Bathing Water and Health

A Health Service Executive guide for responding to incidents of microbiological pollution and other adverse circumstances in relation to both saline and fresh bathing water

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Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

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This document is a guidance document to assist HSE personnel in their response to Bathing Water Incidents that may be of Public Health Significance. It is not a legal interpretation of the relevant Bathing Water Legislation

This is a working document which will be reviewed at the end of the 2021 Bathing Water season.

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1.0 Introduction

Directive 2006/7/EC concerning the management of bathing water quality came into force in March 2006. This Directive gives stronger focus to the protection of public health and is implemented in Ireland through the Bathing Water Quality Regulations (S.I. No. 79 of 2008) (hereafter referred to as the Regulations). There are specific provisions within these Regulations which require a Local Authority to promptly notify the EPA and the HSE about any situation that has, or could reasonably be expected to have, an adverse impact on bathing water quality and on the health of bathers. **Section 15(5) of the Regulations states "A Local Authority shall promptly notify the EPA and the Health Service Executive of any situation that has, or could reasonably be expected to have, an adverse impact on bathing water quality and on the health of bathers".** The HSE's Environmental Health Services and Departments of Public Health may be required to give advice to Local Authorities on bathing water quality with respect to incidents of microbiological pollution and/or other adverse circumstances. However, it is primarily the decision and responsibility of the Local Authority to advise the public of bathing water incidents and related bathing water advice and prohibitions.

This document will assist in facilitating a measured and consistent approach by the HSE when such consultations arise to provide the most effective health protective response. Similarly, if the HSE becomes aware of bathing water as a potential source of infection, outbreak or other illness, this guide will assist in the coordinated management of such an incident.

This document specifically provides a table of action levels (see Table 1) in relation to microbiological contamination of bathing waters, both saline and freshwater. The table has been developed and kept under review in consultation with the EPA Bathing Water Unit. It has regard to the WHO guidelines on safe recreational water environments and parameters set down in legislation concerning bathing water quality.

Within the Regulations several definitions apply and are of relevance to this guidance:

- Abnormal situation – "an event or combination of events impacting on bathing water quality at the location concerned and not expected to occur on average more than once every four years"
- Pollution – "the presence of microbiological contamination or other organisms or waste affecting bathing water quality and presenting a risk to the health of bathers"
- Short-term pollution (STP) – "microbiological contamination as referred to in Schedule 4, column A*, that has clearly identifiable causes, is not normally expected to affect bathing water quality for more than approximately 72 hours after the bathing water quality is first affected and for which the relevant Local Authority has established procedures to predict and deal with as set out in Schedule 6"

(* Schedule 4, Column A – Intestinal enterococci and *Escherichia coli*)

1.1 Legislation and Guidance

This document should be read in conjunction with the following:

- Directive 2006/7/EC concerning the management of bathing water quality
- Bathing Water Quality Regulations, 2008 (S.I. No. 79 of 2008)
- European Commission: Bathing Water Profiles: Best Practice and Guidance. December, 2009

- WHO "Guidelines for Safe Recreational Water Environments" (Vol 1. Coastal and Fresh Waters) 2003 and its associated 2009 addendum with updates
- Health Acts 1947, 1953, 2004, Health (Duties of Officers) Order 1949, Infectious Diseases Regulations 1981 (SI No. 390 of 1981) and subsequent amendments – S.I. No. 151/2000 - Infectious Diseases (Amendment) Regulations, 2000 and S.I. No. 559/2007 - Infectious Diseases (Amendment) Regulations 2007.
- EPA Guidance on the Management of Poor Bathing Waters (updated 19th May 2015)
- EPA Guidance Note for Local Authority Management and Reporting of Bathing Water Incidents under the 2008 Bathing Water Quality Regulations (updated 29th May 2019).
- EPA A framework to assist Local Authorities in the assessment of submissions for the identification of new bathing waters EPA Bathing Water Unit July 2016

2.0 Background

2.1 Benefits of bathing water

Recreational use of water can deliver important benefits to both physical and mental health and well-being. Other health benefits may accrue from employment and economic value of tourism and green reputation associated with water-based recreation.

2.2 Potential risks of bathing water

There may also be adverse health effects associated with recreational use if the water is polluted or unsafe. While the document is directed at identified bathing water locations, in previous legislation referred to as 'designated bathing areas', the scientific basis for intervention action holds true for all bathing waters. Consideration must be given to the bathing water location with regard to the quality of the water. An objective assessment should be made as to possible contamination sources, their significance in terms of exposure of the public to such pollution and the likelihood of adverse consequences arising.

2.3 Stream Inlets

The quality of water in streams that cross beaches may not be the same as the sea water quality. Freshwater streams can sometimes contain more bacteria, including pathogenic bacteria, than sea water, particularly after heavy rain. After prolonged periods of heavy rain the quality of both stream water and the sea (where the stream discharges into it) may be adversely affected due to surface water run-off from a variety of sources including agricultural land, roads, animals, septic tanks, foul drainage seepages and misconnections. There may be an increased risk of infection. In particular young children paddling and playing in these stream inlets can be at a higher risk due to the increased bacterial/viral loads of these streams.

The HSE recommends that Local Authorities should erect signage at all inlet streams which cross bathing beaches to warn the public about the potential risk of paddling or children playing in these coastal stream inlets unless the Local Authorities have performed risk assessments and sampling programmes which find that the water in the inlet stream is free at all times from contamination or mitigation measures have been

taken. Based on the outcome of risk assessments either temporary or permanent warning/restriction signage should be erected at the inlet streams advising the public "do not paddle/do not play".

Advisory messages that might be considered at such locations include:

- Unsuitable for bathing
- Do not drink or swallow water from beach streams
- Avoid splashing stream water into your mouth
- Do not use for washing utensils
- Wash hands carefully with clean tap or bottled water before eating or handling food
- Keep family pets out of streams where possible.

2.4 Risk of transmission of COVID-19 and Bathing Water

The virus that causes COVID-19, SARS-CoV-2, most commonly spreads from person to person by respiratory droplets during close physical contact – less than 2 metres. It can also spread by touching contaminated surfaces and then touching your mouth or nose. There is no evidence that SARS-CoV-2 can be spread through contact with bathing waters. The most significant risk from COVID- 19 while at the beach is from congregating closely together and not following public health guidance. Public health guidance is available at https://www2.hse.ie/conditions/coronavirus/protect-yourself-and-others.html.

Advice while at the beach:

- wash your hands properly and often and don't share items with people you don't live with;
- practice social distancing both in and out of the water;
- cover coughs and sneezes. You should wear a mask if you are going into crowded areas;
- follow the current Government restrictions.

It has been shown that SARS-Co-V-2 can be shed in the faeces of individuals infected with the virus[1-6]. Several studies have reported the detection of non-infective viral fragments of SARS-CoV-2 in wastewaters and sludge[4,7] . Indeed surveillance of wastewater for the presence of SARS-Co-V-2 can be a useful tool to compliment and inform public health actions. Although data is still emerging, there is little current evidence of the presence of the infectious virus in wastewater. It has been shown that viruses, including coronaviruses, can be inactivated through appropriately designed and operated wastewater treatment processes. The WHO recommends ensuring appropriate wastewater treatment processes are in place to protect against COVID-19 and other infectious diseases[8]

A review of the literature by Cahill and Morris (2020)[9] revealed that there is currently no evidence of transmission of SARS-CoV-2 through contact with bathing waters. It has been demonstrated that enveloped viruses, such as coronaviruses, do not to survive for long periods in waters [4,6]. The risk associated with contracting the SARS-CoV-2 virus via bathing water remains low.

