC/*E. coli* O157 Action Group whose main remit has been to produce a VTEC/*E. coli* O157 Action Plan for Scotland. The Action Group's full Terms of Reference and membership are in the appendices.

Rather than conducting a further review of Task Force recommendations, this Action Plan uses a systematic, logical framework to:

- Describe the pathways of transmission of VTEC (including both *E. coli* O157 and non-O157 strains) from source (colonised animals) to receptor (human case);
- Identify the steps in each pathway where new controls might be effective;
- Recommend new methods of measuring compliance with both new and existing control measures, and of evaluating their effectiveness.

Structure of the VTEC/*E. coli* O157 Action Plan

Sections III and IV of this document summarise the events and issues that gave rise to the Action Plan, and provide a background on VTEC/*E. coli* O157 and the challenges it presents for public health and health protection in Scotland. Section V then explains the logical framework underpinning the Action Plan.

Section VI provides a summary table of the Action Plan's 86 recommendations, and the key agencies to which each recommendation is addressed for implementation. There is an average of four recommendations for each of the 12 steps identified, ranging between 0 and 16 recommendations per step.

The number of recommendations does not imply that the agencies responsible for controlling that step are not already taking action – the criteria for making a recommendation include:

- The importance of the step (i.e. could a failure have severe consequences);
- Whether developments are realistic (i.e. practical and likely to be effective).

Section VII consists of 12 chapters describing the 12 steps identified by the Action Plan's logical framework, for transmission of VTEC from source to receptor; and identifies and recommends controls applicable to each step, and the measures for monitoring compliance with, and evaluating the effectiveness of, those controls.

Chapters 1-3 focus on controlling the excretion of contaminated faeces by animals colonised with VTEC, controlling how animal colonisation occurs, and controlling how animal faeces contaminate the environment. Chapters 4 and 5 address the contamination of untreated or treated water; and Chapters 6 and 7 address the contamination of untreated or treated food. Chapters 8, 9 and 10 describe methods for controlling the infection of humans from water, the environment, animal faeces, and food. Chapters 11 and 12 address the risks from contaminated human faeces, and how these can infect other humans via food, water, the environment or directly.

Risk communication and health education are vital to the control of VTEC infection and are relevant to all steps. The 16 proposals relating to risk communication and health education are therefore presented in Section VIII. Similarly, the 17 proposals for research and surveillance may apply to more than one step, and are presented in Section IX.

Key messages

The theme that links the recommendations, is that the key to reducing VTEC infection in Scotland is hygiene:

- On the farm;
- In the provision of drinking water supplies;
- In food production and processing, and in both commercial and domestic kitchens;
- In the countryside;
- And in the home.

The more dangerous the environment and the more numerous and vulnerable those exposed to it, the greater the need for scrupulous hygiene. Risk can never be eliminated, but the key to its reduction is hygiene.

The main task of a risk communication and health education strategy – which will be crucial to achieving improved levels of hygiene – will be to change behaviour by improving not only industry and the public's knowledge of risk, but also their attitudes to it.

III.

INTRODUCTION

Background to the VTEC/*E. coli* O157 Action Plan

In 2001 the joint Scottish Executive/Food Standards Agency (Scotland) Task Force on *E. coli* O157 produced its report[1] including 104 recommendations to reduce the incidence and severity of verotoxin-producing *Escherichia coli* (VTEC) infections in Scotland. In 2001, there were 235 reported *E. coli* O157 cases in Scotland, and despite the Task Force's recommendations the number has remained largely unchanged, with 234 cases in 2012[2]. Since 2001 incidence rates of *E. coli* O157 infection have remained consistently higher in Scotland than in other UK countries.

The absence of a decline in cases may indicate that the Task Force's recommendations were:

- not implemented, or;
- implemented but ineffective, or;
- implemented and effective, but without them the number of cases would have risen, or;
- implemented and effective, but the number of cases represents an irreducible minimum.

Annual reviews of compliance with Task Force recommendations were conducted by the Scottish Government from 2002 onwards, with additional extensive reviews by Health Protection Scotland (HPS) in 2007, and by Price Waterhouse Cooper (PwC) in 2008. These reviews were hampered by having no power to require responses from those people or agencies to whom recommendations had been made: indeed HPS and PwC concluded that 44 of the recommendations could not be evaluated, mainly because their ownership was unspecified, or the agencies concerned no longer existed. PwC therefore recommended that the Scottish Government convene a VTEC/*E. coli* O157 Action Group.

In late 2010 the Scottish Government invited those agencies deemed most relevant to the task to nominate members to the Action Group, which is chaired by Dr Edward Coyle, Director of Public Health, NHS Fife. The agencies were those the Scottish Government had agreed with HPS were the most qualified to advise on current controls, and on measuring compliance with, and effectiveness of, both new and existing control measures. The agencies nominated their representatives of choice to the Action Group, whose members are listed in the appendices.

[1] http://www.food.gov.uk/multimedia/pdfs/ecolitaskfinreport.pdf

[2] Health Protection Scotland/Scottish *E. coli* O157/VTEC Reference Laboratory. VTEC in Scotland, 2012. HPS Weekly Report 2013; 47: 218-221. http://www.documents.hps.scot.nhs.uk/ewr/pdf2013/1326.pdf

The Action Group's full Terms of Reference are in the appendices, but were in essence to produce a VTEC/*E. coli* O157 Action Plan describing the current epidemiology and management of VTEC in Scotland and to make practical recommendations for actions to reduce the risk of infection to humans. The Action Plan should address ways to measure the implementation of its recommendations, and to evaluate their effectiveness when implemented.

The approach taken by the Action Group was to devise a logical framework to underpin a systematic and consistent consideration of risks and viable control measures related to VTEC infection.

The Action Plan therefore addresses the steps in the pathways of transmission of VTEC infection from source (colonised animal) to receptor (human case). It makes recommendations directed at specific agencies to reduce the risks at each step, and to verify where possible, whether the recommendations have been carried out, and if so, if they have been effective. Where recommendations already exist, including those from previous reports and reviews, they are addressed in the paragraphs dealing with the current position (of control measures, measures of compliance, and evaluation), but are not restated. The Action Group felt that to recommend that agencies do what they have already been recommended to do would be repetitive and unhelpful. Recommendations are therefore for new actions, and are addressed to agencies according to their specific responsibilities, or their capacity, for implementation and evaluation.

The Action Plan is intended for the action of those agencies to whom recommendations are directed, and to other interested bodies or individuals for information. It is also intended to aid Scottish Government to co-ordinate responses by the relevant agencies in Scotland, with the overall aim of minimising risk of infection to the Scottish population.

While the recommendations of the Action Plan relate to VTEC, some of the preventative strategies – for example those on reducing contamination of land for growing food crops, or of private water supplies – have the additional benefit of reducing risk from other pathogens or hazards as well, especially those of animal origin.

The Action Plan is necessarily a sizeable and detailed document. While the Action Group has tried to keep repetition to a minimum, it is inevitable that some stakeholders will wish to concentrate on chapters pertinent to their specific responsibilities. Each chapter has therefore been written so that it can be read as a free standing item, and so some definitions and issues – for example untreated water – appear in more than one chapter.

The number of recommendations for each step in the pathway is not a reflection of deficiencies in the control measures that already exist. Public water supplies, for example are extremely safe and current control measures are highly effective, but the consequences of any fault with a public mains supply are potentially very serious, and so the Action Group believes it should seize every opportunity to improve what is already an excellent regime. Similarly there are steps, such as the exposure of

the public to contaminated environments, which undoubtedly pose a risk, but where opportunities for control – other than risk communication and scrupulous personal hygiene – are limited.

As the Action Group was commissioned to produce the Action Plan on behalf of the Scottish Government, the agencies represented on the group therefore endorse the Action Plan and the implementation of its recommendations. The Action Plan has been presented to Scottish Ministers as the culmination of this phase of the Action Group's work, and Ministers have been asked to respond to the Action Plan and its recommendations. The Action Group recognises the obvious implications for the resources that need to be committed to implement the Action Plan, and call upon Scottish Ministers, and the agencies to which the recommendations are directed, to ensure that the required resources are provided.

For brevity the plan provides only selected references. Generally accepted facts and well known research and legislation are not referenced, but relevant documents and papers are included in a bibliography within this document, and a fuller list of relevant references is provided online.

IV.

BACKGROUND

Escherichia coli O157 and non-O157 VTEC

E. coli O157 is the serogroup of verotoxigenic *E. coli* (VTEC) most commonly detected in humans in Scotland and the UK. Health Protection Scotland (HPS) surveillance data show that in recent years, verotoxigenic strains of non-O157 *E. coli* (non-O157 VTEC) have also caused significant morbidity in Scotland. This Action Plan therefore focuses on *E.coli* O157 and non-O157 VTEC. For simplicity, these are referred to as VTEC, unless stated otherwise.

Clinical features

Incubation period and infectious dose

The incubation period for VTEC infection is usually three to four days, seldom less than one or more than eight, but occasionally as long as 14. The infectious dose is low, probably well under 1000 organisms.

Clinical presentation and sequelae

VTEC infection can be asymptomatic, or may cause a spectrum of illness from mild non-bloody diarrhoea, through bloody diarrhoea and haemorrhagic colitis, to haemolytic uraemic syndrome (HUS), or death. HPS data show that HUS occurs in 9% of cases in Scotland, although this proportion is falling[2]; it is more likely to develop in children under 16 years old and adults over 60 years old but can occur in any age group as evidenced by the outbreak of VTEC O104 infection in mainland Europe in 2011[3]. The median period for cases continuing to excrete VTEC is 13-29 days; the maximum excretion period reported to HPS surveillance exceeds three months. Pre-symptomatic excretion has also been identified.

Transmission

The sources and routes of transmission of *E. coli* O157 and non-O157 serogroups of VTEC appear generally similar, but novel vehicles of transmission should not be ruled out for any serogroup.

Animals and the environment

VTEC can colonise the gastro-intestinal tract of farm and wild animals, especially cattle and sheep, usually without causing illness. Any food, environment or water (including surface or ground water) contaminated by the excreta of an animal or human is a potential source of infection. Occupational, as well as recreational, exposures have been associated with infection. HPS surveillance and research data show that 17% of all *E. coli* O157 outbreaks (1996-2012[4]), involved farm premises (71% of which involved private farms, their residents and visitors), and that contact with farm animal faeces was the risk factor most strongly associated with sporadic *E. coli* O157 infection.

Food

The surface of meat can become contaminated during slaughter and processing. Unpasteurised or inadequately pasteurised milk, or raw vegetables, may also be contaminated. Minced or ground

[3] Friedrich AW. Enterohaemorrhagic *Escherichia coli* O104:H4: are we prepared now? Euro Surveill 2011; 16(31). http://www.eurosurveillance.org/images/dynamic/EE/V16N31/art19938.pdf.

[4] Data for 2012 remain provisional.

beef products pose a particular risk if they are not cooked properly. Although meat and dairy products have caused large VTEC outbreaks in the UK, other food vehicles identified worldwide include salad leaves, white radish and other sprouted seeds, and raw vegetables. Less commonly reported food vehicles have included unpasteurised apple juice, fermented sausage and hazelnuts. HPS data show that in 28% of all *E. coli* O157 outbreaks (1996-2012[4]), the main mode of transmission was foodborne.

Drinking Water

Sources of drinking water can become contaminated by VTEC. Although rare in the developed world, public water treatment failures can cause large outbreaks. Private water supplies (PWS) in Scotland, which are generally in more rural areas, are more likely to be contaminated with *E. coli* O157 than public supplies. Visitors to rural areas may be more susceptible to infection than local residents. HPS data show that 13% of all *E. coli* O157 outbreaks (1996-2012[4]) involved PWS, with *E. coli* O157 isolated from 17/18 implicated PWS.

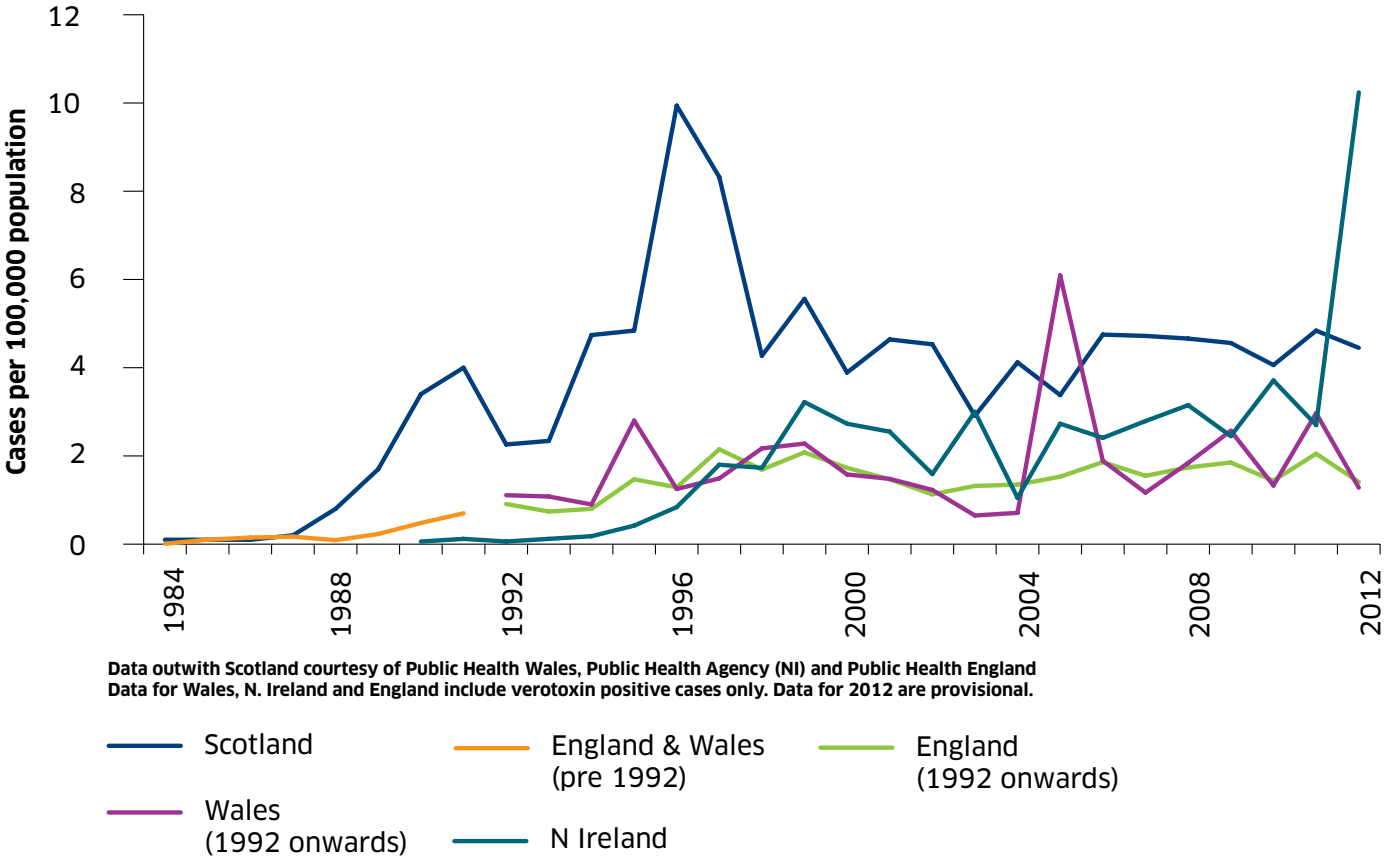
Person-to-person

HPS enhanced surveillance shows that person-to-person (or secondary) spread of infection with VTEC accounts for about 11% of cases. Secondary spread does not require direct contact and can be spread via swimming and paddling pools, environments and surfaces, such as towels.

Epidemiology

E. coli O157 is the only serogroup routinely detected by culture in UK diagnostic laboratories. Reported incidence varies between and within UK countries, and is consistently higher in Scotland (Figure 1) with an average annual total for the last five years 2008-2102, of 235 cases[2]. HPS data show around 15% of infections reported in Scotland are likely to have been acquired outside the UK.

Figure 1: *E. coli* O157: Culture positive cases, rates per 100,000 population, 1984-2012



Almost 50% of cases in Scotland are in children under 16 years of age. Rates of infection are highest in children under 5 years, at 15 cases per 100,000 population, compared with a population average of 4.5 per 100,000. On average 43% of all cases are hospitalised. Amongst patients with HUS, 85% are under 16 years. Whilst exact cause of death is often unknown, less than 2% of patients with *E. coli* O157 in Scotland died following infection. Reports generally peak in the third quarter of the year. On average 80% of cases are not part of general outbreaks (i.e. they are apparently sporadic cases or single household clusters). Although the mechanism is complex, geographic differences in infection rates appear to be related to cattle and human population densities[5].

Microbiology

Most strains of *E. coli* O157 are non-sorbitol fermenting. Diagnostic laboratories therefore use the absence of sorbitol fermentation to detect *E. coli* O157 (98% of which is VTEC in Scotland and therefore requires further laboratory investigation). Only three cases of sorbitol fermenting (SF) VTEC O157 were identified in the UK prior to 2006. In 2006, the first outbreak of SF VTEC O157 was identified in the UK.

It is important to maintain vigilance for newly emerging strains; routine diagnostic techniques to detect these may become more widely available in the future. The significant characteristic of non-O157 and SF VTEC is that they are difficult to identify. Once identified, their public health management is the same as *E. coli* O157.

Public health management of VTEC infection in Scotland

Many professionals and organisations have a role in the public health management of VTEC, including GPs, hospital staff, NHS Boards' Health Protection teams (HPTs), Local Authorities (LAs), Health Protection Scotland (HPS), microbiologists, veterinary surgeons and others. Guidance on the public health management of VTEC is available elsewhere[6].

[5] Innocent GT, Mellor DJ, McEwen SA, Reilly WJ, Smallwood J, Locking ME et al. Spatial and temporal epidemiology of sporadic human cases of *Escherichia coli* O157 in Scotland, 1996–1999. Epidemiol Infect 2005; 133: 1033-41.

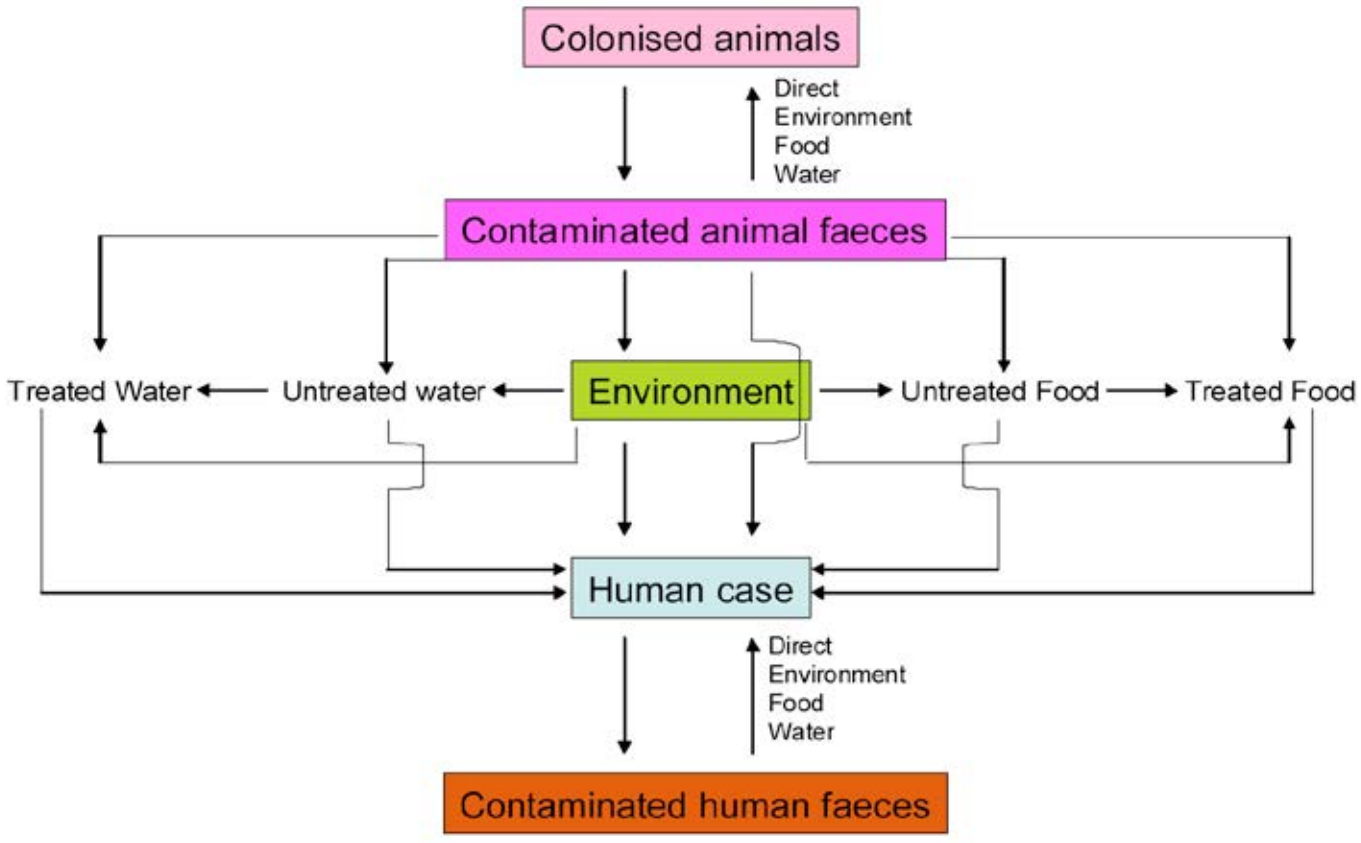
[6] Health Protection Network. Guidance for the Public Health Management of Infection with Verotoxigenic *Escherichia coli* (Second Edition). HPS, 2013. http://www.hps.scot.nhs.uk/giz/guidelinedetail.aspx?id=39336.

V.

LOGICAL FRAMEWORK OF THE PLAN

For a human case of VTEC infection to occur, the organism must have a source, a pathway of transmission, and a receptor to be infected. Pathways from colonised animals to the human case are summarised in Figure 2. 'Colonisation' or 'contamination' in this document refers to VTEC colonisation or contamination unless stated otherwise.

Figure 2.



In this Action Plan, the source of VTEC infection is deemed to be the colonised animal, even though the colonised animal must have become colonised via its food, drinking water, environment, or the faeces of another colonised animal. Human cases can be avoided by removing the source or interrupting a step in the pathway. It is important that current legislation and guidance is followed by those to whom it is addressed, and that the VTEC Action Group is alert to new developments which might inform future guidance. The Action Plan does not describe the control measures applicable to such steps in detail but concentrates on steps where new action is realistic and may

minimise risk of illness. An absence of new recommendations means that no new actions were identified. The section on Research addresses areas where new knowledge might inform new actions, but where evidence is currently insufficient for firm recommendations.

The chapters of this Action Plan therefore:

- Describe the step in the pathway being addressed (shown in red on each chapter's graphic).
- Summarise (briefly where the current position is satisfactory, or not amenable to change) the current position, and make recommendations if appropriate, for:
  - New control measures.
  - New monitoring of compliance with control measures.
  - New evaluation of effectiveness of appropriately applied new control measures.
- Describe in general terms the issues relevant to communication and health education which the Scottish Government should address in its communications strategy.
- Describe in general terms the issues relevant to research which the Scottish Government should address in its research strategy.