REFERENCES

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3. Gwenzi, 2020. Leaving no stone unturned in light of the COVID-19 faecal-oral hypothesis? A water, sanitation and hygiene (WASH) perspective targeting low-income countries. Science of the Total Environment. https://doi.org/10.1016/j.scitotenv.2020.141751
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9. Cahill N, Morris D. Recreational waters - A potential transmission route for SARS-CoV-2 to humans? Sci Total Environ. 2020 Oct 20;740:140122. doi: 10.1016/j.scitotenv.2020.140122. Epub 2020 Jun 11. PMID: 32540743; PMCID: PMC7287419.

The HSE Bathing Water Group acknowledges with gratitude the contribution of Professor Dearbháile Morris N.U.I. Galway in drafting of section 2.4 and for permitting reproduction (in Appendix 14 of this guide) of the paper cited as reference No. 9 above.

Please refer to Appendix 14 for supplementary information and references

3.0 Key Provisions of the Bathing Water Quality Regulations 2008 (SI No 79 of 2008)

3.1 Parameters

The 2006 Directive requires that just two key microbiological parameters be checked: intestinal enterococci (IE) and *Escherichia Coli* (EC), the reason being that scientific experience, as well as the management of the previous 1976 Directive, has shown that these parameters were, in the vast majority of cases, the limiting factor for achieving good bathing water quality. WHO studies have indicated a correlation between these parameters and adverse health effects.[1,2]

3.2 Classification of Bathing Waters

The first classification of bathing waters under SI 79 of 2008 was undertaken at the end of 2014.

The Regulations establish a classification system for bathing water quality based on four classifications "poor", "sufficient", "good" and "excellent" and require that a classification of at least "sufficient" be achieved by 2015 for all bathing waters. Local Authorities must take appropriate measures with a view to improving waters which are classified as "poor" and increasing the number of bathing waters classified as "good" or "excellent". In the event that a bathing water receives a "poor" status during any given 4 year assessment period the bathing water will require to be subject to restrictions on bathing and monitored for the following season. In the event of a bathing water being classified as "poor" for 5 consecutive years it must be permanently closed.

3.3 Beach Restrictions

A significant direction has issued from the European Commission that where a bathing water is assessed as having 'poor' water quality status in any given year from 2014 onwards (in Ireland's case), Local Authorities are obliged to advise the public of this situation and apply appropriate bathing water restrictions to that bathing water for the entire bathing season in the following year while continuing to monitor the bathing water. Given the significance of this direction, Local Authorities will need to undertake appropriate measures at vulnerable bathing waters to ensure that the waters achieve at least a 'sufficient' water quality status to prevent their closure.

Management plans have been submitted to EPA for assessment and approval with the recommendation that these also be communicated to regional / local HSE staff, both Environmental Health and Public Health.

4.0 Reporting and management of bathing water incidents

4.1 Local Authority Reporting of Bathing Water Incidents to the HSE

Where a situation that has, or could reasonably be expected to have, an adverse impact on bathing water quality or the health of bathers Local Authorities are required to notify the Health Service Executive (HSE)

[1] Kay, D., Fleischer, J. M., Salomon, R. L., Jones, F., Wyer, M. D., Goodfree, A. F., Zelenauch-Jacquotte, Z. and Shore, R. (1994). **Predicting likelihood of gastro-enteritis from sea bathing results from randomised exposure**. Lancet 344, pp 905-909.

[2] WHO "Guidelines for Safe Recreational Water Environments" (Vol 1. Coastal and Fresh Waters) 2003 and its associated 2009 addendum with updates

under Regulation 15(5) of the Regulations. These may include unexpected situations such as, proliferation of cyanobacteria, macro-algae, poisonous jelly fish, or marine phytoplankton, and incidents such as oil pollution or rodent Infestation.

Microbiological exceedances that should be notified to the HSE are laid out in Table 1.

Table 1: Action levels in response to microbiological sample results

Escherichia coli	Intestinal enterococci	Recommended Action *
> 2,000 E.coli	**OR > 250 I.E.**	**Issue of a Bathing Prohibition Notice (Appendix 8) See note 1**
≥1,000 - ≤2000 E.coli	**AND ≥ 200 I.E.**	**Issue of a Bathing Prohibition Notice (Appendix 8) See note 1**
≥1,000 - ≤2000 E.coli	**BUT < 200 I.E.**	**Issue of a Bathing Advisory Notice (Appendix 7) and re-sample immediately See note 1 If re-sample is still ≥ 1000 E.coli - Issue of a Bathing Prohibition Notice (Appendix 8)**
≥500 - <1,000 E.coli	**OR ≥100 - ≤250 I.E.**	**Re-sample and monitor situation. Decision based on evidence available/details of pollution event. If re-sample is ≥ 1000 E.coli - Issue of a Bathing Prohibition Notice (Appendix 8)**
Any gross malfunction or leakage of the sewerage system or visual reports of sewage		**Issue of a Bathing Prohibition Notice (until the status of the bathing water quality can be verified).**

Note 1: There are two circumstances where the Local Authority may consider taking a precautionary approach even when the action levels have not been breached.

(i) Where the microbiological result is greater than 90% of the action level, a risk assessment should be carried out which may in some circumstances suggest taking a precautionary approach with the issue of the appropriate bathing water notice.

(ii) Where the microbiological result is greatly in excess of the normal background levels (see Appendix 13) for that bathing area, this circumstance may point to a pollution event in the vicinity. A risk assessment should be carried out which may suggest taking a precautionary approach with the issue of the appropriate bathing water notice.

* *Based on risk assessment, taking into account the beach profile, previous sampling history, probable source of contamination, evidence of human illness etc.*

For criteria for lifting prohibition notices, please see Section 4.5. Please also refer to Section 4.6 in relation to bathing waters that have a Seasonal Bathing Prohibition Notice in place

4.2 HSE Management of Bathing Water Incidents (See Appendices 2- 6)

Similar to the drinking water protocols adopted between the Environmental Health Services and Departments of Public Health, Principal Environmental Health Officers (PEHOs) will be the first point of contact in the HSE for Local Authorities when notifying a bathing water quality incident.

PEHOs will immediately notify the Medical Officer of Health (Specialist in Public Health Medicine on duty) of any proposed bathing advisory or prohibition warnings resulting from exceedances in the action levels in

Table 1. The immediate flow of information to Public Health is vital for the timely ascertainment of whether there are or have been any cases of human illness that could be related to contaminated bathing water exposure at the location in question. Public Health should carry out a public health risk assessment as per Appendix 2.

It should be noted that most gastro-intestinal illness is likely to go unreported – only about 20% with GI illness attend a GP and of these about 20% have microbiological testing.[3,4]. This suggests only about 4% of GI illness will be reported - though probably those who are most ill.

In the event of elevated bacterial counts, Local Authorities, in consultation with the HSE, are advised to implement bather warnings at the agreed action levels provided in Table 1 and undertake management measures advised by the HSE to ensure public safety. Should the water quality deteriorate further during a bathing water pollution incident Local Authorities should consult the action levels and, again in consultation with the HSE, ensure the most appropriate bathing warning notice is in place. **Any gross malfunction or leakage of the sewerage system, confirmed by visual reports of pollution or other risk assessment, should lead to an immediate bathing prohibition until the status of the water quality can be verified.**

PEHOs will also consult with Public Health on any other adverse circumstances where bathing advisory or prohibition warnings are being considered e.g. cyanobacteria, macro-algae, marine phytoplankton, poisonous jelly fish, oil pollution, rodent infestation. Public Health should carry out a public health risk assessment as per Appendix 2. Guidance for the management of both Freshwater and Marine Harmful Algal Blooms (HAB) are provided in Appendices 5 and 6.

Public Health should notify Environmental Health of any illness suspected to be related to exposure to polluted bathing water. Environmental Health should maintain a record of any advice given to the Local Authorities.

The advice given will depend on local conditions and it is recommended that Environmental Health Services download bathing water profiles from the BEACHES website (https://www.beaches.ie/) for each identified bathing water in their area in advance of the bathing water season. Appendix 10 provides instructions on how to download bathing water profiles from the BEACHES website.

Following a bathing prohibition if required, the HSE will advise the Local Authority to do additional sampling and/or the HSE may carry out additional discretionary sampling including sampling of inlets. See Appendix 11 for health and safety guidance for seawater sampling and Appendix 12 for guidance on taking bathing water samples.

A Pre-Season meeting is recommended between the Local Authority and the HSE (EHS and PH) each year to identify appropriate contacts for the season, responsibilities in relation to notifications and any updates to

[3] *Safefood*. Telephone Survey of Infectious Intestinal Disease in the Republic of Ireland. 2013

[4] Elaine Scallan, Timothy F. Jones, Alicia Cronquist, Stepy Thomas, Paul Frenzen, Dina Hoefer, Carlota Medus, Fredrick J. Angulo, and The FoodNet Working Group. Foodborne Pathogens and Disease. Winter 2006, 3(4): 432-438. doi:10.1089/fpd.2006.3.432.

the beach profiles in their areas. A Post-Season meeting is also recommended to identify any issues which arose during the season. If an update is required in relation to potential impact of wastewater discharges on bathing water quality, Irish Water could be invited to participate in pre- or post-season meetings, if considered appropriate.

4.3 Outbreak Control Team

When as a result of poor bathing water quality, an outbreak of human illness has occurred or is suspected to have occurred, it is likely that the Medical Officer of Health (MOH) will set up an outbreak control team (OCT) to investigate and control the outbreak.

The OCT is set up and chaired by the MOH, who has responsibility for the investigation and control of notifiable infectious diseases and outbreaks of human illness[5].

The membership of the team is likely to include appropriate representation from the following:

- Public Health Department
- Environmental Health Services
- Local Authority
- Microbiological Laboratories

Alternatively, or additionally it may be necessary for the Local Authority to convene an incident control team e.g. where significant chemical contamination has occurred that is likely to pose an on-going risk to human health.

4.4 Bathing Water Advisory and Prohibition Notices (Appendices 7-9)

It is recommended that bathing advisory or prohibition warnings be issued when microbiological quality deteriorates as outlined in Table 1. However, nothing in Table 1 should preclude the adoption of appropriate notices following visual reports of gross pollution discharging to the bathing water or if there is evidence of health effects associated with a bathing water.

The HSE and EPA have agreed standard templates (see Appendices 7-9) for bathing prohibition/advisory notices that Local Authorities should use to ensure the public are appropriately informed and to ensure that the requirements under the Regulations are met. A bathing water notice should remain in place at the bathing water until it is confirmed that it is no longer affected and the water quality is acceptable for bathing. Local Authorities may wish to display a further notice informing the public that the incident has ended.

In the case of STP events and planned abnormal situations, Local Authorities need to undertake requirements specified in the Regulations in terms of bather protection with prior warning of the possible incident, provision of information to the public, sampling etc. The EPA has prepared a standard template bathing water notice (Appendix 9) that Local Authorities are advised to use for STP events and planned abnormal situations.

[5] Infectious Diseases Regulations, 1981 as amended

Local Authorities are to be advised that posting of advisory/prohibition notices is recommended at life guard stations, plus at all entrance points to the bathing water areas affected and at associated beach notice boards. It is essential that any notices erected are clearly visible. In addition all advisory/prohibition notices should be actively and promptly disseminated through the use of appropriate media and technologies including the internet.

4.5 Criteria for HSE agreement to lifting an advisory or prohibition notice

(a) In the event of an outbreak

In the event of an outbreak of related illness the MOH with the assistance of the OCT will decide the criteria for lifting the notice. When the decision is made to remove the notices, this should be done without undue delay.

(b) In the event of an incident of contamination without any human illness.

Prior to the lifting of an advisory or prohibition notice at least one satisfactory sample of bathing water must be obtained. **This sample should be a confirmed and not a presumptive result.** This sample should indicate a level of *E Coli* less than 500 cfu/100ml **and** an intestinal enterococci level of less than 200cfu/100ml, at a minimum, but with due regard to the beach profile and the normal background levels for that location. See Appendix 13 for further detail on determining normal background levels.

4.6 Seasonal Bathing Restriction Notices

The EPA has prepared a standard template for Seasonal Bathing Restriction Notices which Local Authorities are obliged to use.('EPA Guidance on the Management of Poor Bathing Waters' Updated 19 May 2015) Following "poor" classification of a bathing water, the responsible Local Authority is required to apply a bathing restriction for the subsequent bathing season. There are two bathing restriction signs for poor bathing waters for the entire season; one for Advice against Bathing and one for Bathing Prohibition. Where a seasonal Advice against Bathing Notice is in place, this restriction may need to be replaced with a temporary Bathing Prohibition Notice in certain situations, (See 4.1).

Please note that where there is a Seasonal Bathing Prohibition Notice in place at a bathing water and following the recording of an unsatisfactory result as per criteria in Section 4.1 Table 1 Action levels, there is no requirement to take a re-sample.

4.7 Local Authority Reporting of Bathing Water Incidents to the EPA

Local Authorities are required to notify all bathing water pollution incidents to the Environmental Protection Agency (EPA) which include short-term pollution (STP) events, abnormal situations and certain circumstances that can have adverse impacts on bathing water quality or bathers' health. These incidents should be reported to the EPA via the Bathing Water Information System (BWIS) application on EDEN (www.edenireland.ie). BWIS incorporates one generic notification form for all incident types: STP events, abnormal situations and certain circumstances that can have adverse impacts. When a new bathing water pollution incident arises the Local Authority is required to submit initial information on the incident via BWIS in as near to real-time as possible, but no later than 11am on the day following the commencement of the incident. This initial submission via BWIS will automatically trigger a notification of the incident to the Bathing Water Unit of the Office of Evidence & Assessment and the Office of Environmental Enforcement (OEE)

within the EPA, will generate a tweet of the incident from the EPA Beaches Twitter Account (@EPABeaches) and will publish the incident on the EPA bathing water website Beaches (https://www.beaches.ie/) to inform the public.