The ultimate measure of the effectiveness of control measures for VTEC is a reduction in the number of human cases but, as the drivers of infection are many and complex, changes in case numbers could not be attributed to any one intervention. For this reason, we do not propose that the number of cases reported to national surveillance in Scotland should be used as a measure of effectiveness.

It is also possible that there is an irreducible minimum number of cases despite the effective application of control measures. It is still important that every effort is made to implement all current and newly recommended control measures.

SUMMARY TABLE OF RECOMMENDATIONS

SECTION VII - STEP-SPECIFIC CONTROL MEASURES, MONITORING AND EVALUATION		Key Agencies
Step 1 – Controlling the excretion of contaminated faeces from colonised animals		
There are no recommendations in this chapter.		
Step 2 – Controlling animal colonisation from contaminated animal faeces via food, water, the environment or directly		
2.1	SG and QMS, in consultation with FSAS, should work with livestock hauliers, markets, and slaughterhouses to develop criteria for adequate cleansing and disinfection facilities for vehicles used to transport livestock – which could be included in the QMS standards – and feed back to the VTEC/*E. coli* O157 Action Group.	SG, QMS, FSAS
Step 3 - Controlling contamination of the environment from contaminated animal faeces		
3.1	HSE should work with SG, HPS and SRC to arrange training sessions for agencies that have enforcement responsibility for animal visitor attractions.	HSE, SG, HPS, SRC
3.2	SG and LAs, in liaison with HSE, should consider measures to ensure that animal visitor attractions make their activities known to LAs.	SG, LAs, HSE
3.3	SG should liaise with agricultural educational establishments, SEPA, NFUS and other stakeholders (e.g. QMS) relevant to farming and rural communities, to ensure that watercourses and the environment are protected by correct application of relevant guidance e.g. the PEPFAA code, Safe Sludge Matrix.	SG, SEPA, NFUS, QMS
3.4	SG should review current land access codes and provide guidance to minimise contamination of environments used for food crops by the public or by animals.	SG
3.5	SG, in liaison with LA representatives, should establish national systems to monitor compliance with issuing and implementation of SG guidance on clearing pasture before/after recreational events involving animals that are registered with an LA (e.g. galas, agricultural shows).	SG, LAs
3.6	SG, in liaison with SEPA and DPMAG, should undertake a snapshot survey of compliance with the PEPFAA Code, Safe Sludge Matrix and other relevant guidance on protection of watercourses and the environment.	SG, SEPA, DPMAG
3.7	SG should then take action based on the findings of the survey of compliance with the PEPFAA Code and other relevant guidance on protection of watercourses and the environment (see Recommendation 3.6 above) and feed back to the VTEC/*E. coli* O157 Action Group.	SG
Step 4 - Controlling the contamination of untreated water from contaminated animal faeces or the environment		
4.1	SW should develop a catchment management policy to include the scope and frequency of inspections and mechanisms for feeding information from inspections into WSP.	SW
4.2	SG should review current land access codes and provide proportionate guidance to minimise contamination of watercourses or the environment wherever possible, by the public or animals.	SG

4.3	DWQR to monitor progress on the catchment management policy regarding scope and frequency of inspections and mechanisms for feeding information from inspections into WSP (see Recommendation 4.1 above) and feed back to the VTEC/*E. coli* O157 Action Group.	DWQR
4.4	DWQR to assess the effectiveness of the catchment management policy regarding scope and frequency of inspections and mechanisms for feeding information from inspections into WSP (see Recommendation 4.1 above).	DWQR
Step 5 - Controlling the contamination of treated water from contaminated animal faeces, untreated water or the environment		
	- Public Water Supplies:	
5.1	SW should revise its Disinfection Policy to define a consistent national policy for: (a) Flow proportional and residual disinfection control; (b) Criteria for auto-shutdown of Water Treatment Works (WTW) on disinfection issues; (c) Secondary disinfection; (d) The requirement for duty and standby disinfection equipment.	SW
5.2	SW should compile an inventory of its existing disinfection systems to give clarity on its assets; and should ensure that its Disinfection Policy is then applied to all assets.	SW
5.3	SW should ensure that all disinfection systems have the appropriate duty and standby disinfection equipment installed.	SW
5.4	SW should ensure that chlorine levels at storage points in distribution systems are site specific and evidence based, to ensure satisfactory microbiological quality of supplies whilst minimising taste and odour impacts to consumers.	SW
5.5	SW should carry out species identification where there are repeat failures of the total coliforms and *E. coli* standards from drinking water samples as per Recommendation 7.13 of the 2001 *E. coli* O157 Task Force Report, and should ensure that criteria for species identification are set out in the appropriate SW quality management system.	SW
5.6	SW should inform public and environmental health professionals of the scope and limitations on typing of *E. coli* positive water samples, and of the implications of this for operational decisions.	SW
5.7	SW should consider producing formal guidance for its staff on the assessment of performance of processes used for colour and turbidity removal to ensure consistency of approach across the country.	SW
	- Private Water Supplies:	
5.8	SG, the DWQR, SoCOEHS and REHIS should determine local authorities' training needs for their statutory duties relating to PWS, and should develop and deliver training as appropriate.	SG, DWQR, SoCOEHS, REHIS
5.9	DWQR, in liaison with SERL and LAs, should issue guidelines to LAs and to laboratories analysing PWS samples, on the forwarding of *E. coli* isolates to SERL for typing.	DWQR, SERL, LAs

5.10	SG, in partnership with LAs, DWQR, and public health professionals should develop a strategy to further promote the benefits of the risk assessment and risk management approach for PWS and the PWS grants scheme to deliver real and lasting improvements to PWS and consequential health benefits. This strategy should include: (a) Methods for improving awareness of the potential health risks from PWS to owners and users and their visitors, and the need for correct installation, operation and maintenance of treatment systems. (b) SG updating section 11 of the PWS Technical Manual (Waterborne Hazard Response for PWS) to include more information on dealing with waterborne incidents; and increase the range and detail on treatment options for small supplies following consultation with LAs, REHIS, DWQR and HPS. (c) SG, in liaison with DWQR, should review the 'Information Guide' for owners and users of PWS in line with recommendations from recent research by Aberdeen University.	SG, LAs, DWQR, REHIS
5.11	SG should consider the following recommendations from an Incident Management Team Report, which propose that SG should: (a) "Create a compulsory registration scheme for properties supplied by a PWS, to aid rapid investigation and provision of advice subsequent to a case of *E. coli* O157 infection" (this should also include non-O157 VTEC). (b) "Require landlords of properties served by a PWS, to inform their tenant(s) of this in their lease, and to advise tenants on the implications for health".	SG
5.12	DWQR should confirm that all laboratories contracted to analyse PWS samples have the appropriate accreditation and that DWQR has reminded all LAs about the accreditation requirements.	DWQR
5.13	SG should liaise with LAs, REHIS and SoCOEHS, and consult with DWQR, to consider methods of improving: (a) Compliance by owners/users of PWS serving public or commercial activities, with legislation requiring them to display notices informing the public that a PWS is in use. (b) The extent to which PWS owners/users are complying with the advice from LA risk assessments and sampling, on how to improve/protect their supplies.	SG, LAs, REHIS, SoCOEHS, DWQR
5.14	DWQR should identify methods to monitor any of the additional control measures recommended above, if it transpires that compliance would not be measurable by existing monitoring systems.	DWQR
5.15	DWQR, on SG's behalf, should monitor the effectiveness of the grants scheme in terms of water quality improvements.	DWQR
5.16	SG Drinking Water Quality Division should feed back to the VTEC/*E. coli* O157 Action Group on the research project they will be managing on the impact of maintenance and different raw water quality parameters on the effectiveness of UV disinfection of PWs.	SG, DWQD

Step 6 – Controlling the contamination of untreated food from contaminated animal faeces or the environment		
6.1	FSAS and SG should support EU proposals to permit the use of lactic acid to reduce microbiological surface contamination on bovine carcases to complement good hygienic practice and HACCP based controls, and feed back to the VTEC/*E. coli* O157 Action Group.	FSAS, SG
6.2	FSAS should continue to support initiatives which promote best practice for controlling microbiological risks including VTEC contamination across all areas of the fresh produce sector.	FSAS
6.3	SG should review current land access codes and provide guidance to minimise contamination of areas used for food crops or irrigation water by the public or by animals.	SG
6.4	FSAS, SEPA and SG should ensure guidance on the safe use of manures and recycled organic wastes in vegetable and fruit production is subject to ongoing review.	FSAS, SEPA, SG
6.5	FSAS and SG should support the EC as it develops proposals for controls to reduce the food safety risks associated with VTEC contamination of sprouted seeds intended to be consumed raw/untreated, and feed back to the VTEC/*E. coli* O157 Action Group.	FSAS, SG
6.6	FSAS should feed back to the VTEC/*E. coli* O157 Action Group the results of its review of official control microbiological sampling undertaken in approved meat establishments for verifying compliance with Food Hygiene Regulations.	FSAS
6.7	FSAS should feed back to the VTEC/*E. coli* O157 Action Group the outcome of its data gathering exercise on compliance monitoring of Scottish vegetable and fruit producers to confirm that appropriate measures are in place to protect produce from VTEC contamination.	FSAS
6.8	NFUS should consider liaising with the fresh produce sector to identify any areas where NFUS believes that industry assurance schemes may not be complied with, and feed back to the VTEC/*E. coli* O157 Action Group.	NFUS
Step 7 – Controlling the contamination of treated food from contaminated animal faeces, untreated food, or the environment		
7.1	FSAS should ensure that LAs receive appropriate training on FSA UK cross-contamination guidance and that guidance is disseminated to all relevant industry sectors in Scotland.	FSAS
7.2	FSAS should ensure that effective cross-contamination control is prioritised in LA enforcement of retail and catering businesses handling raw/untreated and RTE food (i.e. handling both potentially contaminated foods, and foods not subject to subsequent treatment); and that implementation of cross-contamination controls is subject to ongoing review through the LA audit programme.	FSAS
7.3	FSAS and LAs should ensure that, where possible, catering specifications for schools, care homes and hospitals take into account the principles of the cross-contamination guidance.	FSAS, LAs
7.4	FSAS and REHIS should ensure that the principles of the cross-contamination guidance are embedded in training materials and guidance for food businesses in Scotland.	FSAS, REHIS

7.5	SG should liaise with REHIS and SoCOEHS to ensure that LAs continue to disseminate the new Industry Code of Practice 'Preventing or controlling ill health from animal contact at visitor attractions' to all relevant businesses in Scotland.	SG, REHIS, SoCOEHS, LAs
7.6	FSAS should feed back to the VTEC/*E. coli* O157 Action Group the outcome of its evaluation of the impact of the cross-contamination guidance in Scotland.	FSAS
Step 8 – Controlling the infection of humans from contaminated treated drinking water or untreated water		
8.1	SG should produce guidance warning against the drinking of untreated environmental water (e.g. from burns or rivers) by individuals undertaking commercial, educational or other outdoor activities.	SG
8.2	SG should request Health Boards to ensure that IMT reports documenting outbreaks of VTEC infection due to contaminated drinking water should include not only an estimate of the speed with which control measures were applied, but also an estimate of their effectiveness.	SG
Step 9 – Controlling the infection of humans from the environment or from contaminated animal faeces		
9.1	The Communications Strategy Group (CSG) to be convened by SG (see Section VIII) should undertake a snapshot survey of compliance with the provision and application of health education materials and guidance on reducing VTEC risk via personal hygiene.	CSG
9.2	The Communications Strategy Group should then take action based on the findings of the survey of compliance with the provision and application of education and guidance on personal hygiene (see Recommendation 9.1 above) and feed back to the VTEC/*E. coli* O157 Action Group.	CSG
9.3	The Communications Strategy Group should undertake a snapshot survey of the effectiveness of health education materials and guidance on reducing VTEC risk via personal hygiene.	CSG
9.4	The Communications Strategy Group should then take action based on the findings of the survey of the effectiveness of education and guidance on personal hygiene (see Recommendation 9.3 above) and feed back to the VTEC/*E. coli* O157 Action Group.	CSG
Step 10 – Controlling the infection of humans from contaminated untreated or treated food		
10.1	FSAS and LAs should review the display of point of sale information for unpasteurised cheeses sold loose in Scotland (including those served in restaurants) to ensure consumers are able to make an informed choice.	FSAS, LAs
Step 11 – Controlling the excretion of contaminated human faeces		
11.1	SG should commission a group to produce clinical guidance for clinicians, especially GPs, providing advice on the early diagnosis and management of suspected VTEC infection. This group should identify methods for monitoring compliance with its guidance, and for evaluating its effectiveness.	SG
11.2	SERL, in consultation with diagnostic laboratory representatives, HPS and other relevant stakeholders, should compile a report on current thinking about the best methods to optimise rapid microbiological confirmation of non-O157 VTEC infection, and feed back to the VTEC/*E. coli* O157 Action Group.	SERL, HPS

Step 12 – Controlling the infection of humans from contaminated human faeces via food, water, the environment or directly		
12.1	SG should investigate the options for collecting and publishing any existing local data on compliance with current control measures to prevent human infections from contaminated human faeces via food, water the environment or directly, using a national format; or, if that is insufficient, conducting occasional surveys of compliance e.g. by front line NHS staff, HPTs or LAs, or via special studies of confirmed cases e.g. of nurseries, care homes, etc.	SG
12.2	SG should investigate the options for evaluating effectiveness to prevent human infections from contaminated human faeces via food, water the environment or directly, using either (a) any existing local data that could be collected and published using a national format; or (b) occasional surveys e.g. of front line NHS staff, HPTs or LAs, or special studies of confirmed cases, nurseries, care homes etc.	SG
SECTION VIII – PROPOSALS FOR RISK COMMUNICATION AND HEALTH EDUCATION		
C1	SG should convene a Communications Strategy Group to develop and support the implementation of a comprehensive communication strategy for VTEC involving all the key agencies, and feed back to the VTEC/*E. coli* O157 Action Group.	SG
C2	SG with NFUS should ensure VTEC risks are covered in communication with landowners and the public on access to and recreational use of pasture/intensively grazed land.	SG, NFUS
C3	SG should develop information and resources for the public about VTEC risks, which may also help to reduce risk from other zoonoses; this should include: advice on supervision of children; the importance of hand washing after contact with animal and rural environments, and before eating, drinking or preparing food; and what constitutes effective handwashing (including advice against relying on anti-bacterial hand gels or wipes).	SG
C4	FSAS and LAs should continue to highlight the risks associated with undercooked minced meat products, and promote advice on safe cooking.	FSAS, LAs
C5	FSAS should ensure that consumers and caterers continue to be reminded of the potential risks associated with vegetables and fruit that are not supplied as RTE, and how these products should be prepared prior to consumption.	FSAS
C6	FSAS should continue to ensure that the practices that lead to effective cross contamination control are promoted in food hygiene communication activities, including annual Food Safety Week initiatives.	FSAS
C7	FSAS, in partnership with other stakeholders such as REHIS, should ensure that hand hygiene is prioritised in strategies for improving health education for food handlers in catering and domestic kitchens.	FSAS

C8	SG should liaise with REHIS and SoCOEHS to ensure that LAs and HPTs continue to provide information and guidance on preventing contamination of food by human faeces in both private households and commercial premises.	SG, REHIS, SoCOEHS, LAs, HPTs
C9	SG, LAs and REHIS, with input from DWQR and HPS, should develop educational materials to promote risk awareness and management for all PWS owners or users.	SG, LAs, REHIS, DWQR, HPS
C10	SG should ensure that their resources for PWS owners and users include advice on early reporting of diarrhoeal illness (as this is the best way to promote early identification of contaminated supplies); prompt issuing and implementation of boil water notices; and guidance on risk communication for Health Protection Teams and LAs.	SG
C11	SG should consider integrating advice on PWS into generic resources such as the SG leaflet 'Shedding Light on *E. coli* O157'.	SG
C12	SG, SEPA and other key stakeholders, through DPMAG, should continue to work in partnership with the farming and forestry sectors in order to maximise the protection of sources of drinking water, and minimise the risk to human health.	SG, SEPA, DPMAG
C13	SG, in liaison with HPS and FSAS should consider options for raising awareness of the importance of hand hygiene, both generic and targeted at specific settings such as childcare.	SG, HPS, FSAS
C14	SG should consider specific measures to help young children apply hand hygiene.	SG
C15	SG should provide advice for frontline NHS and LA staff on achieving early diagnosis of infectious diarrhoea; on the need for low thresholds for suspecting and testing for VTEC, especially in acute onset bloody diarrhoea; on the issues for cases with non-O157 strains, who may initially have been told they were negative, based on local laboratory results; and on the need to forward locally negative stools from clinically suspicious cases, to the Scottish *E. coli* O157/VTEC Reference Laboratory.	SG
C16	SG should advise frontline NHS and LA staff to provide cases, families and health/social care staff with advice on hygiene and preventing secondary spread, as soon as infectious diarrhoea is suspected (whether VTEC or other aetiology), without waiting for laboratory confirmation.	SG
SECTION IX – PROPOSALS FOR RESEARCH AND SURVEILLANCE		
RS1	SG, in liaison with other relevant agencies, should regularly monitor developments in research efforts to identify practical and efficacious measures for controlling the excretion of VTEC from animals and feed back annually to the VTEC/*E. coli* O157 Action Group on any potentially useful control strategies.	SG
RS2	SG should review available information on proportionate controls to reduce environmental contamination.	SG

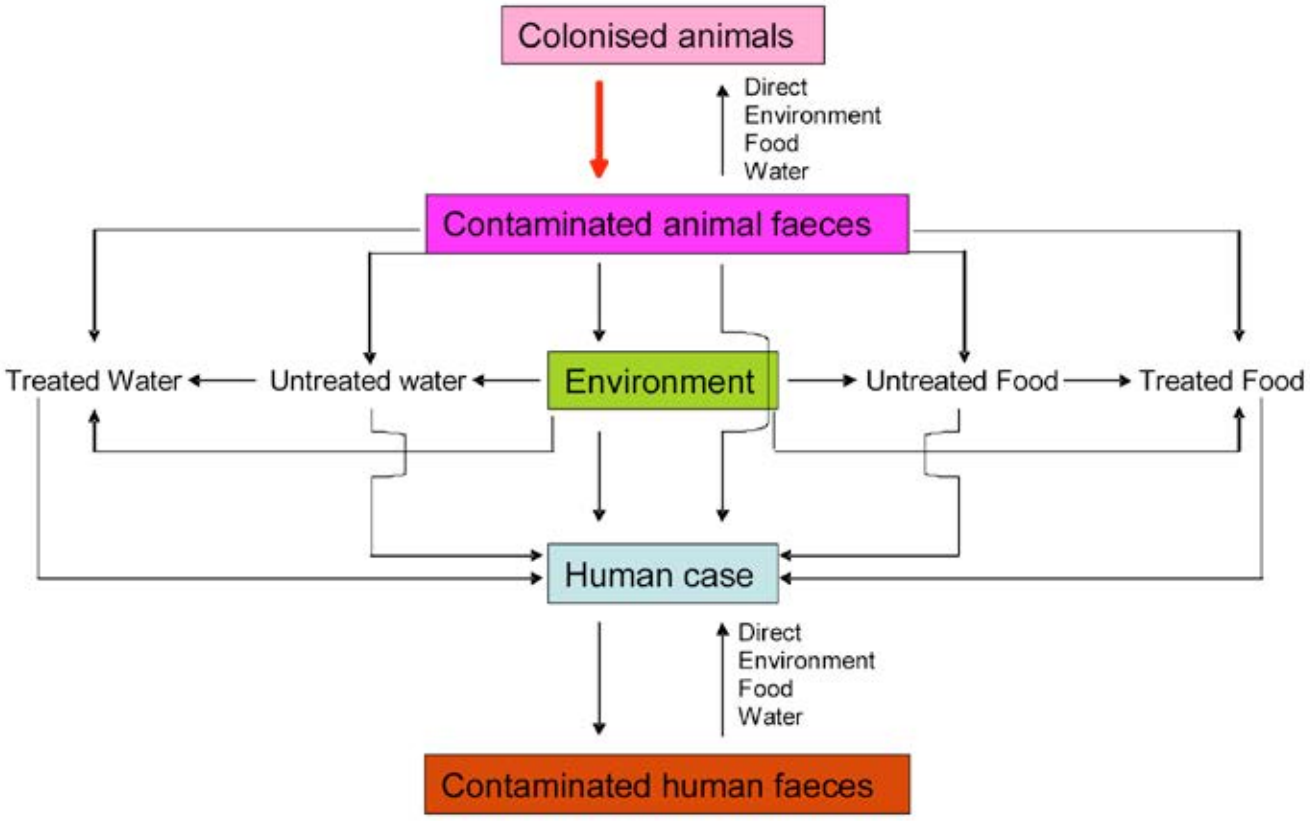
RS3	SG should then consider resourcing, and where appropriate requiring, relevant agencies or groups to implement any proportionate controls identified by their review on reducing environmental contamination (see Recommendation RS2 above).	SG
RS4	SG should feed back to the VTEC/*E. coli* O157 Action Group their review of proportionate control measures for reducing environmental contamination, and their conclusions on which (if any) agencies or groups should be resourced and/or required to implement them; and should ensure that simple national monitoring systems are established for each new control measure resulting from this review.	SG
RS5	FSAS should consider funding research to improve understanding of the potential VTEC risks associated with unwashed and unpeeled fruit and vegetables on retail sale and the food safety implications of internalisation of VTEC by plants.	FSAS
RS6	HPS should consider research to investigate the contribution to VTEC infection in Scotland, of emerging food risks, including fresh produce and sprouted seeds.	HPS
RS7	FSAS and LAs should ensure that surveillance of VTEC in foods is intelligence led and targeted to evaluating the effectiveness of controls applied to the production of foods which are a known VTEC risk.	FSAS, LAs
RS8	FSAS and LAs should ensure that food surveillance programmes include microbiological sampling at food premises producing 'at risk' RTE foods, to evaluate the effectiveness of cross contamination controls undertaken at butchers and catering businesses.	FSAS, LAs
RS9	FSAS – with input from SERL - should consider a review of laboratory provision in Scotland for the testing of *E. coli* and non-O157 VTEC strains in foodstuffs.	FSAS, SERL
RS10	SG should commission research into ages of responsibility in children, and should report progress on this to the VTEC Action Group.	SG
RS11	HPS should consider a case control study to ascertain whether the aetiological fraction has changed since its previous study in 2001.	HPS
RS12	SG should consider commissioning a retrospective study to identify at what stage confirmed cases of *E. coli* O157 and non-O157 VTEC infection were suspected, and whether this was at an early enough stage to allow appropriate public health management.	SG
RS13	SG should consider commissioning a retrospective study to ascertain the dose and duration of excretion in cases who had been suspected and diagnosed early and treated appropriately (cases) compared to cases who had not (controls), and identify differences (if any) between *E. coli* O157 and non-O157 VTEC strains.	SG
RS14	SG should investigate the options for conducting occasional surveys of compliance with exclusion and other infection control guidance e.g. by front line NHS staff, HPTs or LAs, or via special studies of confirmed cases e.g. of nurseries, care homes, etc.	SG

RS15	HPS should consider options for research on pre-symptomatic exclusion, for instance whether it is possible to identify any differences in the risk of transmission from infected but asymptomatic individuals, depending on whether or not: (a) They subsequently develop symptoms. (b) The period of asymptomatic excretion occurred before their onset of symptoms, or after their own symptoms resolved (in those who become symptomatic at some point). (c) Infection was due to *E. coli* O157 or non-O157 VTEC strains.	HPS
RS16	SG should investigate options for sentinel or other surveillance of *E. coli* O157 and non-O157 VTEC in ruminants, to improve understanding of the strains circulating in ruminants, and to compare ruminant strains with those occurring in human cases.	SG
RS17	SG, SERL, HPS and other relevant agencies should consider how molecular epidemiology (including the use of Next Generation Sequencing) may improve understanding of relationships between *E. coli* O157 and non-O157 VTEC strains from ruminants, humans, water, the environment and the foodchain.	SG, SERL, HPS

VII.