As part of the submission the Local Authority proposes the category of incident type which, following assessment, the EPA may re-categorise. Using BWIS, the Local Authority must report whether or not the HSE was contacted and record the HSE contact details and HSE advice given, where applicable. Although notification of STPs to HSE is not a specific requirement under the regulations it is suggested that it would be good practice for LAs to notify HSE of initiation and lifting of STPs.
In addition the Local Authority should upload a copy of the bathing prohibition/advisory notice erected which will be made available to the public as part of the incident information on the Beaches website.

The Local Authority is required to update the incident notification form on BWIS as more information becomes available following investigation, monitoring, and management of the incident. The EPA can request further information or actions to be undertaken by Local Authorities in relation to the incident via BWIS. Once the quality of the bathing water is deemed to be no longer affected and the incident has ceased the end date of the incident is reported by the Local Authority via CRIS. This will automatically generate a tweet from the EPA twitter account that the incident has ended and the incident will be removed from the Beaches website. The Local Authority should also remove any bathing notices applied.

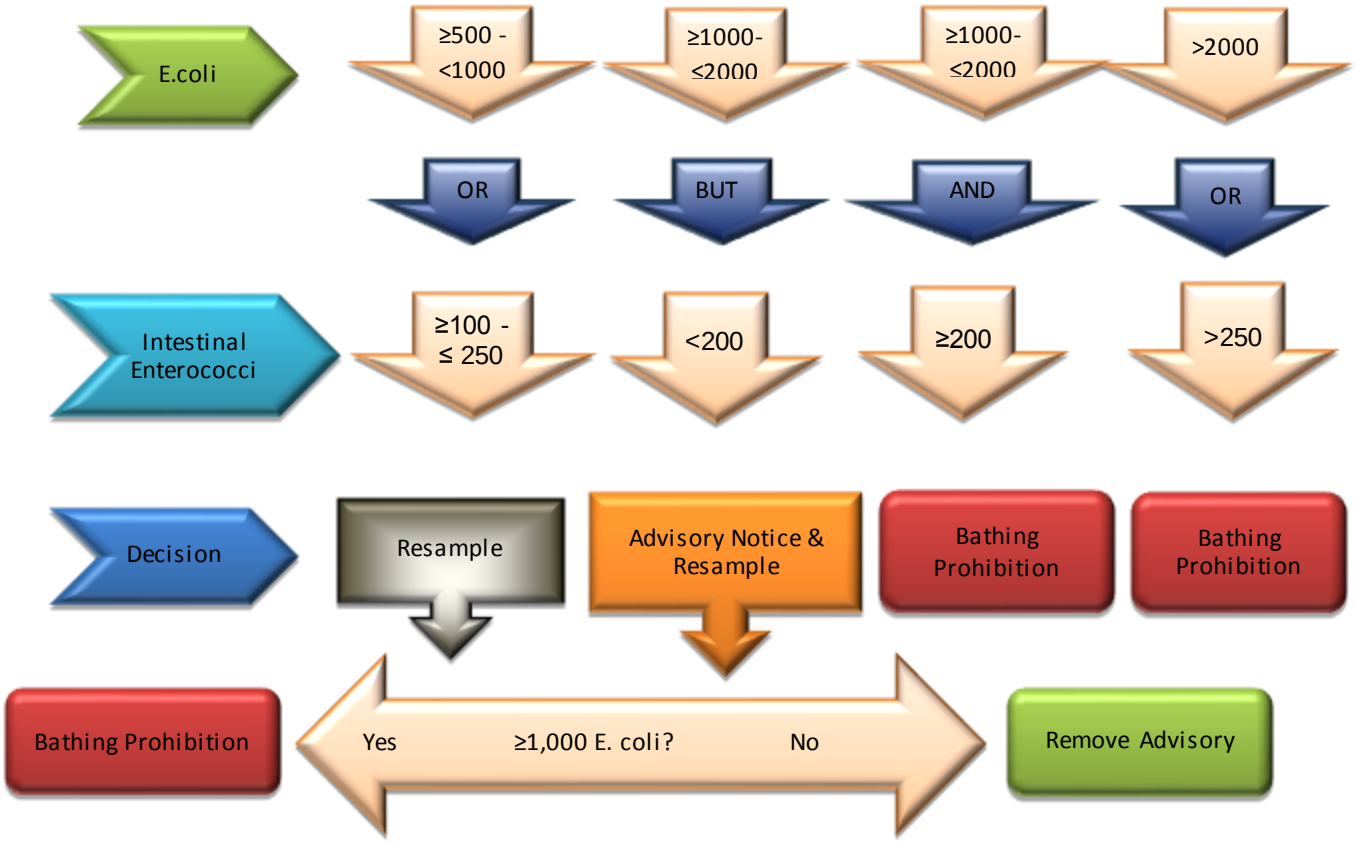
4.8 EPA Management and Reporting of Bathing Water Incidents

The EPA assesses the bathing water pollution incidents notified in terms of compliance with and enforcement of statutory obligations and ensures appropriate measures are undertaken to protect bathers' health and eliminate sources of pollution. The EPA also assesses the incidents to ensure Local Authorities adhere to the requirements specified in the Regulations in relation to provision of information to the public, water sampling and water quality assessment. The EPA reports bathing water incidents during the bathing season, including management measures undertaken and bathing prohibitions recommended, to the European Commission by the 31st December each year.

Appendix 1 - Action levels in response to microbiological sample results

IMPORTANT: Please refer also to Table 1 in section 4.1 for comments on results which are below, but approaching, action levels or for results greatly in excess of normal background levels for the bathing area (see Appendix 13).

For criteria for the lifting of a Bathing Advisory or a Prohibition Notice, please see Section 4.5



Appendix 2 – Approach to the public health risk assessment of a confirmed, probable or possible contamination of bathing water

Initial Public Health Risk Assessment

When informed of a confirmed, probable or possible contamination of bathing water, request any available bathing water sample results if not already received.

Consider:

1. Is the unsatisfactory water sample result unexpected?
2. Is it likely that the reported contamination incident will adversely affect human health?
3. Is there an on-going risk to human health, e.g. the bathing area is a popular bathing area, or there are planned events?
4. Are there known recent cases of illness linked to this bathing water?

If there is no indication of significant contamination or on-going risk to human health you should await further sampling results and continue passive surveillance.

In-depth Public Health Risk Assessment

If you consider that a more thorough public health risk assessment is required the checklist in Table A2.1 may prove useful.

The principle aim in seeking the information below is to establish, where possible, the source of contamination, the period of exposure, and the potential population exposed. This will enable a targeted review of public health notifications in terms of potential organism, time period of most relevance, and geographical area of residence of those potentially exposed.

The EPA's website www.beaches.ie hosts information that may be useful to inform a PHRA of an identified bathing water, including water quality results and bathing water profiles. The profiles contain information for example on bathing water facilities, activities, and catchment characteristics. See Appendix 10 for further details on accessing bathing water profiles on the Beaches website.