STEP-SPECIFIC CONTROL MEASURES, MONITORING AND EVALUATION

1 Controlling the excretion of contaminated faeces from colonised animals



1.1 Description of step

This chapter starts from the assumption that animals are colonised and considers ways to control their excretion of contaminated faeces. In this context, "colonised" includes all animals shedding the organism in their faeces. The ways by which animals become colonised are addressed in Chapter 2.

Although many animal species, including pigs, horses and wild rabbits have tested positive for VTEC, colonised ruminants, especially cattle, are the major known reservoir and

efforts to control excretion in these species are most likely to be beneficial.

Colonisation usually causes no clinical signs and cannot be identified without microbiological testing, nor can "super shedding", in which a small proportion of cattle at any point in time can intermittently and unpredictably shed considerably greater numbers of VTEC (>10^4 organisms/g of faeces). Any strategies to control the excretion of contaminated faeces cannot therefore be targeted specifically at colonised cattle or super-shedders, but must be applied to all.

1.2 Control measures

1.2(a) Current position: control measures

Very little can be done to control the excretion of contaminated faeces from colonised animals. Strategies being explored but which are currently unproven include:

- *E. coli* O157 vaccines have been shown in studies to reduce shedding over a short term in cattle but do not eliminate shedding in all animals that receive the vaccine[7,8].
- Competitive inhibition of VTEC in the bovine gastrointestinal tract using *Lactobacillus* spp. administered in cattle feed prior to slaughter has been assessed, particularly in the USA feedlot system. It is unlikely to be practical in the UK, as its effect is short-lived and the logistical problems of administration e.g. to grazing cattle, are likely to be insuperable.
- 'Rectal lavage' employs disinfectant to reduce VTEC numbers adherent to the recto-anal junction mucosa prior to slaughter. The effectiveness is unclear, but it is unlikely to offer a practical means of limiting transmission between cattle or farms.
- Dietary interventions e.g. finishing rations and feed restriction to firm up or reduce droppings.

1.2(b) Recommendations: new control measures

None of the control measures described are as yet sufficiently well supported by evidence of efficacy to warrant any being recommended.

1.3 Monitoring compliance

As there are no extant or newly recommended control measures, there is nothing for which to monitor compliance.

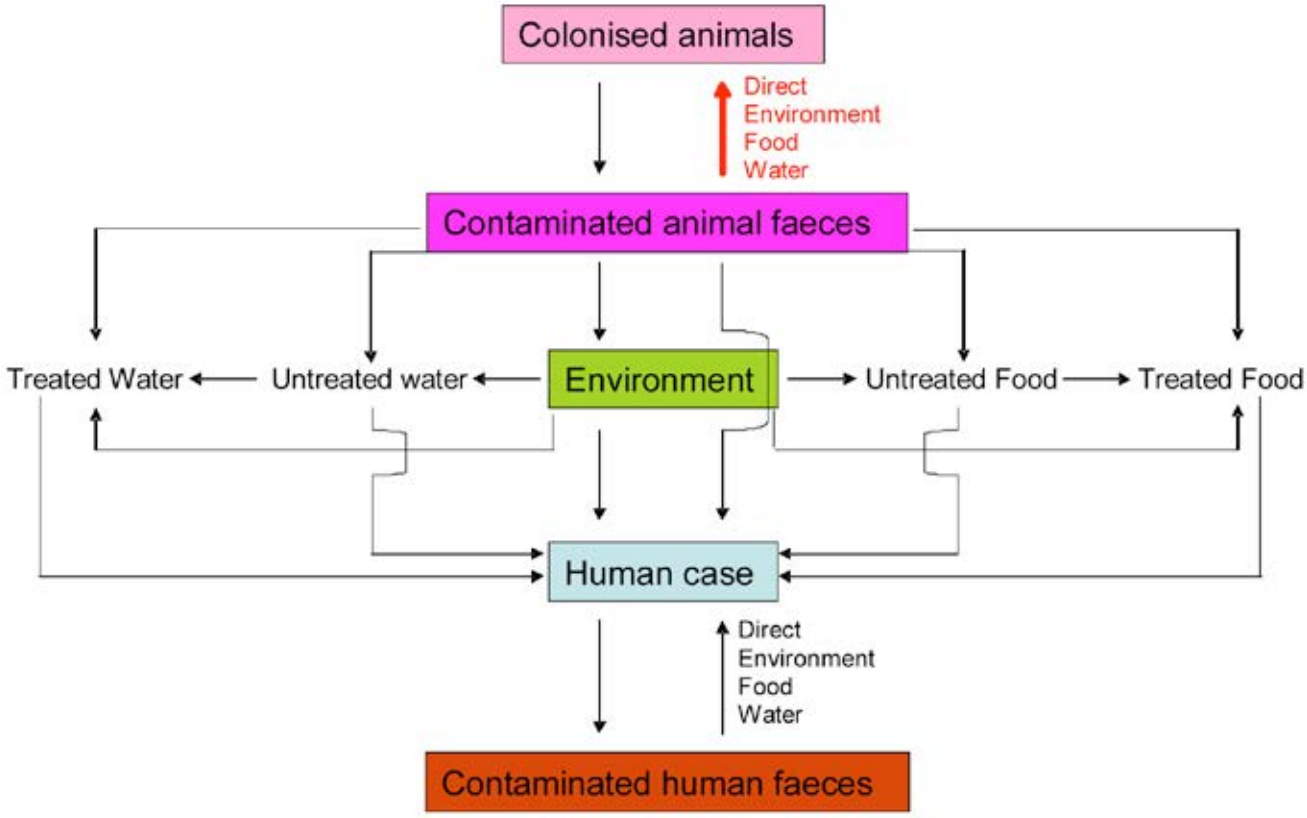
1.4 Evaluating effectiveness

As there are no extant or newly recommended ways to monitor compliance, there are no control measures whose effectiveness can be evaluated.

[7] http://www.ncbi.nlm.nih.gov/pubmed/22704925

[8] http://www.foodsafetynews.com/2012/08/uk-approves-e-coli-o157h7-vaccine-for-cattle/

2 Controlling animal colonisation from contaminated animal faeces via food, water, the environment or directly



2.1 Description of step

Acquisition of VTEC by animals, of which cattle are the most important, occurs through the faecal-oral route either directly (e.g. through licking behaviour) or indirectly via food, water, or the environment. VTEC can survive in the environment in faeces and soils for several months, posing a risk of acquisition by exposed animals.

2.2 Control measures

2.2(a) Current position: control measures

There are currently no fully effective control measures, although Quality Assurance Schemes such as the Quality Meat Scotland (QMS) Cattle and Sheep Assurance Scheme urge animal producers to adopt best management practice[9].

[9] http://www.qmscotland.co.uk/index.php?option=com_content&view=article&id=132&Itemid=97

Best management practice aims to:

- Reduce the level of the contamination of the environment, and
- Reduce the exposure of animals to the contaminated environment

by, where possible:

- Providing adequate and clean bedding
- Avoiding introduction of new animals to established herds
- Considering the diet prior to slaughter so that faeces are firm or reduced in volume
- Maintaining overall farm cleanliness
- Maintaining cleanliness of livestock water troughs, and preventing backflow to animal drinking water supplies
- Achieving high levels of biosecurity e.g. – double fencing, fencing off watercourses and providing water troughs
- Limiting the movement between farms of:
  - Soil or faeces (including slurry) via humans, animals or machinery
  - Feed or bedding

The contamination of animals during transport and in auctions is a small additional risk, but hygiene, and animal mixing are controlled through both legislation[10] and Assurance Schemes (e.g. QMS schemes for Hauliers and Auctions[11]). The legislation[10] stipulates precise requirements for cleansing and disinfection of vehicles before and after transporting animals, but does not define the adequacy of provision of facilities at commercial premises (predominantly livestock markets and slaughterhouses) to allow this to take place in a manner that would minimise the risk of environmental contamination beyond such premises.

Public access to areas used by animals (or from which their water is sourced) may introduce contamination e.g. if faeces are tracked in by humans or animals. However the risk of animals becoming colonised by this route is likely to be very low compared to other routes. Controls around public access are therefore covered in Chapters 3, 4 and 6.

2.2(b) Recommendations: new control measures

There is no evidence that new control measures are required, if the control measures called for by existing legislation, guidance, codes of practice or assurance schemes are rigorously applied.

2.3 Monitoring compliance

2.3(a) Current position: monitoring compliance

The VTEC Action Group has some concern that compliance with current controls may sometimes fall short of the ideal. This cannot be confirmed by current measures of compliance.

2.3(b) Recommendations: new monitoring of compliance

2.1 – SG and QMS, in consultation with FSAS, should work with livestock

[10] The Transport of Animals (Cleansing and Disinfection) (Scotland) Regulations 2005, http://www.scotland.gov.uk/Topics/farmingrural/Agriculture/animal-welfare/Diseases/Transport

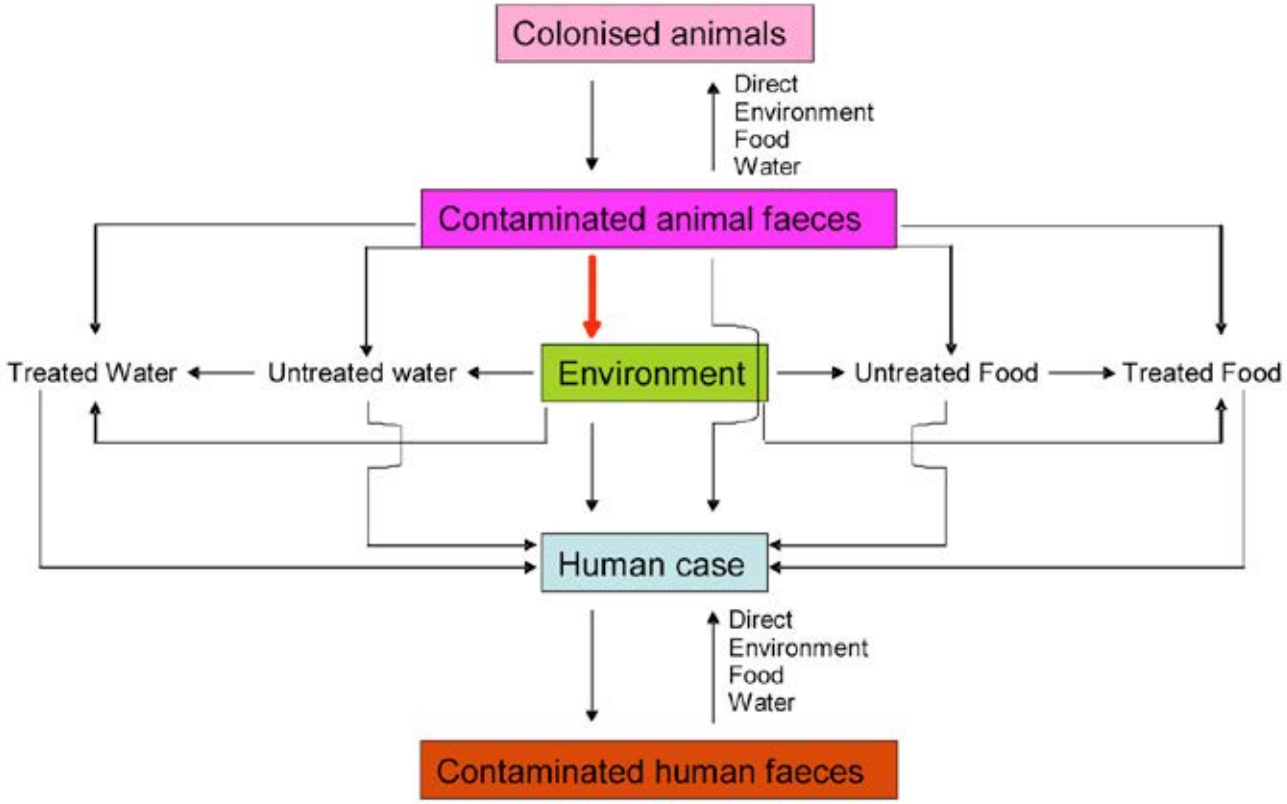
[11] http://www.qmscotland.co.uk/index.php?option=com_content&view=article&id=132&Itemid=97

hauliers, markets, and slaughterhouses to develop criteria for adequate cleansing and disinfection facilities for vehicles used to transport livestock – which could be included in the QMS standards – and feed back to the VTEC/*E. coli* O157 Action Group.

2.4 Evaluating effectiveness

There are no practical ways in which the effectiveness of current control measures can be evaluated. Until the criteria referred to in recommendation 2.1 above are agreed, and compliance with them can be measured, their effectiveness cannot be evaluated.

3 Controlling contamination of the environment from contaminated animal faeces



3.1. Description of step

Many environments may be contaminated by animal faeces, including all land and water accessible by animals. Some environments have a higher potential risk of becoming contaminated because they are used by cattle, sheep or goat, especially if: the animals or their faeces are present in larger quantities; or if the animals are excreting more organisms because they are young or stressed, including for instance by large numbers of visitors. Such environments include, but are not limited to:

- Private farms that are not open to the public commercially, but which may have open days, or social or occupational visitors, or where the public may walk through farmyards or grazing land.
- Animal visitor attractions e.g. open farms/farm parks; animal petting/handling areas within other attractions (including zoos); educational establishments e.g. city farms; working farms with livestock that occasionally open to the public,

e.g. for school visits, Open Farm Sundays, etc; rare breed/rescue centres; markets, agricultural shows or country fairs where livestock are present; mobile menageries or petting/handling enterprises; other visitor facilities where the public have animal contact, even if (like stables) they represent a lower risk of VTEC carriage than premises with ruminants; and any picnic/play areas these attractions include that could be contaminated e.g. by faeces tracked in by humans or animals.

- Abattoirs and other meat or animal product facilities.
- Houses, gardens or other non-farm residential or other public premises adjoining the above.
- Farm vehicles or equipment; slurry or animal transporters; and other vehicles.
- Rural footpaths, roads, verges, tracks, footpaths, fences, gates and stiles on or by grazing land.
- Machairs, beaches, sea shores, rivers, lochs, bathing or shellfish waters on or near grazing.
- Bodies of water including sources of drinking water.
- Fields used for fruit and vegetable production.

These environments may be contaminated by animal faeces by various routes including but not limited to:

- Direct contamination by the faeces of domesticated or wild animals, including transfer from their hides on to gates and other surfaces, as well as direct excretion on to land, pen floors and watercourses.
- Contamination by manure, slurry and farm effluents.
- Diffuse contamination i.e. further spreading of animal faeces, soil or slurry.
- Water courses e.g. burns, rivers, including sources of drinking water, run-off from fields.

3.2 Control measures

3.2(a) Current position: control measures

Controlling contamination of most environments by animal faeces is difficult or impossible, not least because colonised animals cannot be identified without microbiological testing. Current control measures rely on rigorous risk management based on the available legislation or guidance e.g. on organic wastes (including recycled waste) animal visitor attractions, or on public events on land previously used by animals.

Reducing the risk related to organic animal waste relies on strict application of relevant guidance such as the PEPFAA Code (Prevention of Environmental Pollution from Agricultural Activity), including Farm Waste Management Plans, and the Safe Sludge Matrix[12], etc. PEPFAA advises farmers and others involved in agricultural activities on minimising environmental pollution and on appropriate storage, handling, transportation and application to land of livestock manures and slurries. PEPFAA highlights the need to reduce the potential for run-off (an important contributor to diffuse contamination),

[12] The Safe Sludge Matrix, ADAS (2001) http://www.adas.co.uk/LinkClick.aspx?fileticket=f_CX7x_v4nY%3d&tabid=211&mid=664

the need for diligence around food crops, and measures to reduce contamination of healthy livestock. Farmers and other members of rural communities have a role in addressing the protection of watercourses (which may contribute to further spread of environmental contamination, as well as spreading waterborne contamination) by applying the PEPFAA code.

Animal visitor attractions are also subject to regulation and guidance. Organisers of school and other visits to animal visitor attractions including agricultural shows, and camping areas, also have responsibilities under SG and industry guidance. Outbreaks linked to animal visitor attractions have prompted increasing recognition of the need for risk awareness and risk management at these premises, in particular around the prevention of environmental contamination, which resulted in a new Industry Code of Practice[13] (ICoP) drawn up in consultation with HSE. Some guidance in the ICoP and elsewhere is also more widely applicable e.g. preventing build up of animal faeces in areas where the public are more likely to go, or in animal transport vehicles, would protect farming families as well as animal attraction visitors.

The control of contamination in abattoirs and other meat or animal product facilities is highly regulated[14] and inspected. EU food hygiene legislation requires the cleanliness of cattle and sheep presented for slaughter to control the level of faecal contamination on hides. FSA UK guidance already recommends that in order to achieve cleanliness farmers should establish good husbandry. Pre-slaughter clipping should only be undertaken as a last resort and with great care. Due to health and safety concerns around clipping live animals, some abattoirs use post-slaughter clipping to ensure the hide is clean prior to dressing, which may also control faecal contamination more effectively than pre-slaughter clipping. There are many industry regulations, standards and guidance on reducing spread from transported animals or from abattoirs, including spread to other environments, the application of which is important to reduce the extent to which these activities can spread contamination further throughout the environment or into watercourses.

Fields where fruit and vegetables are grown present a special case. Legislation, standards and guidelines exist to control the treatment and application of organic wastes on agricultural land to minimise the risk of their contamination with VTEC and other pathogens. Public access to environments where food crops are grown may introduce contamination, albeit the risk is small e.g. if faeces are tracked in by humans or animals.

3.2(b) Recommendations: new control measures

3.1 – HSE should work with SG, HPS and SRC to arrange training sessions for agencies that have enforcement responsibility for animal visitor attractions[15].

[13] http://www.face-online.org.uk/CodeofPractice

[14] Regulations (EC) No. 852/2004, 853/2004

[15] As defined in the Glossary.

3.2 – SG and LAs, in liaison with HSE, should consider measures to ensure that animal visitor attractions[15] make their activities known to LAs.

3.3 – SG should liaise with agricultural educational establishments, SEPA, NFUS and other stakeholders (e.g. QMS) relevant to farming and rural communities, to ensure that watercourses and the environment are protected by correct application of relevant guidance e.g. the PEPFAA code, Safe Sludge Matrix.

3.4 – SG should review current land access codes and provide guidance to minimise contamination of environments used for food crops by the public or by animals.

3.3 Monitoring compliance

3.3(a) Current position: monitoring compliance

There are various mechanisms for monitoring compliance with current control measures, particularly involving the meat industry and related agencies such as FSA, in relation to abattoirs, prevention of faecal contamination in vegetables and fruit production etc. None of the current monitoring systems would address the additional controls recommended here.

3.3(b) Recommendations: new monitoring of compliance

3.5 - SG, in liaison with LA representatives, should establish national systems to monitor compliance with issuing and implementation of SG guidance on clearing pasture before/ after recreational events involving animals that are registered with an LA. (e.g. galas, agricultural shows).

3.6 – SG, in liaison with SEPA, and the Diffuse Pollution Management Advisory Group (DPMAG), should undertake a snapshot survey of compliance with the PEPFAA Code, Safe Sludge Matrix and other relevant guidance on protection of watercourses and the environment.

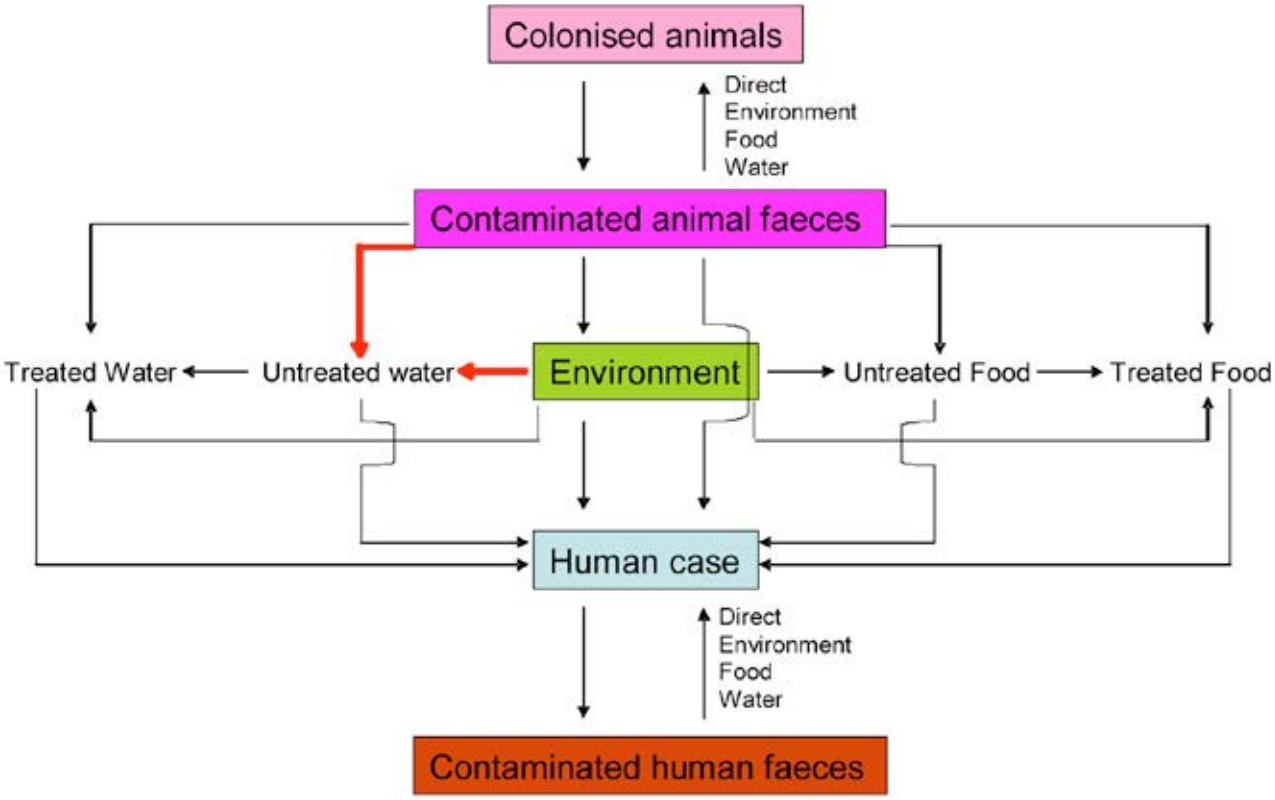
3.7 - SG should then take action based on the findings of the survey of compliance with the PEPFAA Code and other relevant guidance on protection of watercourses and the environment (see Recommendation 3.6 above) and feed back to the VTEC/*E. coli* O157 Action Group.