Table A2.1: Information checklist to assist completion of in-depth PHRA

About the Bathing Water
• **Fresh or salt bathing water?**
If BW sample result indicates exceedance: • Sample result? Compare with Table 1 Action Thresholds on page 7. • Reason for sample – routine or otherwise? • Date sample taken? • Where was sample taken from? • Is there a stream inlet adjacent to the bathing area? • If yes, was it tested? • If the stream was tested what are the results?
• **Is source of contamination known?**
If yes: • What is source? • When did contamination most likely commence? • Is contamination on-going or ceased? • If ceased – when?
If no: • What hypotheses are being investigated? • When most likely to have commenced? • Is contamination on-going or ceased? • If ceased – when?
• **Is it likely that conditions at beach have changed** since sample was taken that would increase or decrease the risk of on-going contamination, e.g. heavy rainfall, flooding or local agricultural activity?
• **Date of most recent previous sample and result?**
• **Historical BW quality at this location?**
• **Have there been similar incidents in the past?**
About Exposure
• **What is the typical level of activity** at the beach (e.g. number of bathers) during the BW season?
• **Is it a beach frequented mainly by the local community or is it a popular tourist location?** Do tourists generally originate from any specific area within the country or outside of the jurisdiction e.g. Northern Ireland?
• **Have there been any recent public gatherings** in the area e.g. regattas, triathlon / surfing competitions, local festivals etc?
• **What are the public facilities** at the bathing area e.g. toilets, showers, hand wash basins?

Public Health Measures

Surveillance

- Establish if there is any evidence of cases of human illness linked to this bathing water
    - Assess recent notifications to the local Public Health Department of organisms of possible waterborne origin (e.g. norovirus, VTEC, cryptosporidium, Leptospirosis) or notifications of GI outbreaks with unconfirmed organism and identify if there was bathing water exposure
    - If preliminary investigations suggest that the bathing area is frequented by members of the public from other geographical areas contact relevant MOHs and ask that they do as above and revert if possible cases identified
    - It may be necessary to make contact with the Public Health Agency in Northern Ireland
    - It may be necessary to undertake active case finding e.g. by contacting GPs, EDs etc
    - Inform EHS as to whether or not there is evidence of human illness associated with the bathing water

Control

- Investigate any potential illness or outbreak
    - If notifiable disease or outbreak associated with bathing water is identified, investigate, control spread and remove conditions favourable to such infection as per the Infectious Diseases Regulations 1981 as amended
    - Consider the benefits of OCT, keeping in mind that an OCT may require "data processing" as per the GDPR 2018, and so needs to be in accordance with ID and DP legislation
- Ensure that any remaining threat to public health is controlled
    - If no notifiable disease or outbreak associated with bathing water is identified, discuss with the EHS what, if any, health protection control actions should be taken by the Local Authority.
    - Liaise with the EHS to ensure that the correct bathing water notice has been appropriately erected by the Local Authority as per Section 4.4 of this guidance.

Appendix 3 provides a summary checklist to guide both the PHRA and EHRA of bathing water contamination.

If a risk assessment indicates that significant bathing water contamination has or may have occurred then the algorithm in Appendix 4 should be consulted.

Public Health Risk Assessment of a possible Harmful Algal Bloom

Public health risk assessment to consider toxicity and exposure risk should cover:

i) Assessment of water body characteristics and use
   a. Type and size of water body
   b. Type of water use - Higher risk from immersive/swallowing exposure to lower risk from non-contact uses
   c. Reports of human or animal illness, dead fish, etc

ii) Assessment of nature and intensity of bloom
   a. History – occurrence, duration, size
   b. Presence and size of bloom, presence of scum on surface or shoreline
   c. Location of bloom or scum in relation to human / animal exposure
   d. Wind direction – may move scum, bloom

iii) Cyanobacterial characterisation (species and cell count confirmation)
   a. Confirmation, speciation
   b. Count per ml/ micrograms of chlorophyll a per litre as per **Table A2.2**

iv) Comparison of cell count with WHO guidance levels – see **Table A2.2**

Table A2.2 - WHO Guidelines for safe practice in managing bathing waters which may produce or contain cyanobacterial cells and/or toxins[1]

Guidance level or situation	How guidance level derived	Health risks	Recommended action
Cyanobacterial scum formation in bathing areas	Inference from oral animal lethal poisonings Actual human illness case histories	Potential for acute poisoning Potential for long-term illness with some cyanobacterial species Short-term adverse health outcomes, e.g. skin irritations, gastrointestinal illness	Immediate action to prevent contact with scums; possible prohibition of swimming and other water-contact activities Public health follow-up investigation Inform relevant authorities and services
100,000 cells cyanobacteria per ml or 50 µg chlorophyll a per litre with dominance of cyanobacteria	From provisional drinking water guideline for microcystin-LR, and data concerning other cyanotoxins	Potential for long-term illness with some cyanobacterial species Short-term adverse health outcomes, e.g. skin irritations, gastrointestinal illness	Watch for scums Restrict bathing and further investigate hazard Post on-site risk advisory signs Inform relevant authorities and services
20,000 cells cyanobacteria per ml or 10 µg chlorophyll a per litre with dominance of cyanobacteria	From human bathing epidemiological study	Short-term adverse health outcomes, e.g. skin irritations, gastrointestinal illness, probably at low frequency	Post on-site risk advisory signs Inform relevant authorities and services