3.4 Evaluating effectiveness

The effectiveness of current and recommended control measures as a whole can only be evaluated by measuring the degree of contamination of the environment. The effectiveness of any single control measure cannot therefore be evaluated.

[15] As defined in the Glossary.

4 Controlling the contamination of untreated water from contaminated animal faeces or the environment



4.1 Description of step

Untreated water includes all environmental water and untreated sources of drinking water, including for example:

- Lochs and ponds including those used for water sports.
- Man-made or influenced bodies of water such as raw water reservoirs supplying water treatment works on the public water supply and recreational water facilities.
- Rivers and streams.
- Springs and boreholes (including those used for drinking water).
- Run-off water.
- Bathing and shellfish waters.

Contamination of water sources may occur by various routes:

- By colonised animals defecating directly into water sources.
- Sewage works and septic tanks feeding into raw drinking water sources.

- By run-off water from grazing land, animal housing, dung heaps etc – either naturally (e.g. rainfall or flooding), or by human activity.
- Directly and indirectly from spread manure, slurry, farm effluents.
- From drains, animal sewage sources, ditches.
- From tracking or splash-up into water sources from vehicles (e.g. cars, bikes, farm vehicles, animal transport); or from footwear.

4.2 Control measures

4.2(a) Current position: control measures

Scottish Water (SW) does not generally own water catchments and therefore has limited control of activities on catchments. Additionally, many PWS catchments will not always be owned and controlled by the users of the PWS.

Guidance such as the PEPFAA Code or Safe Sludge Matrix provide practical guidance to those involved in farming activities with practical advice on how to reduce the effects of diffuse agricultural pollution on the wider water environment, including drinking water sources. Legislation to protect and improve the water environment and sources of drinking water includes The Water Environment (Controlled Activities) (Scotland) Regulations, 2011 ("the CAR Regulations"). The CAR Regulations enable the Scottish Environment Protection Agency (SEPA) to control activities, including diffuse agricultural pollution, which may have an adverse impact on the water environment and the interests of other users of the water environment through a risk based framework of controls such as general binding rules, registration and licenses. The PEPFAA Code and the CAR Regulations include requirements to prevent livestock from having access to water courses which are used as sources of drinking water and for better control by the use of fencing and buffer strips to minimise environmental pollution.

The Water Framework Directive protects and improves the quality of the water environment by protecting areas such as drinking water and bathing and shellfish waters, and reducing diffuse agricultural pollution. SEPA is also considering measures to more effectively protect abstraction points for drinking water and its sources. SG, with SEPA and other stakeholders, has developed a diffuse pollution plan for Scotland and a long term communication strategy for land managers and land users to minimise pollution of sources of drinking water and the water environment more generally.

SW has Water Safety Plans (WSPs) for all of its drinking water supplies. This source-to-tap risk assessment and risk management approach should help identify potential sources of contamination in the catchment and identify control measures to minimise risk to supplies.

There is a statutory duty on LAs to carry out risk assessments on PWSs. They have powers to serve notices of improvement, which can include measures to protect drinking water sources. Application of regulations and guidance on organic waste by the relevant industries (e.g. livestock farms, meat processing facilities) should reduce as far as possible the spread of contamination into the environment or watercourses.

Public access may introduce contamination by walking through watercourses or land from which PWS are sourced, albeit the risk is small e.g. if faeces are tracked in by humans or animals.

4.2(b) Recommendations:
new control measures

4.1 - SW should develop a catchment management policy to include the scope and frequency of inspections and mechanisms for feeding information from inspections into WSP.

4.2 – SG should review current land access codes and provide proportionate guidance to minimise contamination of watercourses or the environment wherever possible, by the public or animals.

4.3 Monitoring compliance

4.3(a) Current position: monitoring compliance

There are various mechanisms for monitoring compliance with current control measures, particularly in relation to the statutory sampling of drinking water.

The requirements for the sampling and analysis of raw water supplies for public supplies are set out in Information Letter (4/2007) which the SG issued in December 2007. They are currently being reviewed and are likely to be based on risk assessment of the catchment. SG plans to introduce revised legislation at the earliest opportunity.

4.3(b) Recommendations:
new monitoring of compliance

4.3 – Drinking Water Quality Regulator (DWQR) to monitor progress on the catchment management policy regarding scope and frequency of inspections and mechanisms for feeding information from inspections into WSP (see Recommendation 4.1 above) and feedback to the VTEC/*E. coli* O157 Action Group.

4.4 Evaluating effectiveness

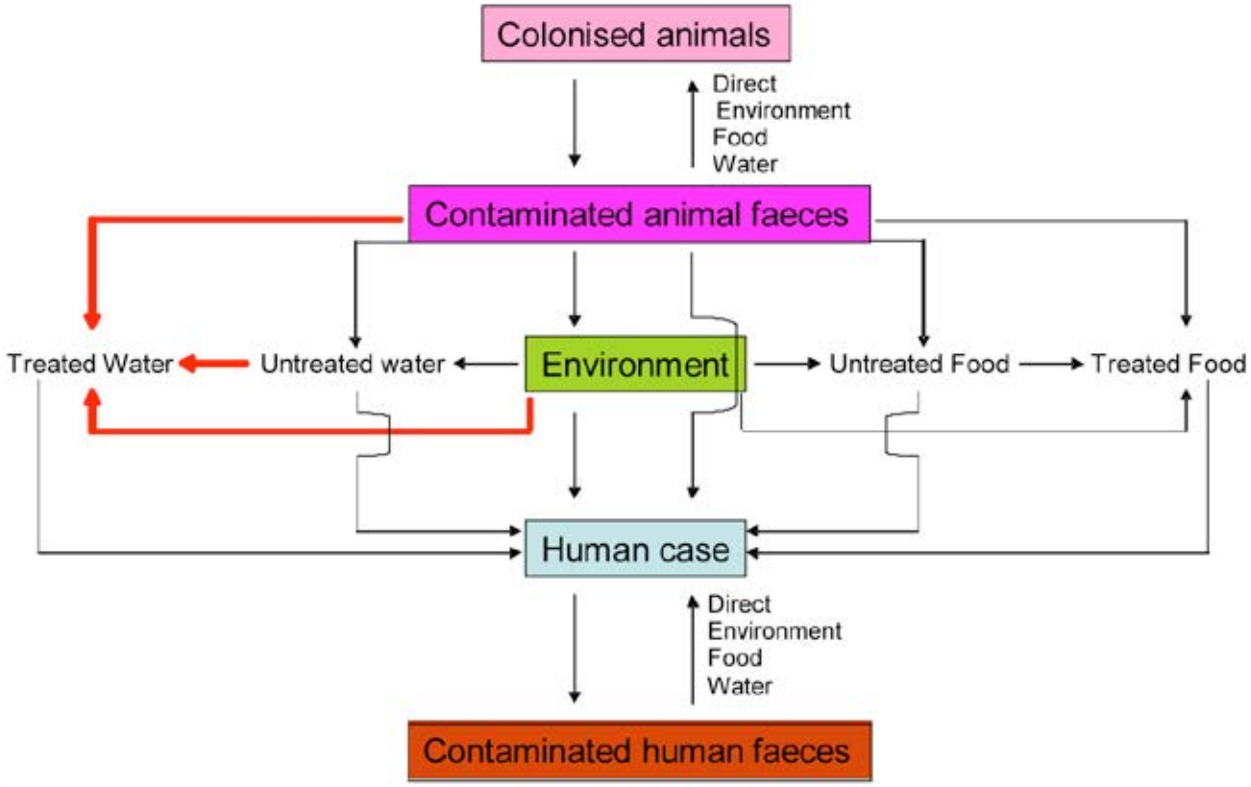
4.4(a) Current position:
evaluating effectiveness

Evaluating effectiveness is not possible in those areas where compliance is not monitored.

4.4(b) Recommendations:
new evaluation of effectiveness

4.4 – DWQR to assess the effectiveness of the catchment management policy regarding scope and frequency of inspections and mechanisms for feeding information from inspections into WSP (see Recommendation 4.1 above).

5 Controlling the contamination of treated water from contaminated animal faeces, untreated water or the environment



5.1 Description of steps

Controlling contamination of treated water from animal faeces, untreated water, or environments, may be difficult but extensive legislation and controls are already in place.

Treated water includes:

- Treated drinking water storage tanks and pipelines.
- Water stored within buildings in domestic distribution systems.
- Drinking water supplies (including public water supplies and treated PWS).
- Point-of-use (POU) water coolers (including "bottle-type" water coolers) and bottled water.

Untreated water includes all environmental water and untreated sources of drinking water, for example:

- Lochs and ponds including those used for water sports.

- Man-made or influenced bodies of water such as raw water reservoirs supplying water treatment works on the public water supply and recreational water facilities.
- Rivers and streams.
- Springs and boreholes (including those used for drinking water).
- Run-off water.
- Bathing and shellfish waters.

Drinking water includes:

- All post-treatment public water supplies;
- All PWS (treated or untreated);
- POU water coolers and bottled water – neither of which will be covered in detail in the Action Plan, as they involve very low VTEC risk, and are highly unlikely to be contaminated by the routes that might contaminate other treated water sources.

Contamination of treated water from either untreated water or the environment may occur by various routes. For public supplies in Scotland this is rare in practice due to comprehensive control measures, the stringency of which reflects the potentially high impact should any public supply ever have become contaminated.

Contamination via these routes should therefore be confined almost exclusively to PWS, usually resulting from events where contaminated water leaks into treated water storage points of pipework which are not secure.

Sources of contamination can include:

- Water from grazing land, animal housing, vehicles, gates, fences etc as a result of run-off from natural water or rainfall.
- Manure and farm effluents seeping into water or via run-off or irrigation.
- Sewage.
- Flooding.
- Poor design, or hygiene or maintenance practices, e.g. badly sited or maintained extraction or access points, meters or pipework; or failure to clean and disinfect equipment, taps, hands or footwear before contact with treated water distribution systems, for instance when working in tanks sited on cattle pasture.

5.2 Control measures

5.2(a) Current position: control measures

VTEC is readily inactivated by effective chlorination and ultraviolet (UV) irradiation, the commonly used disinfection methods used in drinking water treatment. All of SW's supplies are effectively disinfected, and it is important that this critical process is carefully managed.

Many PWS do not have disinfection, and many of those which do have disinfection installed may continue to fail microbiological standards. Owners and users of treated PWS must be aware of the need for the correct installation, operation and maintenance of their water treatment processes.

For public supply distribution systems, it is good practice to have site specific chlorine targets to ensure adequate secondary disinfection while minimising consumers' taste and odour complaints. However, SW currently has an arbitrary minimum target chlorine concentration for all water storage points in distribution systems. SW is currently setting site specific targets at storage points.

Secondary disinfection systems are used at strategic points in distribution systems to ensure adequate chlorine levels at consumers' properties. There are no formal criteria for the installation or monitoring of secondary disinfection.

Water treatment processes such as coagulation and filtration, and membrane filtration are commonly used to remove organic and particulate matter from supplies before disinfection. Failure of these processes can lead to unmanageable loads on disinfection processes. SW sets filtered turbidity alarms using local experience, with set points agreed between local process scientists and operational team leaders. The methodology is detailed within a Scottish Water Quality Management System. Coagulation and filtration system checks are based on the analysis of on-line monitoring of residual coagulant metal, turbidity and chlorine results. This is based on good operational practice, but there is no formal procedure.

The SW Disinfection Policy makes no reference to *E. coli* typing in the event of repeat microbiological failures, despite this being recommended in Paragraph 7.13 of the *E. coli* O157 Task Force report of June 2001.

In 2010, 99.99% of samples taken from consumers' taps were free from *E. coli*, which is used as an indicator of faecal contamination. *E. coli* O157 cannot be distinguished on the routine culture medium used by SW to detect *E. coli* and special techniques are required to detect *E. coli* O157 and other VTEC e.g. during investigation of an incident as a result of repeat microbiological failures. Any presumptive isolates detected are then forwarded to the Scottish *E. coli* O157/VTEC Reference Laboratory (SERL) for confirmation.

A DWQR survey of some of the LAs showed that most staff were comfortable carrying out the risk assessments on distribution systems, although some felt that further training would be beneficial.

The United Kingdom Accreditation Service (UKAS) and DWQR independently audit SW's laboratories, which are required by regulations to have external accreditation. All laboratories contracted to carry out analysis on PWS samples should have accreditation as this is also a regulatory requirement. The PWS Grant Scheme does not include provision for connecting to the public supply, which already exists through the "Reasonable Cost of Connection" Regulations.

Type A PWS (defined by new legislation on PWS in 2006[16] as supplying 50 or more persons; or 10 or more cubic metres of water; or regardless of size,

[16] http://www.legislation.gov.uk/ssi/2006/209/contents/made

any supply for a commercial or public activity) are subject to more stringent regulation than Type B PWS (defined as any non-Type A supply).

DWQR is aware of three incidents in recent years in which treated PWS were involved or suspected as the cause of infection, at least one of which involved Type A supplies and/or involved inadequate maintenance of disinfection processes. In these incidents, important lessons were learned, and there appeared to be scope to expand the section of SG's PWS Technical Manual advising on the management of such issues. Post-outbreak proposals have also included compulsory registration of properties supplied by PWS, to enable the fastest possible identification, investigation and advising, of anyone at potential risk, when VTEC cases have been using a PWS; and ensuring that landlords inform and advise tenants of properties on PWS.

With regard to bottled water, (which also includes "bottle-type" water coolers), FSA in Scotland is responsible for The Natural Mineral Water, Spring Water and Bottled Drinking Water (Scotland) No2 Regulations 2007 which include provisions for the recognition, exploitation, labelling and marketing of natural mineral water and spring water and sets requirements for the bottling and labelling of drinking water. These Regulations are enforced by Scottish LAs.

5.2(b) Recommendations:
new control measures

Public water supplies:
Due to stringent control measures the quality of the public supply is generally very high. However the following recommendations are made in order to minimise risk from VTEC as far as possible:

5.1 - SW should revise its Disinfection Policy to define a consistent national policy for:

(a) Flow proportional and residual disinfection control;

(b) Criteria for auto-shutdown of Water Treatment Works (WTW) on disinfection issues;

(c) Secondary disinfection;

(d) The requirement for duty and standby disinfection equipment.

5.2 - SW should compile an inventory of its existing disinfection systems to give clarity on its assets; and should ensure that its Disinfection Policy is then applied to all assets.

5.3 - SW should ensure that all disinfection systems have the appropriate duty and standby disinfection equipment installed.

5.4 - SW should ensure that chlorine levels at storage points in distribution systems are site specific and evidence based, to ensure satisfactory microbiological quality of supplies whilst minimising taste and odour impacts to consumers.

5.5 - SW should carry out species identification where there are repeat failures of the total coliforms and *E. coli* standards from drinking water samples as per Recommendation 7.13 of the 2001 *E. coli* O157 Task Force Report, and should ensure that criteria for species identification are set out in the appropriate SW quality management system.

5.6 - SW should inform public and environmental health professionals of the scope and limitations on typing of *E. coli* positive water samples, and of the implications of this for operational decisions.

5.7 - SW should consider producing formal guidance for its staff on the assessment of performance of processes used for colour and turbidity removal to ensure consistency of approach across the country.

Private water supplies:

5.8 - SG, the DWQR, the Society of Chief Officers of Environmental Health in Scotland (SoCOEHS) and the Royal Environmental Health Institute of Scotland (REHIS) should determine local authorities' training needs for their statutory duties relating to PWS, and should develop and deliver training as appropriate.

5.9 - DWQR, in liaison with SERL and LAs, should issue guidelines to LAs and to laboratories analysing PWS samples, on the forwarding of *E. coli* isolates to SERL for typing.

5.10 - SG, in partnership with LAs, DWQR, and public health professionals should develop a strategy to further promote the benefits of the risk assessment and risk management approach for PWS and the PWS grants scheme to deliver real and lasting improvements to PWS and consequential health benefits. This strategy should include:

(a) Methods for improving awareness of the potential health risks from PWS to owners and users and their visitors, and the need for correct installation, operation and maintenance of treatment systems.

(b) SG updating section 11 of the PWS Technical Manual (Waterborne Hazard Response for PWS) to include more information on dealing with waterborne incidents; and increase the range and detail on treatment options for small supplies following consultation with LAs, REHIS, DWQR and HPS.

(c) SG, in liaison with DWQR, should review the 'Information Guide' for owners and users of PWS in line with recommendations from recent research by Aberdeen University.

5.11 – SG should consider the following recommendations from an Incident Management Team Report[17], which propose that SG should:

(a) "Create a compulsory registration scheme for properties supplied by a PWS, to aid rapid investigation and provision of advice subsequent to a case of *E. coli* O157 infection" (this should also include non-O157 VTEC).

(b) "Require landlords of properties served by a PWS, to inform their tenant(s) of this in their lease, and to advise tenants on the implications for health".

5.3 Monitoring compliance

5.3(a) Current position: monitoring compliance

Mechanisms already exist for monitoring compliance with drinking water quality standards for public and PWS. Local authorities are required to complete risk assessments for all Type A PWS[18], and all of SW's supplies have WSP.

5.3(b) Recommendations: new monitoring of compliance

5.12 - DWQR should confirm that all laboratories contracted to analyse PWS samples have the appropriate accreditation and that DWQR has reminded all LAs about the accreditation requirements.

[17] http://www.nhsgrampian.org/nhsgrampian/files/Item10.4.1CGCReportIMTReport.pdf

[18] http://www.legislation.gov.uk/ssi/2006/209/contents/made

5.13 – SG should liaise with LAs, REHIS and SoCOEHS, and consult with DWQR, to consider methods of improving:

(a) Compliance by owners/users of PWS serving public or commercial activities, with legislation requiring them to display notices informing the public that a PWS is in use.

(b) The extent to which PWS owners/users are complying with the advice from LA risk assessments and sampling, on how to improve/protect their supplies.

5.14 – DWQR should identify methods to monitor any of the additional control measures recommended above, if it transpires that compliance would not be measurable by existing monitoring systems.

5.4 Evaluating effectiveness

5.4(a) Current position:
evaluating effectiveness

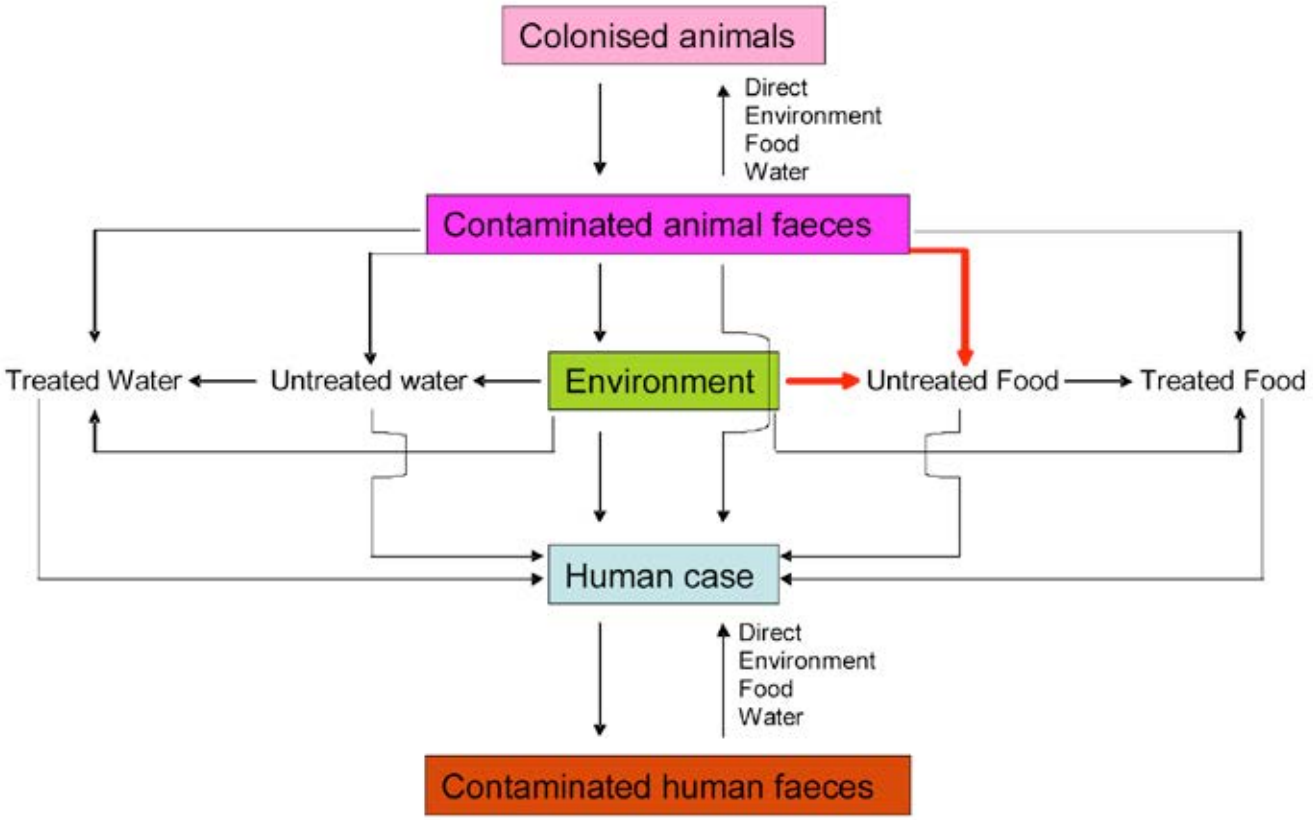
Existing legislation already addresses effectiveness in relation to water quality; LAs undertake sampling and analysis and act upon any failures identified; and DWQR already reports on water quality at national level. As there are no recommendations for new monitoring of compliance with the recommended control measures, their effectiveness cannot be evaluated in isolation.

5.4(b) Recommendations:
new evaluation of effectiveness

5.15 – DWQR, on SG's behalf, should monitor the effectiveness of the grants scheme in terms of water quality improvements.

5.16 – SG Drinking Water Quality Division should feed back to the VTEC/*E. coli* O157 Action Group on the research project they will be managing on the impact of maintenance and different raw water quality parameters on the effectiveness of UV disinfection of PWs

6 Controlling the contamination of untreated food from contaminated animal faeces or the environment



6.1 Description of steps

Untreated food products of animal origin and crops intended for human consumption can become contaminated with VTEC either through direct contact with animal faeces, or via the environment during harvest, slaughter or processing.

In this chapter, untreated foods fall into two categories:

- *Foods which require subsequent treatment by the caterer or consumer to eliminate or reduce potential VTEC risk.* This category includes raw meat[19] and certain vegetables, which would normally be cooked, peeled or washed by the caterer or consumer prior to consumption (e.g. potatoes, carrots, or unwashed spinach).

[19] As defined in the Glossary

- *Foods which do not require subsequent treatment by the caterer or consumer to eliminate or reduce potential VTEC risk.* This category would include some products labelled as Ready to Eat (RTE) (defined in EU Regulations as those 'intended by the producer or the manufacturer for direct human consumption without the need for cooking or other processing effective to eliminate or reduce to an acceptable level micro-organisms of concern'[20]). Untreated RTE foods are produced in conditions where pathogen risks have been tightly controlled by the producer or manufacturer, and include RTE-labelled bagged or packaged salads, herbs, fruit, and sprouted seeds, as well as certain unpasteurised dairy products.

Raw meat[19]

The sources of VTEC contamination of raw meat include faeces that can contaminate the fleeces and hides of livestock on farm or during transport and lairaging of animals at the slaughterhouse (this step is addressed in Chapter 3); and gut contents. Contaminated faeces and hides can contaminate carcasses during dressing procedures, particularly skinning and evisceration at the slaughterhouse. Cross-contamination can occur during processing such as boning, cutting and mincing.

VTEC has been isolated from a range of raw meats[21] including beef, pork, lamb, veal and chicken. Its prevalence on the surface of raw meat[21] cuts on retail sale in the UK has previously been reported as being low[22].

Vegetables and fruit

At the growing stage, there is the potential for land used in the primary production of vegetables and fruit to become contaminated with VTEC directly from animal faeces (grazing livestock, domestic and wild animals, including deer, rabbits etc.), the incorrect management and use of livestock manures and other recycled organic wastes (abattoir wastes, sewage sludge, composted food waste or anaerobic digestate), or the use of contaminated water for irrigation and washing. These foods may also be contaminated indirectly during harvesting, packing, and distribution from inadequately cleaned equipment or storage containers, poor hand hygiene by staff and contact with contaminated water used for cooling. Minimising the potential for contamination during all of these stages is key in ensuring the safety of vegetables and fruit.

Public access to environments from which food crops (or irrigation water) are produced may introduce contamination, albeit the risk is small e.g. if faeces are tracked in or deposited by humans or wild or domesticated animals.

[20] Regulation (EC) No. 2073/2005

[21] See Glossary.

[22] FSA Project B18018 (2010). A UK-wide survey of microbiological contamination of fresh red meats on retail sale.

VTEC outbreaks associated with fresh produce have been documented worldwide, although the reported incidence from surveillance of these foods has been low[23,24]. Whilst the consumption of contaminated raw/untreated produce is likely to present the highest risk to health, the presence of soil on vegetables also presents a potential cross-contamination risk. The Great Britain-wide outbreak of *E. coli* O157 Phage type 8 (PT8) between December 2010 and July 2011 was statistically significantly associated with living in a household where leeks or potatoes purchased loose or from sacks were handled[25]. Contamination is usually confined to the surface of vegetables but there is emerging laboratory evidence that pathogens can become internalised into the tissues of certain plants[26]. A 2008 WHO/FAO review[27] concluded that there was no evidence that internalisation presented a significant risk in practice, particularly where Good Agricultural Practice (GAP)[28] is implemented. There is however a lack of information on non-experimentally-induced internalisation under real conditions in the field and during processing.

VTEC has not been isolated from vegetables and fruit on retail sale in the UK, although surveillance of these foods for *E. coli* has been limited to date.

Sprouted seeds

VTEC can contaminate seeds and sprouted seeds due to poor sanitation during primary production, storage, distribution and handling of seed and through the use of contaminated water during seed washing and germination. Contaminated seed has been identified as the most likely initial source of sprouted seed-associated outbreaks. The temperature and humidity generated through the germination and sprouting of seeds favours the rapid growth of bacteria, and as these foods are often consumed raw/untreated, they are plausible vehicles of infection. Two outbreaks of *E. coli* O104 reported in Germany and France in 2011, were associated with the consumption of sprouted fenugreek seeds, highlighting the particular risks associated with the consumption of these foods[29].

Unpasteurised (raw) milk and dairy products

VTEC can contaminate unpasteurised (raw) milk through faecal or environmental contamination during or after milking. Since the ban on the sale of unpasteurised drinking milk in Scotland in 1983, there has been a marked decline in milkborne illness in this country. However, HPS surveillance data show that a small number of cases of *E. coli* O157 have been reported in Scottish farming communities, in which unpasteurised milk (for private consumption) was

[23]Shiga toxin/verotoxin-producing *Escherichia coli* in humans, food and animals in the EU/EEA, with special reference to the German Outbreak strain STEC O104. ECDC/EFSA Joint Technical Report, June 2011. (http://ecdc.europa.eu/en/publications/Publications/1106_TER_EColi_joint_EFSA.pdf)

[24]FSA Project B11010 Baylis, C., Smith, H., Bolton, E., O'Brien, S. Review of past and current research on Verocytotoxin producing *Escherichia coli* (VTEC) in relation to public health protection (2006).

[25]UK *E. coli* O157 outbreak associated with soil on vegetables. HPA press release; 30 September 2011. http://www.hpa.org.uk/NewsCentre/NationalPressReleases/2011PressReleases/110930Ecolioutbreakassocwithsoilonveg/

[26]Deering, A.J. et al. (2011) Internalisation of *E. coli* O157:H7 and Salmonella in plants: A review. Food Research International In press.

[27]Microbiological hazards in fresh leafy vegetables and herbs, WHO/FAO Meeting Report, Microbiological Risk Assessment Series 14 (2008). http://www.fao.org/food/food-safety-quality/a-z-index/fresh-produce/en/.

[28]Good Agricultural Practice (GAP) is defined as the adoption of management practices that minimise the risks of water, air and soil pollution, ensure the highest possible standards of food safety and allow economic agriculture to continue.

[29]Shiga-toxin producing *E. coli* O104:H4 2011 outbreaks in Europe:Taking Stock. EFSA Journal, 2011; 9(10) 2390.

a potential vehicle. Contamination can also occur in products made from unpasteurised milk including unpasteurised cheeses. VTEC is known to survive during the manufacture, ripening and storage of certain cheeses made from unpasteurised milk[30,31], and as these foods are consumed without further treatment they can present a potential risk, if the necessary hygiene controls are not followed during the production process.

6.2 Control measures

6.2(a) Current position: control measures

VTEC risks are primarily controlled by preventing contamination with animal faeces at all stages of the food chain. Food businesses are legally required to ensure that the risks of contamination of untreated foods are minimised at primary production through the application of GAP and thereafter by the implementation of food safety management systems based on the principles of Hazard Analysis and Critical Control Point (HACCP).

General legislative requirements

Regulation (EC) No. 178/2002 states that unsafe food shall not be placed on the market and that Food Business Operators (FBOs) satisfy the requirements of the food law relevant to their activities at all stages of production, processing and distribution within the business under their control.

Regulation (EC) No. 852/2004 on the hygiene of foodstuffs provides general rules for FBOs for the production and processing of all food throughout the food chain. General implementation of procedures is based on HACCP principles, together with application of good hygiene practice.

Raw meat[32]

The contamination of raw meat is controlled by preventing its exposure to potentially contaminated environments, and avoiding cross-contamination during preparation and processing.

Regulation (EC) No. 853/2004 lays down specific hygiene rules for products of animal origin.

The hygiene requirements for slaughterhouses include:

- Ensuring animals are clean enough to avoid contamination of meat during slaughter and dressing;
- Developing an appropriate slaughter scheme and;
- Developing procedures for the hygienic dressing of animals to protect carcases from unnecessary contamination from hides, fleeces, or gut contents.

Slaughterhouses are also required to request, receive, check and act upon Food Chain Information (FCI)[33] for all animals, other than wild game. FCI provides information on the health status of animals and assists the slaughterhouse operator to organise operations, and the official veterinarian

[30]Maher, M.M., Jordan, K.N., Upton, M.E., and Coffey, A. (2001). Growth and survival of *E. coli* O157:H7 during the manufacture and ripening of a smear-ripened cheese produced from raw milk. Journal of Applied Microbiology 90: 201-207.

[31]Schlesser, J.E., Gerdes, R., Ravishankar, S., Madsen, K., Mowbray, J. And Teo, A.Y. (2006). Survival of a five-strain cocktail of *Escherichia coli* O157:H7 during the 60-day aging period of cheddar cheese made from unpasteurised milk. Journal of Food Protection. 69: 990-998.

[32]See Glossary.

[33]http://www.food.gov.uk/foodindustry/guidancenotes/meatregsguid/fciguidance/

to determine the required ante and post-mortem inspection procedures and whether any further actions may be necessary.

Additional measures at slaughter and processing are prescribed by industry assurance schemes including the QMS Assurance Standards[1,34] which require strict specifications to be met with regard to traceability and hygiene controls for meat classified as Scotch Beef or Scotch Lamb.

Regulation (EC) No. 2073/2005 requires microbiological testing of carcasses to validate HACCP procedures. Further criteria are applied to meat preparations including minced meat to assess hygiene controls and demonstrate safety. The criteria specified in legislation are not directly related to VTEC risk, but products meeting these standards are regarded as likely to have a lower risk of VTEC contamination.

There is evidence from other countries including the US, that decontamination treatments provide a useful tool in reducing microbiological contamination that may be present on the surface of raw meat[35]. However, EU food hygiene legislation does not permit the use of substances other than potable water to remove surface contamination from foods of animal origin unless their use has been approved. In late 2011, the European Commission (EC) initiated discussion on a proposal to authorise the use of lactic acid to reduce microbiological surface contamination on beef carcases. This followed the publication of a favourable scientific assessment undertaken by the European Food Safety Authority (EFSA), which concluded that the use of lactic acid in beef production would not present a food safety concern provided it complied with EU specifications for food additives, and that it could be effective in reducing the levels of bacteria (including VTEC) on beef carcases. The draft EC proposal (which is still subject to vote at the time of writing) recognises the importance of HACCP based procedures in beef production, and requires that this decontaminating treatment complements rather than replaces good hygienic practice and HACCP based controls[36].

Vegetables and fruit

It is not possible to guarantee the absence of bacteria from vegetables and fruit grown in the field, but contamination is controlled by preventing their exposure to VTEC from the environment and water, and avoiding cross-contamination during growing, harvesting, packaging, transport and storage.

EU food hygiene legislation does not place prescriptive hygiene requirements on primary producers and does not require formal HACCP at this stage of production. However, Regulation (EC) No. 852/2004 lays down broad requirements for producers to comply with legislative provisions relating to measures to protect primary products from contamination arising from soil, water and fertilisers. The Regulations also require relevant businesses to ensure hygienic production, transport,

[34] http://www.qmscotland.co.uk/index.php?option=com_content&view=article&id=132&Itemid=97.

[35] See Glossary.

[36] http://www.food.gov.uk/multimedia/pdfs/board/fsa120106.pdf

and storage and that potable or clean water is used when necessary to prevent contamination. Further to this, legislation, standards and guidelines[37,38,39,40,41] exist to control the treatment and application of organic wastes on agricultural land to minimise the risk of pathogens including VTEC.

In addition to legislative controls and standards, industry guidelines exist for the control of contamination in the production and harvesting of produce. Market requirements have also promoted schemes such as The Red Tractor Farm Assurance Fresh Produce Scheme[42] and best practice guidance from trade bodies such as the Chilled Foods Association (CFA)[43]. In addition, some major retailers have developed their own Codes of Practice for their suppliers in the UK and abroad. FSA and the Horticultural Development Company (HDC)[44] have also developed freely available risk-based decision support tools[45] for UK produce growers covering water quality, manure inputs and worker hygiene, as well as guidance on microbial monitoring[46] .

Responsible access codes should recognise the potential for contamination due to human access to areas used for food crops or irrigation water, and although the risk is low, these codes should provide guidance on how to minimise contamination.

Sprouted seeds

Controls relating to the production of sprouted seeds are based on the general hygiene requirements of Regulation (EC) No. 852/2004 and Regulation (EC) No. 178/2002. Businesses producing and selling sprouted seeds or seeds intended for sprouting should identify the points in the production and supply chain where contamination could occur and put in place controls to minimise the risk from seeds, equipment, water, packaging materials and staff hygiene. This approach is similar to HACCP but acknowledges that HACCP is not yet generally feasible at primary production level. Regulation (EC) No. 2073/2005 also defines microbiological criteria for RTE sprouted seeds including specific limits for Salmonella and Listeria monocytogenes. In November 2011, EFSA published a scientific opinion on the public health risk of VTEC and other pathogens that may contaminate seeds and sprouted seeds[47]. This identified the key risk factors contributing to contamination and recommended possible mitigation options to reduce the risk. It concluded that, in the absence of a reliable decontamination method which was capable of eliminating pathogens from seeds, measures to prevent contamination were key to controlling the risks. The EC is currently discussing proposals to

[37] http://eur-lex.europa.eu/LexUriServ/site/en/consleg/2002/R/02002R1774-20060401-en.pdf

[38] http://www.wrap.org.uk/content/bsi-pas-100-producing-quality-compost

[39] Managing Farm Manures for Food Safety (FSA) 2009. http://www.food.gov.uk/multimedia/pdfs/manuresguidance.pdf

[40] PAS 110:2010 Specification for whole digestate, separated liquor and separated fibre derived from the anaerobic digestion of source-segregated biodegradable materials http://www.wrap.org.uk/content/bsi-pas-110-producing-quality-anaerobic-digestate

[41] The Safe Sludge Matrix, ADAS (2001) http://www.adas.co.uk/LinkClick.aspx?fileticket=f_CX7x_v4nY%3d&tabid=211&mid=664

[42] Red Tractor Assurance for Farms. Fresh Produce Scheme (2011) http://www.assuredfood.co.uk/resources/000/618/000/Produce_standard.pdf

[43] Chilled Food Association (2007) Microbiological Guidance for produce suppliers to chilled food manufacturers. Second Edition

[44] http://www.hdc.org.uk/

[45] http://www.safeproduce.eu/Login.aspx?ReturnUrl=%2fDefault.aspx

[46] http://www.food.gov.uk/multimedia/pdfs/microbial.pdf

[47] http://www.efsa.europa.eu/en/efsajournal/pub/2424.htm

tighten controls on sprouted seeds and seeds intended for sprouting, and to introduce new criteria for VTEC in these foods.

Following the outbreaks of *E. coli* O104 reported in Germany and France in 2011, the Fresh Produce Consortium, in consultation with the FSA, developed guidance to help food businesses who produce sprouts, as well as seed producers, to implement appropriate controls and manage appropriate production and handling procedures to minimise the risks associated with ready to eat sprouts[48].

It is important to highlight the differences in the microbiological quality of produce (including salad vegetables, vegetables, fresh herbs, sprouted seeds and fruit) which is labelled and sold to the consumer as RTE[49] and that which is not. Produce which is labelled as RTE is grown, harvested and produced under conditions aimed at preventing contamination at all stages of production via seeds, soil, organic wastes, wild animals, irrigation water, equipment, transport vehicles and food handlers. In addition, RTE leafy vegetables and herbs are subject to a washing procedure (often involving use of a sanitising agent) to remove soil and other gross debris, which also reduces the overall microbiological load. RTE produce should always be protected from cross contamination (see Chapter 7), to ensure it does not become a vehicle for VTEC infection. Produce which is not labelled as RTE should also be produced in accordance with GAP. However as this is not intended to be RTE, it is not subject to the same level of control throughout the production process, particularly at the post harvesting stage, and should be cooked, washed or peeled by the consumer before being eaten.

Unpasteurised (raw) milk and dairy products

The sale of unpasteurised drinking milk is prohibited in Scotland, and the only method of controlling the risks associated with private consumption is through raising public awareness. The key control measure for preventing VTEC contamination of unpasteurised dairy products from animal faeces or the environment is the maintenance of good hygiene practice from unpasteurised milk production through all stages of production and retail. Regulation (EC) No. 853/2004 specifies requirements for the health of dairy livestock, appropriate standards for milk production holdings, effective HACCP based procedures to ensure staff hygiene and the management of cleanliness during milking, collection and transport, and microbiological standards for unpasteurised milk. Regulation (EC) No. 2073/2005 also includes process hygiene and food safety criteria for dairy products made from unpasteurised milk, including milk which has undergone a lower heat treatment than pasteurisation.

[48] Fresh Produce Consortium Guidance for Food Businesses on the hygienic Sourcing, production and safe handling of Ready to Eat Sprouts. First Edition (May 2012)

[49] Regulation (EC) No. 2073/2005 defines ready-to-eat food as 'food intended by the producer or the manufacturer for direct human consumption without the need for cooking or other processing effective to eliminate or reduce to an acceptable level micro-organisms of concern'.

The Specialist Cheesemakers Association has produced guidance[50] for small businesses clarifying how the requirements of the EU Food Hygiene Regulations apply to the production of speciality cheeses. This specifies controls relating to the supply and storage of unpasteurised milk and steps for avoiding cross-contamination and record keeping, as well as guidance on appropriate screening of unpasteurised milk destined for the production of unpasteurised cheeses for pathogens including *E. coli* O157.

6.2(b) Recommendations: new control measures

6.1 - FSAS and SG should support EU proposals to permit the use of lactic acid to reduce microbiological surface contamination on bovine carcases to complement good hygienic practice and HACCP based controls, and feed back to the VTEC/*E. coli* O157 Action Group.

6.2 - FSAS should continue to support initiatives which promote best practice for controlling microbiological risks including VTEC contamination across all areas of the fresh produce sector.

6.3 – SG should review current land access codes and provide guidance to minimise contamination of areas used for food crops or irrigation water by the public or by animals.

6.4 – FSAS, SEPA and SG should ensure guidance on the safe use of manures and recycled organic wastes in vegetable and fruit production is subject to ongoing review.

6.5 - FSAS and SG should support the EC as it develops proposals for controls to reduce the food safety risks associated with VTEC contamination of sprouted seeds intended to be consumed raw/untreated, and feed back to the VTEC/*E. coli* O157 Action Group.

6.3 Monitoring compliance

6.3(a) Current position: monitoring compliance

Regulation (EC) No. 882/2004 sets out the approach for monitoring and enforcing businesses' compliance with food law.

Raw meat[51]

The specific requirements for the organisation of official controls on products of animal origin are laid down in Regulation (EC) No. 854/2004. This legislation is enforced by Official Veterinarians and Meat Inspectors in the FSA's Operations Group, in slaughterhouses, cutting plants, game handling establishments, and other meat establishments which are co-located with any of these premises and which produce meat products, meat preparations, minced meat and/or mechanically separated meat. In the slaughterhouse, official controls currently include ante-mortem and post-mortem checks based on traditional approaches designed over 100 years ago to tackle the public health concerns of that era. FSA is conducting research to inform a review of meat hygiene inspection in slaughterhouses which is being taken forward by the EU to modernise these controls and ensure they are better aligned to microbiological risks such as VTEC.

[50] The Specialist Cheesemakers Code of Best Practice (3rd Edition). The Specialist Cheesemakers Association 2011. http://www.specialistcheesemakers.co.uk/best_practice/index.htm

[51] See Glossary.

LAs are responsible for enforcement in all other meat establishments including retail butchers. FSA monitors levels of compliance by meat establishments under LA control through the results of food law enforcement activities, which FSA collates and publishes through its Local Authority Enforcement Monitoring System (LAEMS).

The results of official control microbiological sampling provide a means by which enforcement authorities can verify compliance with controls applied at approved meat establishments. FSA has recently reviewed microbiological and hygiene sampling carried out in approved meat establishments and has set sampling priorities to inform risk assessment for future compliance monitoring in this area of food production.

Under EU legislation, FSA also conducts annual audit programmes to monitor the enforcement of Regulations (EC) No. 852/2004 and (EC) No. 853/2004 and the implementation and effectiveness of HACCP principles at approved meat establishments. Audits of LAs now include an element of 'reality checks' involving visits to a sample of food premises to assess the scope and performance of inspections. The reports of these audits are published on the FSA website.

FSA has also developed a process called 'Cause for Concern' to monitor approved meat establishments across the UK for levels of compliance with the requirements of Food Hygiene Legislation. Establishments are identified as cause for concern on the basis of an analysis of trends in compliance, and the most recent audit scores for hygienic production, environmental hygiene requirements and HACCP. The details of 'Cause for Concern' meat establishments are included on a publically available list until the necessary improvements are made by the FBO.

Vegetables and fruit

LAs and the Scottish Government Rural Payments and Inspections Directorate (RPID) enforce compliance with regulations relating to the prevention of microbiological contamination in the growing, harvesting and distribution of untreated vegetables and fruit. FSA monitors records of inspection and compliance for primary production through the Scottish Primary Production Official Controls System (SPPOCS).

Producers who take part in assurance schemes are also subject to third party audit for compliance against scheme standards and the UK's major multiple retailers audit produce suppliers against their own Codes of Practice. Market requirements have driven many vegetable and fruit suppliers to adopt these high standards of production. However, it is unclear to what extent producers which do not belong to assurance schemes and may be supplying to a smaller market are complying with the necessary controls. FSA has recently asked LAs to gather data on levels of compliance by producers of vegetables and fruit grown in Scotland (with an emphasis on crops that can be consumed raw/untreated) to inform future enforcement regimes in this area.

Sprouted seeds

LAs are responsible for the enforcement of legislation which applies to seed sprouters, importers and traders, to ensure that these establishments can demonstrate that they have identified the points in the production and supply chain where risks of microbiological contamination may occur and that effective action has been taken to ensure products placed on the market are safe (including through appropriate verification checks, such as microbiological testing).

Unpasteurised (raw) dairy products

Official controls for milk and dairy products are laid down in Regulation (EC) No. 854/2004. In Scotland, these regulations are enforced in milking parlours and cheese producers through LA inspection.

6.3(b) Recommendations:
new monitoring of compliance

6.6 - FSAS should feed back to the VTEC/*E. coli* O157 Action Group the results of its review of official control microbiological sampling undertaken in approved meat establishments for verifying compliance with Food Hygiene Regulations.

6.7 - FSAS should feed back to the VTEC/*E. coli* O157 Action Group the outcome of its data gathering exercise on compliance monitoring of Scottish vegetable and fruit producers to confirm that appropriate measures are in place to protect produce from VTEC contamination.