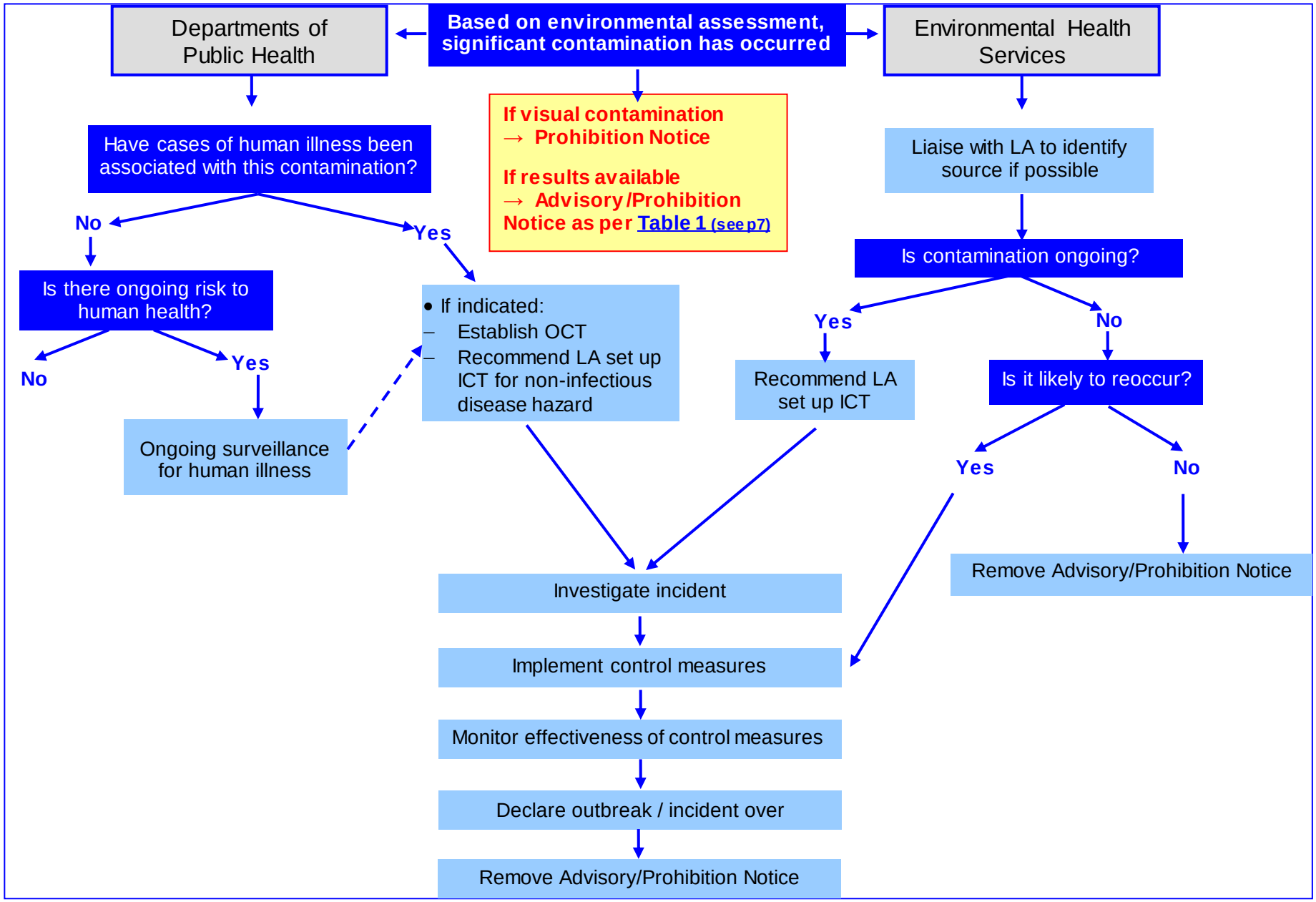
Table A2.2 is helpful but depends on availability of laboratory results - if detailed risk assessment is not possible/delayed and there is a concern about exposure risk, it may be safest to assume toxicity initially and prohibit entering the water/ use of the water until considered safe and inform public to keep pets and children away from the water and avoid skin contact with the water or algae.

Appendix 3: Risk assessment prompts to guide assessment of bathing water contamination and the degree to which the public may have been exposed or affected

Public Health	Environmental Health	
Assessment of exposure	**Environmental assessment**	**Sampling & results**
• Establish potential exposure period and incubation period • What is the typical level of activity at the bathing area (e.g. no of bathers) during the BW season? • Is it a beach frequented mainly by the local community or is it a popular tourist location? • Do tourists generally originate from any specific area within the country or outside of the jurisdiction e.g. Northern Ireland? • Have there been any recent public gatherings in the area e.g. regattas, triathlon / surfing competitions, local festivals etc? • What are the public facilities at the beach / bathing area e.g. toilets, showers, hand wash basins? • Review recent notifications of organisms of possible waterborne origin (e.g. norovirus, VTEC, cryptosporidium, Leptospirosis) or GI outbreaks with unconfirmed organism and identify if there was bathing water exposure • Contact MOHs in other areas and ask that they do as above and revert if any possible cases identified • Contact GPs and other healthcare providers in the area (eg Emergency Departments) if appropriate	• When / how was incident discovered? • Likely source of contamination • When did contamination most likely commence? • Is contamination ongoing or ceased? • If ceased – when? • If ongoing – how long might it last? • Beach profile • Visual inspection of beach • Other beaches affected nearby • Any remediation action taken by Local Authority • Forecasted weather (wind / rain / sun) • Tide times / directions	• Sample result • Reason for sample – routine or otherwise? • Date and time sample taken • Weather conditions at the time • Where was sample taken from • Is it likely that conditions at beach have changed since sample was taken to increase or decrease risk likelihood of ongoing contamination? • Date of most recent previous sample and result • Historical BW quality at this location • In what timeframe will a repeat sample result be available from the laboratory?

If a risk assessment indicates that significant bathing water contamination has or may have occurred then the algorithm in Appendix 4 should be consulted.

Appendix 4: Algorithm for key steps and actions when a significant contamination incident has occurred



Appendix 5: Interim Fresh Water Algal Bloom Guidance[6]

1. About algal blooms

"**Harmful algal blooms** (HABs) are excessive accumulations of microscopic photosynthesizing aquatic organisms that produce biotoxins or otherwise adversely affect humans, animals and ecosystems"[7].

Algae are natural inhabitants of fresh water such as in lakes and reservoirs. When conditions are very suitable for growth – shallow, warm, slow-moving or still water - an algal bloom can occur. Cyanobacteria or 'blue-green algae', a type of blooming algae, can produce toxins. These toxins can kill wild animals, livestock and pets. They can also harm people. Toxins include hepatotoxins, neurotoxins and endotoxins which cause human health effects[6] such as:

- Skin – rash, irritation, swelling, sores
- Gastrointestinal – nausea, vomiting, abdominal cramps, diarrhoea, anorexia
- Respiratory – nasal congestion, cough, congestion, wheeze, shortness of breath, chest tightness, sore throat
- Neurological – confusion, tingling, headache
- Eye/ear – watery eyes, eye irritation, visual disturbance, earache
- General – dizziness, muscle aches, fatigue, fever, malaise, back pain, weakness

Planktonic cyanobacteria often form obvious algal scums on lake surfaces and shorelines. However, some 'benthic cyanobacteria' (e.g. Oscillatoria, Phormidium) have also been directly attributed to or implicated in animal poisonings, with documented cases of fatal canine neurotoxicosis in several Irish lakes. These scums are less conspicuous, yet they produce very potent toxins (e.g. Anatoxin-a & Homoanatoxin-a). Their musty taste and odour may be attractive to dogs scavenging along lake shores, although other mammals and livestock are susceptible. Veterinary intervention often proves unsuccessful with death occurring quickly, e.g. 15-20 minutes after ingestion of relatively small doses. Benthic mats of cyanobacteria are also prevalent in remote oligotrophic freshwaters not normally anticipated to suffer from water quality problems and are widespread in rivers.

2. What to do if there is a suspected or confirmed algal bloom/ cyanobacteria incident?

Recognising a bloom

During an algal bloom water becomes less clear and may look green, blue-green or greenish-brown. Scums can form during calm weather when several bloom forming species rise to the surface. This can look like paint, mousse or small clumps – see photos.