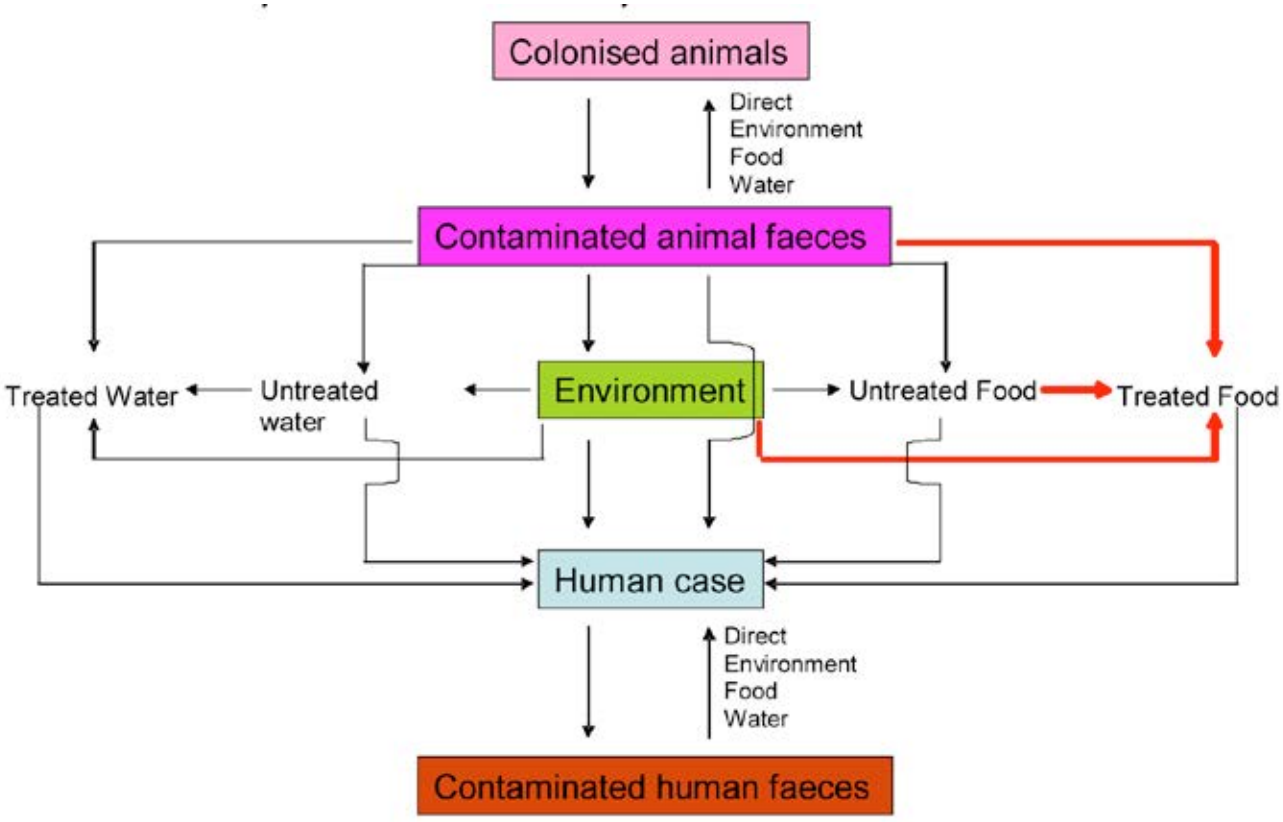
6.8 – NFUS should consider liaising with the fresh produce sector to identify any areas where NFUS believes that industry assurance schemes may not be complied with, and feed back to the VTEC/*E. coli* O157 Action Group.

6.4 Evaluating effectiveness

The overall effectiveness of current and recommended control measures could be evaluated by measuring the prevalence of VTEC in the relevant foodstuffs. However the microbiological testing required by EU legislation is in place to verify the effectiveness of HACCP controls, and does not prescribe specific end product standards for VTEC. As a result, the generation of data specifically related to VTEC in untreated foods produced in the UK, relies on targeted surveillance.

The effectiveness of these controls may also be evaluated by estimating the contribution of these foods to cases in Scotland. HPS enhanced VTEC surveillance suggests that 35-40% of cases in Scotland may have been exposed to types of foods which are known to be a potential VTEC risk. However, estimating the proportion of cases that may be attributable to foodborne transmission requires carefully designed epidemiological investigation; and as the drivers of foodborne infection are many and complex, changes in case numbers could not be attributed to any one intervention.

7 Controlling the contamination of treated food from contaminated animal faeces, untreated food, or the environment



7.1 Description of steps

In this chapter, treated foods fall into two categories:

- Foods which are sold as Ready to Eat (RTE), as defined in EU Regulations i.e. those foods 'intended by the producer or the manufacturer for direct human consumption without the need for cooking or other processing effective to eliminate or reduce to an acceptable level micro-organisms of concern'[52]. These include washed bagged salads which are labelled as RTE, cooked meats, pates and sandwiches.
- Foods which have been cooked, washed or peeled by the caterer or consumer.

Contamination of treated foods by animal faeces can occur either directly or from environments contaminated by

[52] Regulation (EC) No. 2073/2005.

them e.g. grazing land or animal visitor attractions[53], including when they are being handled or consumed in these settings. It is unclear how commonly this occurs.

Cross-contamination from contaminated untreated food can occur in food processing, storage, distribution, retail, catering and domestic kitchen environments and can be direct, via contact with contaminated raw meat[54], faecal matter on soiled vegetables, or indirect via surfaces, hands or utensils. VTEC can survive in foods and on food preparation surfaces at low temperatures, so avoiding cross-contamination and ensuring adequate cleaning and disinfection, are critical in minimising the risk.

7.2 Control measures

7.2(a) Current position: control measures

The most effective means of controlling cross-contamination is by the complete physical separation of surfaces, equipment, wrapping and utensils used for the preparation of untreated and treated foods. In circumstances where complete physical separation is not possible, adequate cleaning, disinfection and hand hygiene are essential in the control of cross-contamination risks.

Manufacture, catering and retail

EU Food Hygiene Regulation (EC) No. 852/2004 requires all food businesses involved in the production of RTE foods to maintain procedures based on HACCP principles, including the avoidance of cross-contamination. Regulation (EC) No. 178/2002 prohibits the sale of unsafe food and requires all FBOs to initiate a withdrawal of any food supplied by them if considered unsafe. FSA has produced the guidance packs 'CookSafe'[55], 'Retail Safe'[56] and 'Safer Food, Better Business'[57], to support the implementation of HACCP in catering and retail.

Regulation (EC) No. 2073/2005 defines microbiological criteria for a range of RTE foods at manufacture and retail, which are used to help to verify and validate the FBO's food safety management systems. Unsatisfactory results can lead to the withdrawal or recall of foods on the market and/or action to improve production hygiene.

In 2011, FSA issued new guidance for food businesses to specifically clarify the steps needed to control VTEC cross-contamination risks and how to protect their customers. The guidance also advises LA food safety officers on appropriate sanctions for enforcing these controls.

The key controls are:

- Identification of separate work areas, surfaces and equipment for raw/ untreated and RTE food.
- Use of separate complex equipment, such as vacuum-packing machines, slicers, and mincers for raw/ untreated and RTE food.
- Handwashing using a recognised technique. Anti-bacterial gels and

[53] As defined in the Glossary.
[54] As defined in the Glossary.
[55] http://www.food.gov.uk/foodindustry/regulation/hygleg/hyglegresources/cookretailscotland/cooksafe/
[56] http://www.food.gov.uk/foodindustry/regulation/hygleg/hyglegresources/cookretailscotland/retailsafe/
[57] http://www.food.gov.uk/foodindustry/regulation/hygleg/hyglegresources/sfbb/

wipes must not be used instead of thorough handwashing.

- Disinfectants and sanitisers must meet recognised outcome standards and be used as instructed by the manufacturer.

Domestic kitchens

Control measures in the domestic kitchen rely on consumers' knowledge of how to control cross-contamination between raw/untreated and RTE foods, and hand hygiene. Since 2001, the FSA's Food Hygiene Campaign has promoted the simple 4Cs principles (**C**leaning, **C**ooking, **C**hilling and avoiding **C**ross contamination) to improve consumer awareness of good food hygiene. These principles also continue to form the basis for the annual FSA-led Food Safety Week initiative.

Outdoor settings/animal visitor attractions

An Industry Code of Practice has recently been published entitled 'Preventing or controlling ill health from animal contact at visitor attractions'[58]. This details the location of eating areas within such sites and the provision of appropriate signage/ facilities to discourage visitors from eating in animal contact areas and promote hand washing after animal contact and before eating or drinking.

7.2(b) Recommendations: new control measures

7.1 - FSAS should ensure that LAs receive appropriate training on FSA UK cross-contamination guidance and that guidance is disseminated to all relevant industry sectors in Scotland.

7.2 - FSAS should ensure that effective cross-contamination control is prioritised in LA enforcement of retail and catering businesses handling raw/ untreated and RTE food (i.e. handling both potentially contaminated foods, and foods not subject to subsequent treatment); and that implementation of cross-contamination controls is subject to ongoing review through the LA audit programme.

7.3 - FSAS and LAs should ensure that, where possible, catering specifications for schools, care homes and hospitals take into account the principles of the cross-contamination guidance.

7.4 - FSAS and REHIS should ensure that the principles of the cross-contamination guidance are embedded in training materials and guidance for food businesses in Scotland.

7.5 - SG should liaise with REHIS and SoCOEHS to ensure that LAs continue to disseminate the new Industry Code of Practice 'Preventing or controlling ill health from animal contact at visitor attractions'[59] to all relevant businesses in Scotland.

7.3 Monitoring compliance

7.3(a) Current position: monitoring compliance

Manufacture, retail and catering

The requirements of Regulations (EC) No. 852/2004 which applies to retail and catering businesses producing RTE foods are enforced by LAs. The implementation of food safety controls relevant to this step is monitored by FSA through the results of food law enforcement activities, which are collated and published by FSA through LAEMS. FSA also conducts annual audits to monitor the enforcement of this legislation, which now include an

[58] http://www.face-online.org.uk/CodeofPractice
[59] http://www.face-online.org.uk/CodeofPractice

element of 'reality checks' involving visits to a sample of food premises to assess the scope and performance of inspections. The reports of these audits are published on FSA's website.

In Scotland, the results of inspections conducted by LAs on catering businesses are also made publically available through the Food Hygiene Information Scheme (FHIS)[60], whereby food businesses are given a hygiene score ('pass' or 'improvement required') based on the results of inspections conducted to check compliance with food hygiene legislation.

In 2012, FSA conducted research to evaluate the impact of the cross-contamination guidance on industry and enforcement authorities across the UK. This assessed the levels of awareness of the risks relating to *E. coli* O157 and cross-contamination and how industry and enforcement practices have changed as a result of the guidance. The implementation of the guidance in Scotland is subject to on-going review.

Domestic kitchens

There are no legal requirements for consumers in their own homes to comply with the measures described for this step and therefore no means by which the relevant controls can be monitored in domestic kitchens. However, FSA monitors consumer awareness of food safety messages disseminated through its Food Hygiene Campaign through its surveys on public attitudes, statistics on visits to the relevant websites, and evaluation of media campaigns and news stories.

7.3(b) Recommendations:
new monitoring of compliance

7.6 - FSAS should feed back to the VTEC/*E. coli* O157 Action Group the outcome of its evaluation of the impact of the cross-contamination guidance in Scotland.

7.4 Evaluating effectiveness

The effectiveness of controls to prevent the contamination of treated food could be evaluated by measuring the prevalence of VTEC or indicator bacteria in RTE foods at retail and catering.

LA sampling programmes routinely include the testing of RTE foodstuffs for faecal indicator organisms and occasionally VTEC. This data is recorded on the UK Food Surveillance System (UKFSS), which is currently used by 29 out of the 32 LAs in Scotland. UKFSS data indicates that, between 2008 and 2011, less than 500 samples of RTE food were tested annually in Scotland for the presence of *E. coli* O157, none of which was positive. Since 2008, over 3000 food samples and environmental swabs have been tested annually for the presence of non-pathogenic *E. coli*, with an overall failure rate of less than 3%.

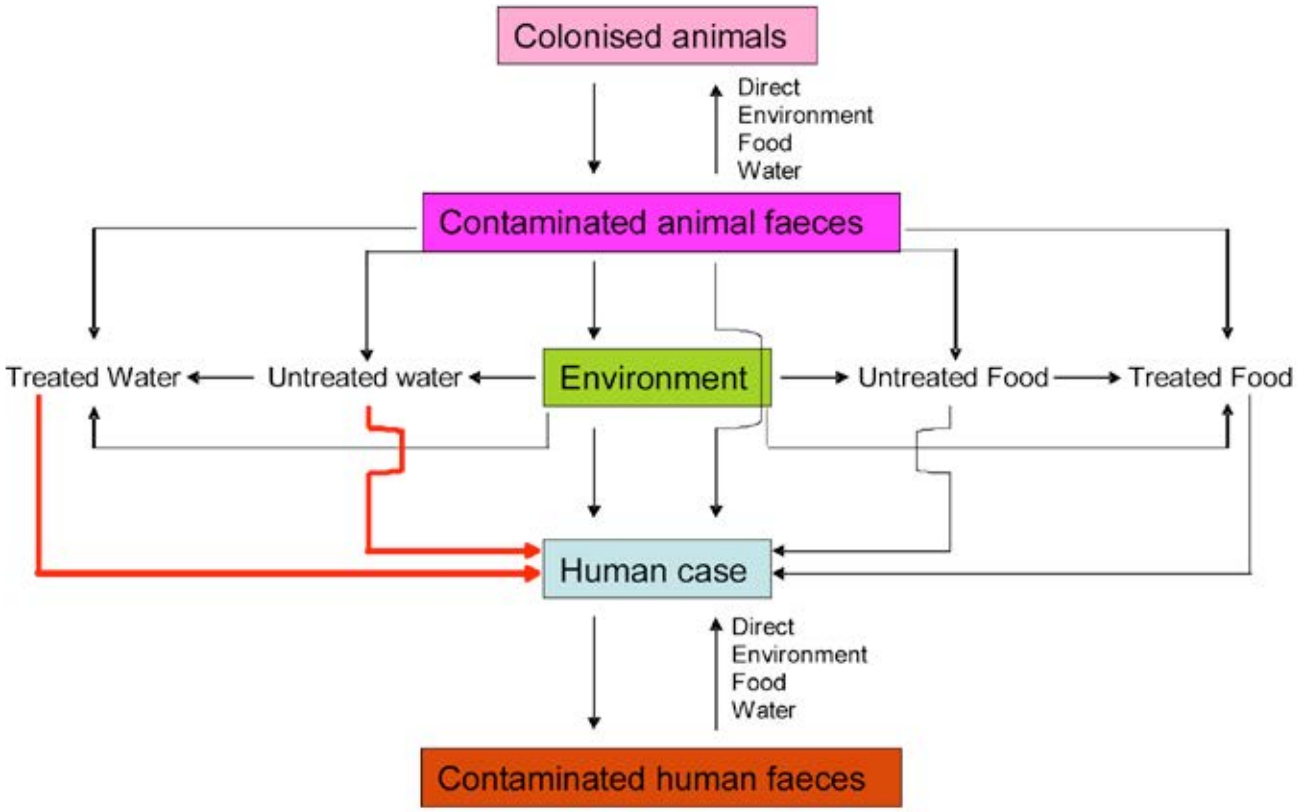
The absence of specific legislative end-product standards for VTEC in foods, coupled with its rare occurrence and low prevalence in the foodchain, limits the value of conducting ongoing VTEC surveillance of food.

It is not currently possible to establish the extent to which the consumption of

[60] http://www.food.gov.uk/scotland/safetyhygienescot/foodhygieneinfoscot/

contaminated RTE foods contributes to human infection in Scotland from existing disease surveillance. However, estimating the proportion of cases that may be attributable to foodborne transmission requires carefully designed epidemiological investigation; and as the drivers of foodborne infection are many and complex, changes in case numbers could not be attributed to any one intervention.

8 Controlling the infection of humans from contaminated treated drinking water or untreated water



8.1 Description of steps

This chapter addresses the prevention of infection of humans from contaminated treated and untreated water.

Treated water consists of all drinking water, which has had treatment to improve its quality and includes (but not confined to) disinfection. The term includes all public water supplies and some PWS, and includes:

- Treated drinking water storage tanks and pipelines.
- Water stored within buildings in domestic distribution systems.
- Drinking water supplies (including public water supplies and treated PWS).
- Point-of-use (POU) water coolers (including “bottle-type” water coolers) and bottled water.

Untreated water includes all environmental water and untreated sources of drinking water, for example:

- Lochs and ponds including those used for water sports.
- Man-made or influenced bodies of water such as raw water reservoirs supplying water treatment works on the public water supply and PWS and recreational water facilities.
- Rivers and streams.
- Springs and boreholes (including those used for drinking water).
- Run-off water.
- Bathing and shellfish waters.

Drinking water includes:

- All public water supplies;
- All PWS (treated or untreated);
- POU water coolers and bottled water – neither of which will be mentioned further, as they involve very low VTEC risk, and are highly unlikely to be contaminated by the routes that might contaminate other treated water sources.

The step from drinking water to human infection in the pathway from colonised animals is much less critical than the assurance of uncontaminated drinking water, as once treated drinking water is contaminated there is little scope for the prevention of human infection other than boiling water. The step from contaminated drinking water to the human case is its consumption without further treatment. The step from contaminated untreated environmental water to human infection is deliberate or accidental consumption.

8.2 Control measures

8.2(a) Current position: control measures

Once contamination of treated drinking water has occurred, opportunities for prevention of human infection are limited; the only realistic control measure being the rapid identification of the contaminated water supply through sampling and analysis, additional disinfection of the supply, boiling water and the prevention of consumption until the cause of contamination has been identified and rectified.

SW in collaboration with others developed the Scottish Waterborne Hazard Plan, an emergency management system.

In the event of an incident involving microbiological contamination of drinking water, SW may issue a boil water notice at the request of the NHS board in whose area the incident is occurring. The decision on the need for a boil notice is the responsibility of NHS boards, with SW providing specialist technical information and advice to the Health Board and implementing the request. LAs will routinely be involved in incidents and emergency planning due to their specialist environmental health roles including food retailers and manufacturers. The DWQR may be requested to act as an impartial observer during Incident Management Team (IMT) meetings and on conclusion of incidents will investigate and determine whether enforcement action against SW is necessary.

Where faecal indicators such as *E. coli* are detected through PWS sampling,

LAs contact the affected persons and advise them to boil water for particular activities. LAs and Health Boards meet regularly and LAs routinely advise Health Boards of samples which fail standards. Some LAs use the standard boil notice leaflet which is provided in the Scottish Government PWS Technical Manual, while others have modified the leaflet for their own use.

The 2006 Regulations require an information notice to be displayed in premises with PWS where the supply is used as part of a public or commercial activity. The DWQR is aware that many premises do not display this notice, thereby not allowing consumers the option of avoiding using the supply or taking precautions. It is recommended that local authorities actively promote compliance with this requirement.

In the case of treated drinking water, control consists of sampling and analysis of the supply, the rapid identification of the source and extent of the contaminated water supply and either the prevention of its further consumption or the introduction of temporary control measures such as treatment (e.g. additional disinfection at service reservoirs) or boil water notices, until the cause of the contamination has been identified and rectified.

In the case of untreated PWS, control consists of the same initial steps to identify the contaminated water supply, and either the rectification of the cause of contamination, disinfection, installation of appropriate water treatment or advice to the owners or users of the supply to boil water until the supply is made safe.

The Water (Scotland) Act 1980 gives local authorities powers to require SW, where practicable, to provide an alternative supply of water e.g. in a tank or bowser. This is at the expense of the PWS owner or user.

In the case of environmental water, control entails public education about the risks of consumption. These are currently insufficient, as drinking untreated environmental water (e.g. from burns or rivers) is commonplace particularly in outdoor activities – including private, commercial and educational. There is a need to address this.

8.2(b) Recommendations:
new control measures

8.1 - SG should produce guidance warning against the drinking of untreated environmental water (e.g. from burns or rivers) by individuals undertaking commercial, educational or other outdoor activities.

8.3 Monitoring compliance

Compliance is currently monitored by including in outbreak reports the time taken for the association of cases with exposure to treated or untreated water to be suspected, and control measures implemented.

8.4 Evaluating effectiveness

8.4(a) Current position:
evaluating effectiveness

The only measures of the effectiveness of existing controls to prevent the infection of humans from contaminated treated or untreated water are sampling and analysis of the supply and HPS VTEC and outbreak surveillance systems. However, this cannot evaluate the effectiveness of control measures

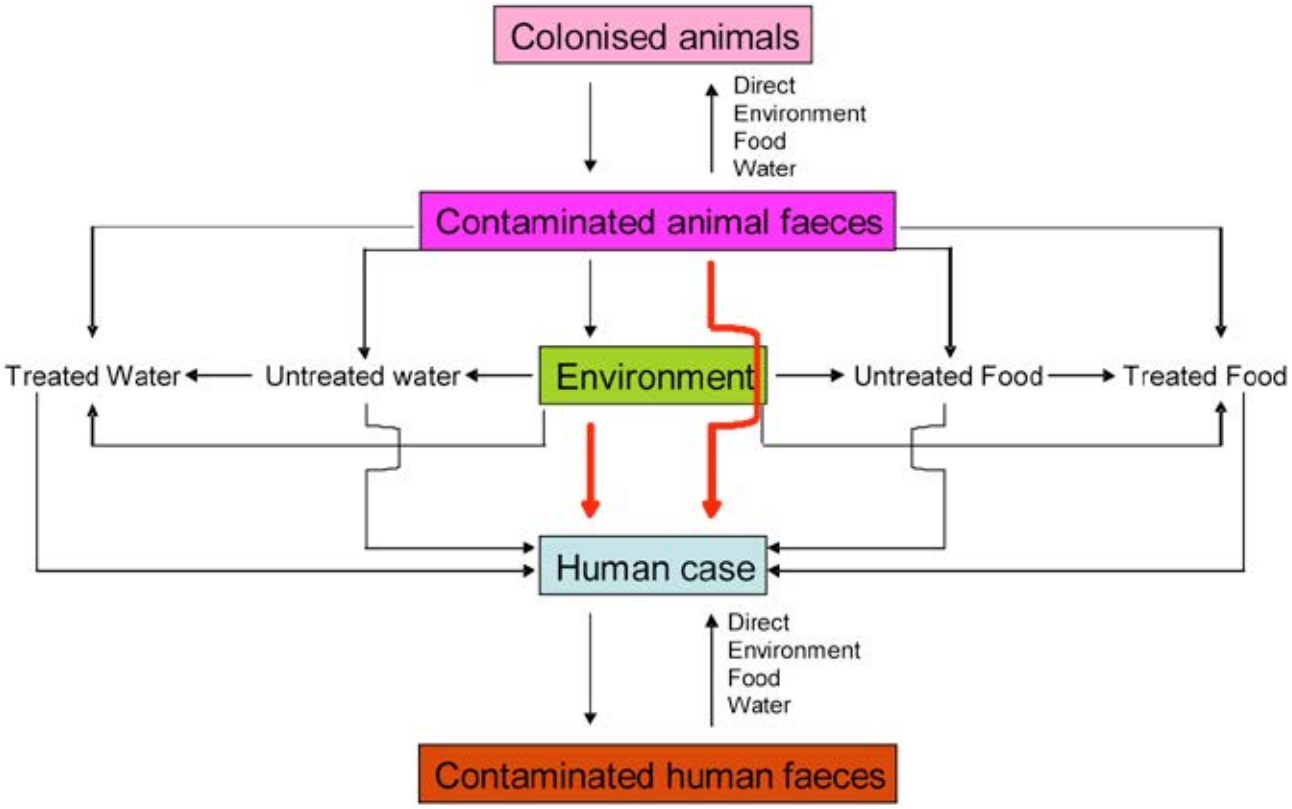
preventing the infection of humans by drinking water in isolation.

Outbreak surveillance can help evaluate the effectiveness of the rapid identification, and management of outbreaks in which water is suspected to be the source or vehicle but only if the time between the occurrence of cases, the identification of the outbreak and the introduction of control measures is documented.

8.4(b) Recommendations:
new evaluation of effectiveness

8.2 – SG should request Health Boards to ensure that IMT reports documenting outbreaks of VTEC infection due to contaminated drinking water should include not only an estimate of the speed with which control measures were applied, but also an estimate of their effectiveness.

9 Controlling the infection of humans from the environment or from contaminated animal faeces



9.1 Description of steps

Human cases can be infected by contact with animal faeces either directly or as a result of contact with an environment contaminated by them. Exposures may be residential, occupational or recreational. Contaminated animal faeces and environments are major sources of VTEC and are important in both sporadic infections and outbreaks. VTEC and other zoonotic pathogens may be present in the rural environment throughout the year. Chapter 3 addresses the measures necessary to control contamination of the environment; this chapter assumes the environment to be contaminated and describes the consequent control measures. Some environments pose a potential risk for transmission of VTEC because they may be contaminated by cattle, sheep or goat faeces, especially if: the animals or their faeces are present in larger quantities; if the animals are excreting more organisms because they are young or stressed; or if these environments are lived in or visited by people of young age, or

in large numbers. The list below gives some examples but is not exhaustive, as any environment that may become contaminated by animal faeces may pose a risk for human infection:

- Animal visitor attractions e.g. Open farms/farm parks; animal petting/handling areas within other attractions (including zoos); educational establishments e.g. city farms; working farms with livestock that occasionally open to the public e.g. for school visits, Open Farm Sundays, etc; rare breed/rescue centres; markets, agricultural shows or country fairs where livestock are present; mobile menageries or petting/handling enterprises; other visitor facilities where the public have animal contact, even if (like stables) they represent a lower risk of VTEC carriage than premises with ruminants; and any picnic/play areas these attractions include that could be contaminated e.g. by faeces tracked in by humans or animals.
- Private farms that are not open to the general public in an organised sense, but which may have social or occupational visitors, or where the public may walk through farmyards or grazing land.
- Abattoirs and other meat or animal product facilities.
- Houses, gardens or other non-farm residential or other public premises adjoining the above.
- Farm vehicles or equipment; slurry or animal transporters; and other vehicles.
- Rural footpaths, roads, verges, tracks, and fields; and fences, gates or stiles on or by grazing.
- Machairs, beaches, sea shores, rivers, lochs or bathing water where ruminants may graze.

9.2 Control measures

The most effective generic control measure to avoid human cases occurring as a result of contact with animal faeces or environments contaminated by them is scrupulous personal hygiene (e.g. removing work or other outerwear and washing hands, after being in contact with animals or with any environment, water etc that might have become contaminated by their faeces, especially before eating or drinking or entering domestic or food preparation areas). This can only be achieved by modifying the public's behaviour. The strategies to achieve this are addressed in the section on Communications.

Control measures to protect the public are currently very scanty, consisting of advice and guidance such as hand-washing after animal/environmental contact, before eating or preparing food, and removal of work clothes and footwear before entering home/food preparation areas.

The new Industry Code of Practice covers school visits to animal visitor attractions[61] and highlights what teachers and others who organise visits for children can do to prevent infection with zoonoses such as VTEC. The importance of handwashing should be emphasised to children at an early age, especially after touching animals and before eating and drinking. As a general

[61] http://www.face-online.org.uk/CodeofPractice

requirement under the Health and Safety at Work etc Act 1974, farm and other animal visitor attractions should provide clean water for handwashing.

9.3 Monitoring compliance

9.3(a) Current position: monitoring compliance

The only measure in place to control human infection from the environment and animal faeces is health protection education. The compliance of agencies and the public with the messages in the education can only be measured by surveys of their activities.

Most animal visitor attractions are commercial operations, the primary purpose of which is leisure/entertainment, at which visitors are encouraged to have hands-on contact with animals. Responsibility for enforcing health and safety legislation at such premises falls to the LAs by virtue of the Health & Safety (Enforcing Authority) Regulations 1998. However, there are a small number of equivalents to animal visitor attractions on premises whose main activity is as an agricultural undertaking, for which enforcement falls to HSE.

9.3(b) Recommendations:
new monitoring of compliance

9.1 – The Communications Strategy Group to be convened by SG (see Section VIII) should undertake a snapshot survey of compliance with the provision and application of health education materials and guidance on reducing VTEC risk via personal hygiene.

9.2 – The Communications Strategy Group should then take action based on the findings of the survey of compliance with the provision and application of education and guidance on personal hygiene (see Recommendation 9.1 above) and feed back to the VTEC/*E. coli* O157 Action Group.

9.4 Evaluating effectiveness

9.4(a) Current position:
evaluating effectiveness

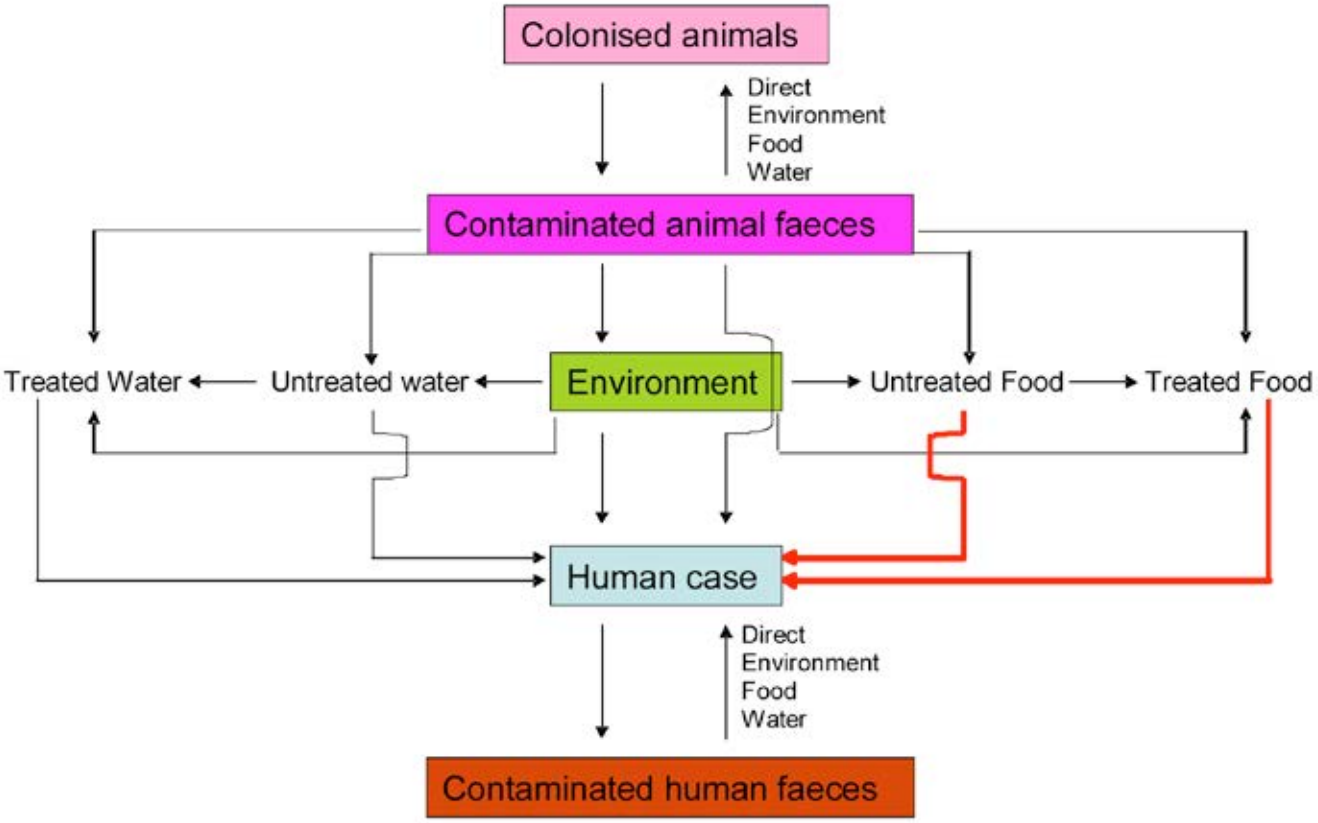
The effectiveness of the implementation of guidance in modifying the public's behaviour can only be achieved as part of a public information campaign and through inspection by HSE/LA. The compliance of agencies and the public with the messages in the education can only be measured by surveys of the public's knowledge attitude and behaviours.

9.4(b) Recommendations:
new evaluation of effectiveness

9.3 – The Communications Strategy Group should undertake a snapshot survey of the effectiveness of health education materials and guidance on reducing VTEC risk via personal hygiene.

9.4 - The Communications Strategy Group should then take action based on the findings of the survey of the effectiveness of education and guidance on personal hygiene (see Recommendation 9.3 above) and feed back to the VTEC/*E. coli* O157 Action Group.

10 Controlling the infection of humans from contaminated untreated or treated food



10.1 Description of step

This chapter addresses the prevention of infection of humans from contaminated food. The prevention of contamination of food is dealt with in chapters 6 and 7. Once food is contaminated the only way to minimise the risk of human infection is through the application of treatment capable of eliminating VTEC risk. Where this has not been applied, the only means of preventing human infection is through rapid identification of the contaminated food and its withdrawal or recall from the market. Cases can also be reduced by rapid detection and effective management of outbreaks.

10.2 Control measures

10.2(a) Current position: control measures

Under Regulation (EC) No. 178/2002, FBOs are required to immediately withdraw and/or recall food from the market if it is not in compliance with food safety requirements and to inform the Competent Authority (FSA and relevant LA). Where the

unsafe food may have reached the final consumer, the FBO must inform consumers effectively and accurately of the reasons for the withdrawal of the product. The FBO must also recall the food from consumers where other measures are insufficient to protect their health.

For consumers to protect themselves from foodborne VTEC risks, it is critical that they are aware, through proper labelling, whether a food is RTE or whether it requires washing, peeling or cooking. EU regulations require most pre-packed food to be clearly labelled with appropriate instructions for use, including the need to cook thoroughly prior to consumption. With regard to RTE cheeses made from unpasteurised milk it is important that consumers are able to identify such products in order that they can make an informed choice in relation to the potential risk. This is particularly important when the food is intended for people whose health status puts them at increased risk of infection or severe consequences. Regulation (EC) No. 853/2004 requires products made with unpasteurised milk to be labelled clearly with the words 'made with raw milk'. Cheeses not pre-packed but sold loose (e.g. at a market or delicatessen), require this information to be displayed at the counter, although there is no legal requirement for it to accompany the product after sale.

Heat treatment is the most effective control measure for eliminating VTEC in foodstuffs, and applies to the cooking of meat, vegetables and fruit, and the pasteurisation of dairy products.

Minced meat, burgers and rolled joints present a particular risk as any bacteria present on the surface of the meat are distributed throughout the product, and therefore require thorough cooking prior to consumption. FSA guidance recommends cooking minced meat products to a temperature of 70°C for 2 minutes or equivalent[62], and promotes consumer awareness of safe cooking practice on an ongoing basis through its Food Hygiene Campaign activities.

Vegetables and fruit which are not sold as RTE, particularly those which are visibly contaminated with soil and have not been produced in accordance with GAP should always be washed or peeled prior to consumption. Although washing and peeling cannot be relied upon to eliminate the microbiological risk these steps will help to reduce the numbers of bacteria which may be present on the surface. In recognition of the potential risks associated with soil contamination on produce, FSAS began a campaign in 2011 to remind consumers of the importance of washing vegetables and fruit which are not supplied as RTE[63].

10.2(b) Recommendations: new control measures

Recommended new control measures for this pathway are communications strategies outlined in Section VIII of this document.

10.3 Monitoring compliance

10.3(a) Current position: monitoring compliance

The requirements of Regulation (EC) No. 852/2004 which applies to retail and catering businesses producing RTE

[62] http://www.food.gov.uk/multimedia/pdfs/acmsfburgers0807.pdf

[63] http://www.food.gov.uk/scotland/aboutus_scotland/pressreleases/2011/nov/vegcampaignscot

foods are enforced by LAs. The results of inspections conducted by LAs on catering businesses in Scotland are published through the FHIS.

It is not possible to monitor whether the general public are compliant with the actions which are necessary to control VTEC in domestic kitchen environments. However, FSA monitors consumer awareness of food safety messages disseminated through its Food Hygiene Campaign via surveys on public attitudes, statistics on visits to the relevant websites, and evaluation of media campaigns and news stories.

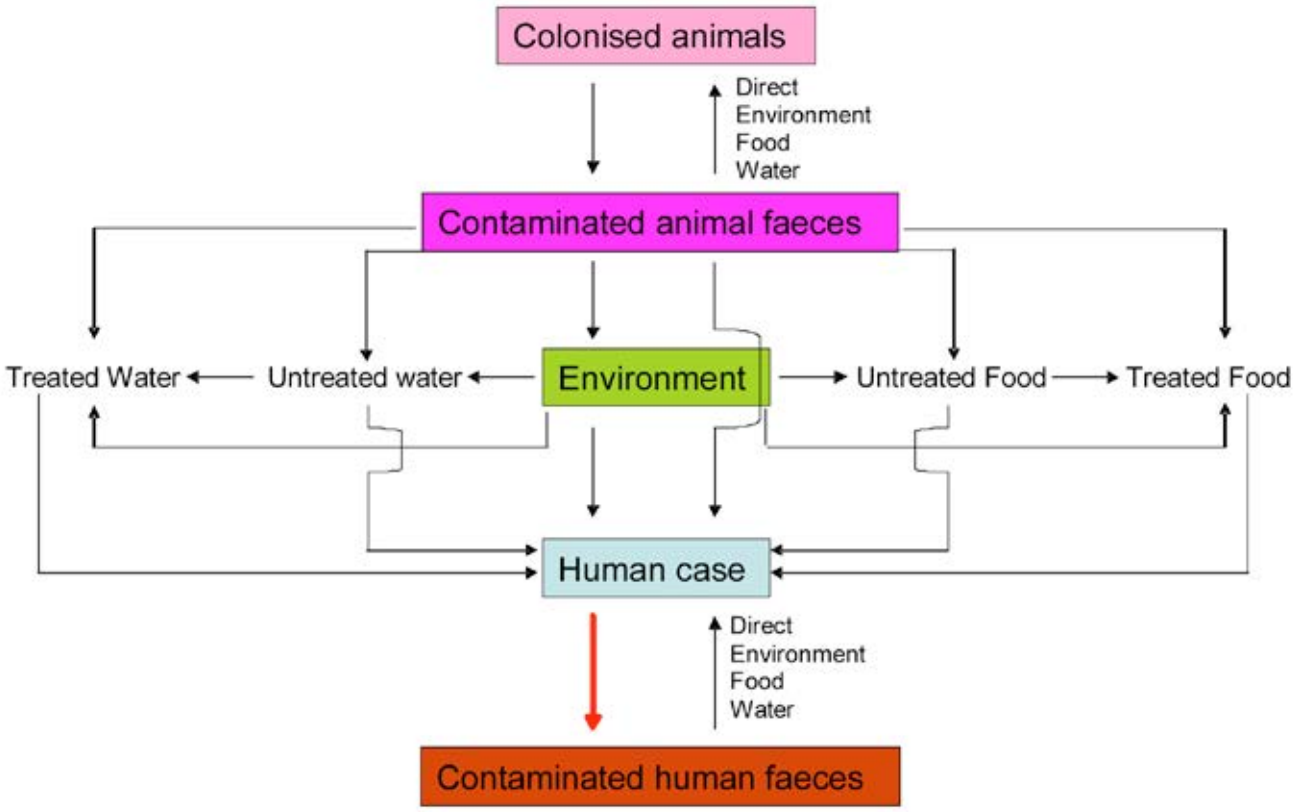
10.3(b) Recommendations:
new monitoring of compliance

10.1 - FSAS and LAs should review the display of point of sale information for unpasteurised cheeses sold loose in Scotland (including those served in restaurants) to ensure consumers are able to make an informed choice.

10.4 Evaluating effectiveness

The effectiveness of controls applied to this step may be evaluated through measuring the level of public awareness of food hygiene messages, and ultimately, through a reduction in the number of foodborne outbreaks and sporadic cases which may be attributed to food. However, estimating the proportion of cases that may be attributable to foodborne transmission requires carefully designed epidemiological investigation; and as the drivers of foodborne infection are many and complex, changes in case numbers could not be attributed to any one intervention.

11 Controlling the excretion of contaminated human faeces



11.1 Description of step

Contaminated human faeces are excreted not only by symptomatic cases of VTEC infection, but also by asymptomatic, post-symptomatic, and possibly pre-symptomatic cases. A small number of cases identified by HPS enhanced surveillance have continued to excrete the organism for more than 3 months after their symptoms have ceased. Evidence from HPS surveillance, and outbreak investigations in Scotland, also supports the contention that pre-symptomatic excretion occurs, but available data are limited.

This chapter considers the measures for controlling the excretion of contaminated faeces. Chapter 12 then goes on to describes the measures for preventing the acquisition of infection from contaminated human faeces.

11.2 Control measures

11.2(a) Current position: control measures

For symptomatic cases, the mainstay of controlling the excretion of contaminated faeces is the early suspicion diagnosis and treatment of VTEC infection The quicker cases recover, the shorter the duration of excretion.

Early suspicion requires alertness to the diagnosis on the part of clinicians. Bloody diarrhoea of acute onset with no other apparent cause in children should always be considered as a medical emergency.

Early diagnosis and treatment require rapid access to care and early intervention to reduce risk of transmission. Microbiological confirmation of the clinical diagnosis also requires alertness to the guidance recommending routine screening of diarrhoeal stools, in a range of health care settings including general medical, surgical, and gastrointestinal units, as well as GP surgeries and A&E units. Microbiological confirmation of non-O157 VTEC strains is generally less rapid, as they are only detectable by the more sensitive testing in use at the Scottish *E. coli* O157/VTEC Reference Laboratory (SERL); and this in turn relies on appropriate, and speedy, forwarding to SERL, of locally negative stools from clinically suspicious cases. Enabling local laboratories to detect non-O157 strains would raise significant issues e.g. around the feasibility and reliability of locally-achievable tests, and ensuring nationally-standardised results and reporting. Measures to facilitate speedier forwarding of locally negative stools may therefore offer more easily accessible advantages.

There are no practical control measures for preventing the excretion of contaminated faeces by pre-symptomatic cases. In the first place they are difficult or impossible to identify: in the second the strategies recommended for asymptomatic and post-symptomatic cases are either unproven (probiotics) or unproven and generally inappropriate (antibiotic therapy).

Administering antibiotics and probiotics to control the excretion of contaminated faeces by asymptomatic (Jensen et al., 2005) and post-symptomatic individuals has been suggested but there is no good evidence of their efficacy and they cannot be recommended, because in confirmed, probable, or suspected VTEC infection, antibiotics should not be administered. There is no evidence to suggest that antibiotics improve the clinical course of infection. Indeed, children and adults may suffer a higher rate of HUS when given antibiotics. Anti-motility agents and opioid narcotics should also be avoided as these have also been associated with a risk of HUS and neurological complications.

11.2(b) Recommendations: new control measures

11.1 - SG should commission a group to produce clinical guidance for clinicians, especially GPs, providing advice on the early diagnosis and management of suspected VTEC infection. This group should identify methods for monitoring compliance with its guidance, and for evaluating its effectiveness.

11.2 – SERL, in consultation with diagnostic laboratory representatives, HPS and other relevant stakeholders, should compile a report on current

thinking about the best methods to optimise rapid microbiological confirmation of non-O157 VTEC infection, and feed back to the VTEC/ *E. coli* O157 Action Group.

11.3 Monitoring compliance

There is currently no system to monitor compliance with the control measure we recommend: the early suspicion, diagnosis, and treatment of cases of VTEC infection.

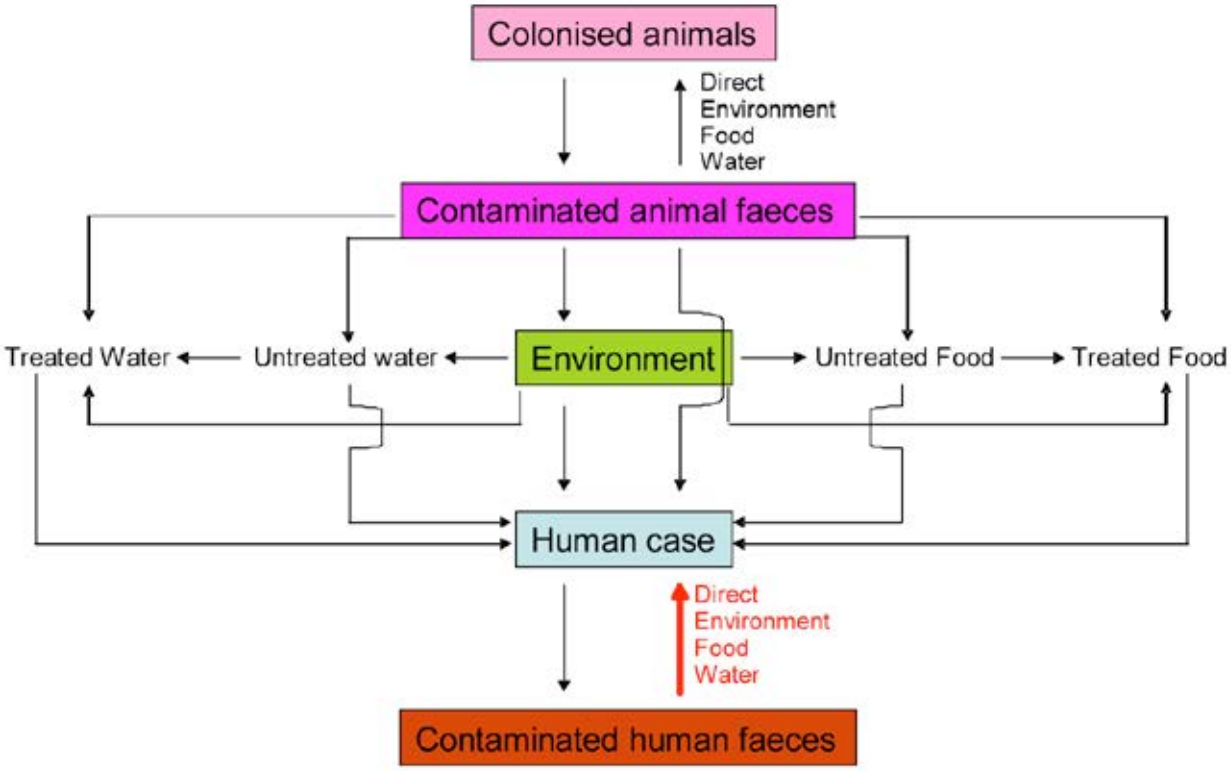
Activity by relevant frontline responders in the NHS cannot be monitored by any extant surveillance, and new systems to do so would be difficult and inordinately expensive to run. The only practical way to monitor compliance, therefore, would be to conduct occasional surveys (e.g. of GPs) to ascertain their practice, or special studies of confirmed cases to determine at what stage of their patient journey their diagnosis was suspected and diagnosed, and whether it was appropriately managed at these stages.

SERL has already undertaken periodic reviews of the criteria on forwarding locally negative stools from clinically suspicious cases. Measuring compliance with these criteria would also require a special study; and investigating the forwarding decisions for every bloody stool submitted, even to a single diagnostic laboratory over a given time frame, could be a sizeable and resource-consuming task. We do not recommend such a study as it would require disproportionate resources.

11.4 Evaluating effectiveness

There is currently no system in place for evaluating the effectiveness of early suspicion and diagnosis. Like monitoring compliance, this can only be achieved with special studies.