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[6] WHO is updating its international guidance and this document will be revised at that point – For more information please see **Toxic Cyanobacteria in Water: A guide to their public health consequences, monitoring and management**
http://apps.who.int/iris/bitstream/handle/10665/42827/0419239308_eng.pdf;jsessionid=5D41342969592B97C8FF911FFBECD9C9?sequence=1

[7] Hillborn ED, Roberts VA, Backer L, DeConno E, Egan J, Hyde JB et al. Algal-bloom associated disease outbreaks among users of freshwater lakes, United States, 2009-2010. MMWR 10/1/2014 Vol 63, 1

Actions

Should an incident occur in a freshwater bathing site that gives cause for concern, the Local Authority will risk assess and bring the incident to the attention of the HSE. The following steps for the Local Authority are suggested;

1. Determine extent of suspect bloom (size of area involved, presence of scum in bathing location) and eliminate obvious cause (turbidity/discolouration due to weather/wave action/localised activity) which could give rise to such characteristics
2. Take a photograph of suspected bloom in situ.
3. Get a preliminary laboratory analysis if possible to confirm biological agent rather than suspended matter (suspended sediment, broken up seaweed, detritus, wastewater overflow etc). Local Authorities will either use their own laboratory or a private laboratory to test the sample microscopically for species.
    a. Actual toxicity testing can be carried out through a Scottish laboratory with expertise in this area. [Scottish Water, PO Box 8855, Edinburgh, EH10 6YQ 0345 ph 00443456018855; e mail: scientific@scottishwater.co.uk]
    b. Kerry County Council has a lot of experience of monitoring and dealing with algal blooms and might be able to provide expertise in this if required

The following table may be helpful in guiding actions.

Table A5.1 - WHO Guidelines for safe practice in managing bathing waters which may produce or contain cyanobacterial cells and/or toxins[8]

Guidance level or situation	How guidance level derived	Health risks	Recommended action
Cyanobacterial scum formation in bathing areas	Inference from oral animal lethal poisonings Actual human illness case histories	Potential for acute poisoning Potential for long-term illness with some cyanobacterial species Short-term adverse health outcomes, e.g. skin irritations, gastrointestinal illness	Immediate action to prevent contact with scums; possible prohibition of swimming and other water-contact activities Public health follow-up investigation Inform relevant authorities
100,000 cells cyanobacteria per ml or 50 µg chlorophyll a per litre with dominance of cyanobacteria	From provisional drinking water guideline for microcystin-LR, and data concerning other cyanotoxins	Potential for long-term illness with some cyanobacterial species Short-term adverse health outcomes, e.g. skin irritations, gastrointestinal illness	Watch for scums Restrict bathing and further investigate hazard Post on-site risk advisory signs Inform relevant health authorities
20,000 cells cyanobacteria per ml or 10 µg chlorophyll a per litre with dominance of cyanobacteria	From human bathing epidemiological study	Short-term adverse health outcomes, e.g. skin irritations, gastrointestinal illness, probably at low frequency	Post on-site risk advisory signs Inform relevant authorities

[8] Hillborn ED, Roberts VA, Backer L, DeConno E, Egan J, Hyde JB et al. Algal-bloom associated disease outbreaks among users of freshwater lakes, United States, 2009-2010. MMWR 10/1/2014 Vol 63, 1

4. If confirmed as a Harmful Algal Bloom (HAB), bathing and exposure to contaminated water must be prohibited and the suggested standard warning signs should be erected. Depending on the nature and extent of the HAB the suggested standard warning may be supplemented with further advice to the public. Table 1 is helpful but if laboratory results and a detailed risk assessment is not possible/delayed and there is a concern about exposure risk, it may be safest to assume toxicity initially and bathing and exposure to contaminated water must be prohibited (See suggested standard warning sign below).
5. The decision as to when to remove restrictions should take into account a variety of factors including the species toxicity, presence of scum and will be dependent on obtaining a favourable environmental risk assessment including;
    - 2 clear samples if possible, ideally a week apart
    - No obvious evidence of algae present
    - No weather and environmental conditions which could cause recurrence of the bloom

Examples of Blue Green Algae[9]

3. Suggested standard warning sign

WARNING

- This water contains high levels of blue-green algae which may cause illness in humans and animals including pets
- Avoid contact with scum, visible algae and surrounding water
- Do not swim in water near visible algae

[9] Water Quality Guidance for Open Water Events and Training Sessions. (2018). [ebook] British Triathlon, Royal Life Saving Society UK, p.11. Available at: http://www.triathlonscotland.org/wp-content/uploads/2017-Water-Quality-Guidance.pdf [Accessed 5 Apr. 2018].

- Do not touch scum on the shore
- Wash hands if you touch the algal material
- Keep children and pets away from the water's edge
- Do not let pets drink the water. Wash pets if they come into contact with water

4. Minimising future algal bloom

Minimising future algal bloom should be considered based on environmental conditions (and those predicted with climate change) and importance of the water body for ecology and human use. Algal blooms block sunlight from reaching other plants in the water. They also use up oxygen in the water at night which can suffocate fish and other creatures. Oxygen is also used up when the bloom decays. For example, increasing shade and reducing nutrients in the water can control algae.

Appendix 6: Marine Algal Bloom Guidance

Algal Blooms in Marine Bathing Areas (not freshwater lakes or rivers, this only refers to saline waters)

1. About Marine Algal Blooms

- The Marine Institute run a comprehensive national marine phytoplankton monitoring system, for Harmful Algal Blooms (HABs) intended to complement the national shellfish safety programme. This programme analyses in near real time (2 day turnaround) suite of samples from all coastal areas in Ireland and is year round. https://www.marine.ie/Home/site-area/areas-activity/marine-environment/phytoplankton-monitoring
- This current programme provides a sentinel system for a HAB that might have significance in marine bathing water / water for recreational use.
- In general, blooms occurring in the sea in Ireland are not harmful for bathers. There are some species associated with fresh water that may be harmful but these generally only are detected in marine areas following exceptional freshwater runoff. To date there have been no experiences of such a HAB in coastal bathing areas (bloom in Inner Galway Bay last year – identified subsequently to be a non-harmful microcystis species).

2. What to do if there is a suspected or confirmed algal bloom/ cyanobacteria incident?

- Should an event occur in a marine BW site, that gives cause for concern, the following steps are suggested;

1. Determine extent of suspect bloom (size of area involved, presence of scum in bathing location) and eliminate obvious cause (turbidity/discolouration due to weather/wave action/localised activity) which could give rise to such characteristics
2. Get a preliminary laboratory analysis if possible to confirm biological agent rather than suspended matter (suspended sediment, broken up seaweed, detritus, wastewater overflow etc)
3. Take a photograph of suspected bloom in situ and submit to joe.silke@marine.ie See photos below.