12 Controlling the infection of humans from contaminated human faeces via food, water, the environment, or directly



12.1 Description of pathway

Human infection with VTEC from the faeces of an infected person occurs either directly or indirectly via the environment, food, or water of any type.

Direct transfer from contaminated human faeces is usually by hand to mouth spread. Indirect transfer via the environment is usually via surfaces (especially in kitchens or bathrooms) or items such as towels. Indirect transfer via food is usually via RTE foods[64], or via foods which although purchased not RTE, have been cooked, washed or peeled by the caterer or consumer (including hand-transferred cross-contamination e.g. whilst working with animals). Transfer via untreated food which is then inadequately treated may also occur. Transfer from contaminated human faeces via drinking water or environmental water is unlikely, but

[64] As defined in EU Regulation (EC) No. 2073/2005

transfer via swimming pool water poses a particular risk. There is also potential risk from human excretion during countryside activities e.g. in burns, woodland, walking areas or beaches, as well as potential for leakage from inadequate septic tanks.

Direct and indirect infection via the environment and food is facilitated by deficiencies in the hand hygiene of either the case or those caring for them, particularly if the case is very young, physically incapacitated or unable to maintain good hygiene for other reasons.

12.2 Control measures

12.2(a) Current position: control measures

Current control measures are reliant on:

- Early identification and diagnosis of cases and identification of contacts, including:
  - Early application by medical practitioners of low thresholds for suspecting and testing for VTEC when symptoms suggest gastroenteritis of infectious aetiology.
  - Rapid microbiological confirmation of infection, to inform or confirm the application of infection control procedures.
  - Referral by clinicians and microbiologists of locally negative stools from clinically suspicious cases to the Scottish *E. coli* O157/ VTEC Reference Laboratory.
- Early provision of infection control advice by all relevant front line responders in the NHS and environmental health to cases with suspected infectious gastroenteritis, and their families or carers, without awaiting confirmation of microbiology or of an outbreak.
- Provision by LAs, HPTs, and other relevant agencies of information on infection control, food hygiene and other control measures to residential institutions, nurseries and other facilities.
- Knowledge and strict application of:
  - Personal hygiene and cleaning, in private homes, workplaces, residential institutions, nurseries, schools, hospitals, etc.
  - Food hygiene and food safety practice.
  - Water treatment legislation, regulation and procedures.
  - Swimming pool water legislation and guidance.
  - Other national guidance such as the Public Health Management of Infection with VTEC; Prevention and Control of Infection in Childcare Settings.
  - The Sludge Regulations 1989 regarding any use of sewage sludge on farmland.
  - The Safe Sludge Matrix (agreed between the British Retail Consortium, Water UK and ADAS) provides Guidelines for the Application of Sewage Sludge to Agricultural Land. Regulations for use of compost and anaerobic digestate Regulation (EC) No. 1069/2009.
- Provision of adequate handwashing, cleaning and other facilities in settings described above.

- Reducing the number of people potentially exposed to the faeces of an infected person e.g. by:
  - Strict application of VTEC guidance on excluding cases or contacts who are at special risk of passing on infection[65] – this includes exclusion from nursery or school, or from food handling or personal care work etc.
  - Cohort nursing and other infection control measures in hospitals/ residential institutions.
  - Ensuring protective measures are in place for those at higher risk of acquiring infection[66] e.g. teaching effective handwashing to children, and ensuring they do not share towels used by known or suspected cases.

12.2(b) Recommendations:
new control measures

None. This pathway is comprehensively addressed by existing control measures, which should be effective if correctly applied.

12.3 Monitoring compliance

12.3(a) Current position:
monitoring compliance

There are no widely available data at national level from systems currently monitoring compliance in this area. Establishing new national monitoring systems could be prohibitively complex and costly.

12.3(b) Recommendations:
new monitoring of compliance

12.1 – SG should investigate the options for collecting and publishing any existing local data on compliance with current control measures to prevent human infections from contaminated human faeces via food, water the environment or directly, using a national format; or, if that is insufficient, conducting occasional surveys of compliance e.g. by front line NHS staff, HPTs or LAs, or via special studies of confirmed cases e.g. of nurseries, care homes, etc.

12.4 Evaluating effectiveness

12.4(a) Current position:
evaluating effectiveness

There are no widely available data at national level from systems currently evaluating effectiveness in this area.

12.4(b) Recommendations:
new evaluation of effectiveness

12.2 – SG should investigate the options for evaluating effectiveness to prevent human infections from contaminated human faeces via food, water the environment or directly, using either (a) any existing local data that could be collected and published using a national format; or (b) occasional surveys e.g. of front line NHS staff, HPTs or LAs, or special studies of confirmed cases, nurseries, care homes etc.

[65] As defined in the Glossary.
[66] As defined in the Glossary.

VIII.

PROPOSALS FOR RISK COMMUNICATION AND HEALTH EDUCATION

Communication of risk and preventive measures are essential to risk reduction. Communication strategies should target those groups:

- Who are most vulnerable to infection or its consequences
- Where the greatest reduction in case numbers is likely to be achieved

Communication strategies should be those that most effectively promote the required knowledge, attitudes and behaviours, to comply with the current and new control measures described in the Action Plan.

Current Position

Epidemiological data and expert reports indicate the main risk factors for VTEC and associated target audiences for risk communication and health education, as summarised below:

Risk Factor	Target Audiences
Livestock/ animals and their environments	Farming and other rural residents. Farm/agricultural and other rural workers; animal handlers; veterinarians. Visitors to the countryside or to animal visitor attractions[67]; rural activity groups e.g. scouts, walkers, sporting groups. Proprietors of animal visitor attractions[66], or farmland used by walkers, etc. Organisers of farm visits, events in rural areas, on pasture, etc.
Food	Food handlers (occupational and domestic) and consumers. Food production workers eg abattoirs, food processing plants. LA staff or others involved in inspection and enforcement
Private Water Supplies	PWS owners and users. LA staff or others involved in inspection, operation, maintenance, treatment installation, etc. Visitors to properties supplied by PWS. Land users, farmers, forestry workers.
Secondary spread	Cases, their households, carers, relatives, and social contacts. GPs, other frontline medical practitioners, and other health and social care staff. Proprietors and managers of child care facilities, care homes, etc.

[67] As defined in the Glossary.

A wealth of information on VTEC is currently available from various sources. It can be either specific to VTEC, or generic e.g. general prevention of food borne, zoonotic or gastrointestinal disease. It covers most of the target audiences, using various formats e.g. web pages, leaflets and professional guidelines. For more detail about the information available, including sources, types and target audiences, see Online Appendix (iii). The perceptions and attitudes of certain groups to VTEC risks have also been investigated. There are nonetheless gaps and inconsistencies, and an integrated VTEC risk communication strategy should therefore address:

- Undertaking risk communication needs assessment of both the population and target groups.
- Reviewing all research on attitudes to and perceptions of risk.
- The lessons learned from major investigations and inquiries.
- Analysing and assessing the content of current risk communication materials.
- Options for nationally co-ordinated advice on topics that may be covered differently by different HBs or LAs at present (e.g. infection control advice to cases, households and carers).
- Promoting a joined up approach between key agencies to ensure consistent content/ quality.

Recommendation

C1 - SG should convene a Communications Strategy Group to develop and support the implementation of a comprehensive communication strategy for VTEC involving all the key agencies, and feed back to the VTEC/*E. coli* O157 Action Group.

Implementation of the strategy will be across a matrix of both generic and targeted approaches and will take into account social marketing methodology aimed at a sustainable change in attitudes and behaviours. Specific components that should be considered for inclusion in the strategy are:

Rural Households, Workers or Visitors, Proprietors/Inspectors of animal visitor attractions[68]

C2 - SG with NFUS should ensure VTEC risks are covered in communication with landowners and the public on access to and recreational use of pasture/intensively grazed land.

C3 - SG should develop information and resources for the public about VTEC risks, which may also help to reduce risk from other zoonoses; this should include: advice on supervision of children; the importance of hand washing after contact with animal and rural environments, and before eating, drinking or preparing food; and what constitutes effective handwashing (including advice against relying on anti-bacterial hand gels or wipes).

Food Handlers and Consumers (Occupational and Domestic)

C4 - FSAS and LAs should continue to highlight the risks associated with undercooked minced meat products, and promote advice on safe cooking.

C5 - FSAS should ensure that consumers and caterers continue to be reminded of the potential risks associated with vegetables and

[68] As defined in the Glossary.

fruit that are not supplied as RTE, and how these products should be prepared prior to consumption.

C6 - FSAS should continue to ensure that the practices that lead to effective cross contamination control are promoted in food hygiene communication activities, including annual Food Safety Week initiatives.

C7 - FSAS, in partnership with other stakeholders such as REHIS, should ensure that hand hygiene is prioritised in strategies for improving health education for food handlers in catering and domestic kitchens.

C8 - SG should liaise with REHIS and SoCOEHS to ensure that LAs and HPTs continue to provide information and guidance on preventing contamination of food by human faeces in both private households and commercial premises.

Private Water Supply Owners and Users, and Relevant LA and Health Protection Staff

C9 - SG, LAs and REHIS, with input from DWQR and HPS, should develop educational materials to promote risk awareness and management for all PWS owners or users.

C10 – SG should ensure that their resources for PWS owners and users include advice on early reporting of diarrhoeal illness (as this is the best way to promote early identification of contaminated supplies); prompt issuing and implementation of boil water notices; and guidance on risk communication for Health Protection Teams and LAs.

C11 - SG should consider integrating advice on PWS into generic resources such as the SG leaflet 'Shedding Light on *E. coli* O157'.

C12 - SG, SEPA and other key stakeholders, through the Diffuse Pollution Management Advisory Group (DPMAG), should continue to work in partnership with the farming and forestry sectors in order to maximise the protection of sources of drinking water, and minimise the risk to human health.

Secondary Spread, General Infection Control, Diagnosis and Testing

C13 – SG, in liaison with HPS and FSAS should consider options for raising awareness of the importance of hand hygiene, both generic and targeted at specific settings such as childcare.

C14 - SG should consider specific measures to help young children apply hand hygiene.

C15 - SG should provide advice for frontline NHS and LA staff on achieving early diagnosis of infectious diarrhoea; on the need for low thresholds for suspecting and testing for VTEC, especially in acute onset bloody diarrhoea; on the issues for cases with non-O157 strains, who may initially have been told they were negative, based on local laboratory results; and on the need to forward locally negative stools from clinically suspicious cases, to the Scottish *E. coli* O157/ VTEC Reference Laboratory.

C16 - SG should advise frontline NHS and LA staff to provide cases, families and health/ social care staff with advice on hygiene and preventing secondary spread, as soon as infectious diarrhoea is suspected (whether VTEC or other aetiology), without waiting for laboratory confirmation.

IX.

PROPOSALS FOR RESEARCH AND SURVEILLANCE

Despite the considerable resources that have been applied to research into VTEC, many gaps in our knowledge remain. The VTEC/*E. coli* O157 Action Group has identified areas in which further research is required to inform better evidence-based control measures. These include:

Chapters 1 and 2

RS1 – SG, in liaison with other relevant agencies, should regularly monitor developments in research efforts to identify practical and efficacious measures for controlling the excretion of VTEC from animals and feed back annually to the VTEC/*E. coli* O157 Action Group on any potentially useful control strategies.

Chapter 3

RS2 – SG should review available information on proportionate controls to reduce environmental contamination.

RS3 – SG should then consider resourcing, and where appropriate requiring, relevant agencies or groups to implement those any proportionate controls identified by their review on reducing environmental contamination (see Recommendation RS2 above).

RS4 – SG should feed back to the VTEC/*E. coli* O157 Action Group their review of proportionate control measures for reducing environmental contamination, and their conclusions on which (if any) agencies or groups should be resourced and/or required to implement them; and should ensure that simple national monitoring systems are established for each new control measure resulting from this review.

Chapters 6 and 7

RS5 – FSAS should consider funding research to improve understanding of the potential VTEC risks associated with unwashed and unpeeled fruit and vegetables on retail sale and the food safety implications of internalisation of VTEC by plants.

RS6 – HPS should consider research to investigate the contribution to VTEC infection in Scotland, of emerging food risks, including fresh produce and sprouted seeds.

RS7 – FSAS and LAs should ensure that surveillance of VTEC in foods is intelligence led and targeted to evaluating the effectiveness of controls applied to the production of foods which are a known VTEC risk.

RS8 – FSAS and LAs should ensure that food surveillance programmes include microbiological sampling at food premises producing 'at risk' RTE foods, to evaluate the effectiveness of cross contamination controls undertaken at butchers and catering businesses.

RS9 – FSAS – with input from SERL - should consider a review of laboratory provision in Scotland for the testing of *E. coli* and non-O157 VTEC strains in foodstuffs.

Chapter 9

RS10 – SG should commission research into ages of responsibility in children, and should report progress on this to the VTEC Action Group.

RS11 – HPS should consider a case control study to ascertain whether the aetiological fraction has changed since its previous study in 2001.

Chapters 11 and 12

RS12 – SG should consider commissioning a retrospective study to identify at what stage confirmed cases of *E. coli* O157 and non-O157 VTEC infection were suspected, and whether this was at an early enough stage to allow appropriate public health management.

RS13 – SG should consider commissioning a retrospective study to ascertain the dose and duration of excretion in cases who had been suspected and diagnosed early and treated appropriately (cases) compared to cases who had not (controls), and identify differences (if any) between *E. coli* O157 and non-O157 VTEC strains.

RS14 – SG should investigate the options for conducting occasional surveys of compliance with exclusion and other infection control guidance e.g. by front line NHS staff, HPTs or LAs, or via special studies of confirmed cases e.g. of nurseries, care homes, etc.

RS15 – HPS should consider options for research on pre-symptomatic exclusion, for instance whether it is possible to identify any differences in the risk of transmission from infected but asymptomatic individuals, depending on whether or not:

(a) They subsequently develop symptoms.

(b) The period of asymptomatic excretion occurred before their onset of symptoms, or after their own symptoms resolved (in those who become symptomatic at some point).

(c) Infection was due to *E. coli* O157 or non-O157 VTEC strains.

RS16 – SG should investigate options for sentinel or other surveillance of *E. coli* O157 and non-O157 VTEC in ruminants, to improve understanding of the strains circulating in ruminants, and to compare ruminant strains with those occurring in human cases.

RS17 – SG, SERL, HPS and other relevant agencies should consider how molecular epidemiology (including the use of Next Generation Sequencing) may improve understanding of relationships between *E. coli* O157 and non-O157 VTEC strains from ruminants, humans, water, the environment and the foodchain.

X.

APPENDICES

i) Membership of the VTEC/*E. coli* O157 Action Group:

Edward Coyle	NHS Fife (Chair)
Bob Adak	Public Health England
Mark Aitken/Calum McPhail	Scottish Environment Protection Agency
James Beattie	Royal Hospital for Sick Children, Glasgow
Gareth Brown	Scottish Government Health Protection Team (succeeded by Simon Cuthbert-Kerr)
John Coia	Scottish Salmonella Shigella and Clostridium difficile Reference Laboratory
John Cowden	Health Protection Scotland
Lucy Denvir	NHS Dumfries & Galloway
Jim Dixon	Society of Chief Officers of Environmental Health in Scotland
Alison Duncan	Scottish Government Corporate Project Office (Project Support)
Mary Hanson	Scottish *E. coli* O157/VTEC Reference Laboratory
Robert Howe	Royal Environmental Health Institute of Scotland
Helen Howie	Consultants in Public Health Medicine Group
Frances Kelly/David Coackley	Health & Safety Executive
John Locke	NHS Dumfries & Galloway
Mary Locking	Health Protection Scotland
Chris Low/Geoff Foster	Scottish Agricultural College (now SRC)
Ishbel MacKinnon	Haemolytic Uraemic Syndrome Help (HUSH)
Charlotte Maltin	Quality Meat Scotland
Jacqui McElhiney	Food Standards Agency in Scotland
Dominic Mellor	Health Protection Scotland/University of Glasgow
Nigel Millar	National Farmer's Union Scotland
Alison Motion	Royal Highland Educational Trust
Kevin Pollock	Health Protection Scotland
Andrew Riley	Scottish Government Health Protection Team (succeeded by Duncan McCormick)
Colette Robertson-Kellie	Drinking Water Quality Regulator
Roland Salmon	Public Health Wales
Janet Sneddon	Scottish Government Health Protection Team
Abhayadevi Tissington/ Lynn Byers	Health Protection Nurse Specialists Group
Andrew Todd	Monklands Hospital, Motherwell
Sheila Voas	Scottish Government Animal Health Division
David Williamson	Scottish Government Drinking Water Quality Division

ii) Remit and Terms of Reference of the VTEC/*E. coli* O157 Action Group:

Mission:

To reduce the risk and consequences of VTEC infection to the Scottish population

Strategic Aims

To:

- Produce a VTEC Action Plan, identifying priorities and recommendations to specified stakeholder groups, to be implemented within agreed timescales.

  Recommendations will include:
  - Risk reduction strategies.
  - Communication, health education, research and surveillance initiatives.
- Monitor the implementation and effectiveness of these strategies and initiatives.

Objectives

The Action Plan will:

- Identify the precise responsibilities of key stakeholders e.g. Scottish Government Departments, Health Protection Scotland, NHSScotland, Food Standards Agency (Scotland), Local Authorities, Drinking Water Quality Regulator (Scotland).
- Review, revise, and assign to stakeholder groups, the VTEC Task Force recommendations.

Monitoring will consist of:

- Ascertaining from VTEC AG members their progress on implementation of Action Plan recommendations.
- The VTEC AG will conduct an annual review of overall progress on implementation.
- Evaluating the effectiveness of recommendations in terms of:
  - Their immediate consequences (e.g. public knowledge, attitude, and behaviour); and:
  - Attempting to assess the overall impact of the Action Plan recommendations as a whole.

Accountability

- The Action Plan will be owned by Scottish Government.
- The Action Group will have no formal accountability, but will advise SG, HPS, Health Protection Network Steering Group (HPNSG), and, if appropriate, other stakeholder groups, on its assessment of the VTEC Action Plan's performance, appropriateness and effectiveness.
- The Action Group will meet at a frequency appropriate to its tasks.

Administration

Scottish Government will lead the Action Group, delegating specific functions to other agencies e.g. HPS, FSAS.

Communications

The Action Group will:

- Communicate with SG, HPS, HPNSG, Health Protection Agency (HPA) and other stakeholder groups via their VTEC Action Group members.
- Produce an annual statement of progress.
- Continue to meet as necessary after producing the Action Plan, in order to monitor the progress and impact of recommendations.

iii) Abbreviations and Acronyms:

CAR	The Water Environment (Controlled Activities) (Scotland) Regulations, 2011 (known as the "CAR Regulations")
CFA	Chilled Foods Association
DPMAG	Diffuse Pollution Management Advisory Group
DWQR	Drinking Water Quality Regulator
EC	European Commission
EFSA	European Food Safety Authority
EU	European Union
FBOs	Food Business Operators
FCI	Food Chain Information
FHIS	Food Hygiene Information Scheme
FSAS	Food Standards Agency in Scotland
GAP	Good Agricultural Practice
GP	General Practitioner
HACCP	Hazard Analysis and Critical Control Point
HB	Health Board
HPA	Health Protection Agency
HPNSG	Health Protection Network Steering Group
HPS	Health Protection Scotland
HPT	Health Protection Team (in NHS board)
HS	Health Scotland
HSE	Health and Safety Executive
HUS	Haemolytic Uraemic Syndrome
ICoP	Industry Code of Practice[69]
IMT	Incident Management Team
LA	Local Authority
LAEMS	Local Authority Enforcement Monitoring System
NFUS	National Farmers Union Scotland
PEPFAA	Prevention of Environmental Pollution from Agricultural Activity (the PEPFAA Code)
POU	Point-of-use
PT	Phage type
PwC	Price Waterhouse Cooper
PWS	Private water supply/supplies
QMS	Quality Meat Scotland

[69] http://www.face-online.org.uk/CodeofPractice

REHIS	Royal Environmental Health Institute for Scotland
RELU	Rural Economy and Land Use
RTE	Ready to eat
SCSWIS	Social Care and Social Work Improvement Scotland
SEPA	Scottish Environment Protection Agency
SERL	Scottish *E. coli* O157/VTEC Reference Laboratory
SG	Scottish Government
SRC	Scotland's Rural College (formerly Scottish Agricultural College)
SoCOEHS	Society of Chief Officers of Environmental Health for Scotland
SW	Scottish Water
UKAS	United Kingdom Accreditation Service
UKFSS	UK Food Surveillance System
UV	Ultraviolet
VTEC	Verotoxigenic *E. coli*
VTEC AG	VTEC/*E. coli* O157 Action Group
WHO/FAO	World Health Organisation/Food & Agriculture Organisation
WSP	Water Safety Plan
WTW	Water Treatment Works

iv) Glossary

- Animal visitor attractions e.g. Open farms/farm parks; animal petting/handling areas within other attractions (including zoos); educational establishments e.g. city farms; working farms with livestock that occasionally open to the public, e.g. for school visits, Open Farm Sundays, etc; rare breed/rescue centres; markets, agricultural shows or country fairs where livestock are present; mobile menageries or petting/handling enterprises; other visitor facilities where the public have animal contact, even if (like stables) they represent a lower risk of VTEC carriage than premises with ruminants; and any picnic/play areas these attractions include that could be contaminated e.g. by faeces tracked in by humans or animals.
- Contamination – the presence, or potential presence, of VTEC organisms in or on the animal, human, substance or environment concerned.
- High risk groups:
  - Groups at higher risk of acquiring infection – i.e. groups such as children, the elderly or those who are immunocompromised, who have characteristics that make them more vulnerable to becoming infected – [as opposed to "At special risk of passing on infection [see below].
  - Groups at special risk of passing on infection – as defined by the VTEC Guidance – e.g. the under 5s or others likely to have immature or poor personal hygiene, and those whose work includes food handling or personal care tasks for others [as opposed to "At higher risk of acquiring infection", see above]; also know as Risk Groups A to D.
- Private water supplies – anything other than a public water supply. They are the responsibility of the owners and users of the supplies.
- Public water supply – a water supply provided by Scottish Water as part of its core function as a water authority.
- Raw meat – meat that has not been heat-treated.
- Type A PWS - defined as supplying 50 or more persons; or 10 or more cubic metres of water; or regardless of size, any supply for a commercial or public activity[70].
- Type B PWS - defined as any non-Type A supply[70].

[70] http://www.legislation.gov.uk/ssi/2006/209/contents/made

XI.

BIBLIOGRAPHY

This section includes references that provide general further reading on VTEC (marked *). A fuller selection of references (including legislation, regulations, and all specific reports and papers etc cited as footnotes in the Action Plan) are listed in the Online Appendix, which can be accessed at http://www.hps.scot.nhs.uk/giz/vteco157actionplan.aspx.

The VTEC/*E. coli* O157 Action Group cannot guarantee or endorse the content of external references or websites but we have endeavoured to link only to high quality information sources.

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XII.

ONLINE APPENDICES

The following Online Appendices can be accessed at
http://www.hps.scot.nhs.uk/giz/vteco157actionplan.aspx:

i) Additional References

ii) Clean farm to abattoir environments – Control, monitoring and compliance options

iii) Current communication documents matrix

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The Scottish Government
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