Examples of Blue Green Algae

4. If required, dispatch sample, at least 50ml for analysis, preserved with *lugols iodine* and if possible a second unpreserved sample to Mr Joe Silke, Section Manager, Marine Institute, Rinville, Oranmore, Co. Galway. H91 R673 091 387200 (or his deputy).
5. If confirmed as a Harmful Algal Bloom (HAB), bathing and exposure to contaminated water must be prohibited and the suggested standard warning signs should be erected. Depending on the nature and extent of the HAB the suggested standard warning may be supplemented with further advice to the public.
6. The decision as to when to remove restrictions should take into account a variety of factors including the species toxicity and presence of scum, and will be dependent on obtaining a favourable environmental risk assessment including;
    - 2 clear samples if possible, ideally a week apart
    - No obvious evidence of algae present
    - No weather and environmental conditions which could cause recurrence of the bloom

3. Suggested standard warning sign

WARNING

- This water contains high levels of blue-green algae which may cause illness in humans and animals including pets
- Avoid contact with scum, visible algae and surrounding water
- Do not swim in water near visible algae
- Do not touch scum on the shore
- Wash hands if you touch the algal material
- Keep children and pets away from the water's edge
- Do not let pets drink the water. Wash pets if they come into contact with water

Appendix 7: Temporary Warning Notice

<ENTER B WATER NAME HERE>

<ENTER LOCAL AUTHORITY LOGO HERE>

<ENTER NOTICE DATE HERE>

ADVICE NOT TO SWIM

Bathers are advised not to swim at this bathing water due to an increase in the levels of bacteria found in bathing water sample taken on dd/mm/yyyy.

To reduce the risk of illness, beach users should take the following precautions:

- **Avoid swallowing or splashing water**
- **Wash your hands before handling food**
- **Avoid swimming with an open cut or wound**
- **Avoid swimming if you are pregnant or have a weakened immune system.**

Higher levels of bacteria are usually short-lived and most bathers are unlikely to experience any illness.

LIKELY CAUSE:

EXPECTED DURATION:

ACTIONS TAKEN/PROPOSED:

For further information please contact: <enter LA contact details here> Tel: <enter tel no>
Visit: https://www.beaches.ie/ or <enter the LA website details here>

Appendix 8: Temporary Prohibition Notice

<ENTER B WATER NAME HERE>

<ENTER LOCAL AUTHORITY LOGO HERE>

<ENTER NOTICE DATE HERE>

DO NOT SWIM

SWIMMING IN THIS WATER MAY CAUSE ILLNESS

BATHING IS PROHIBITED DUE TO:

LIKELY CAUSE:

EXPECTED DURATION:

ACTIONS TAKEN/PROPOSED:

For further information please contact: <enter LA contact details here> Tel: <enter tel no>
Visit: https://www.beaches.ie/ or <enter the LA website details here>

[Appendix 9: Prior Warning Notice]

<ENTER B WATER NAME HERE>

<ENTER LOCAL AUTHORITY LOGO HERE>

BN3 Bathing Prior Warning Notice

<ENTER NOTICE DATE HERE>

Bathers are advised of the possibility of an increase in the levels of bacteria in the bathing water over the coming days due to <enter reason here>.

To reduce the risk of illness, beach users should take the following precautions:

- **Avoid swallowing or splashing water**
- **Wash your hands before handling food**
- **Avoid swimming with an open cut or wound**
- **Avoid swimming if you are pregnant or have a weakened immune system.**

Higher levels of bacteria are usually short-lived and most bathers are unlikely to experience any illness.

LIKELY CAUSE:

EXPECTED DURATION:

ACTIONS TAKEN/PROPOSED:

For further information please contact: <enter LA contact details here> Tel: <enter tel no>
Visit: https://www.beaches.ie/ or <enter the LA website details here>

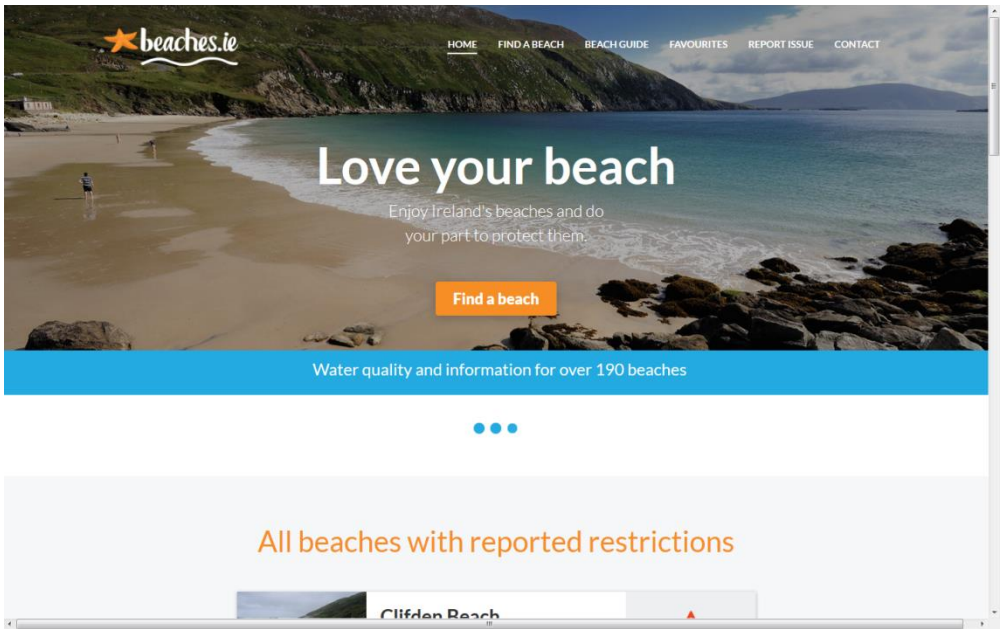
Appendix 10 – Bathing Water Profiles

This appendix is a step-by-step guide on how to use the Beaches website (https://www.beaches.ie/) to access bathing water profiles

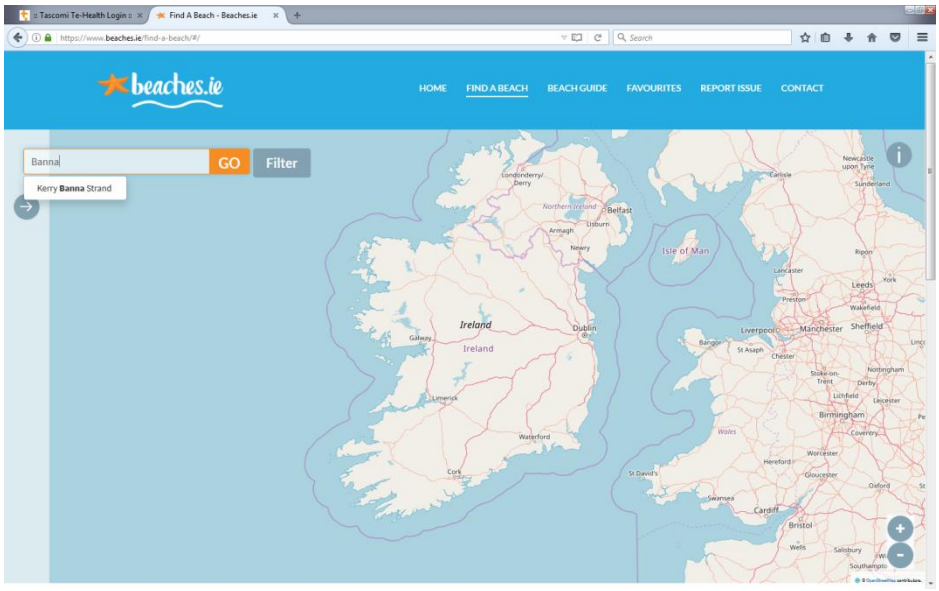
Bathing Water Profiles

Bathing water profiles are easy to find on the Beaches website.

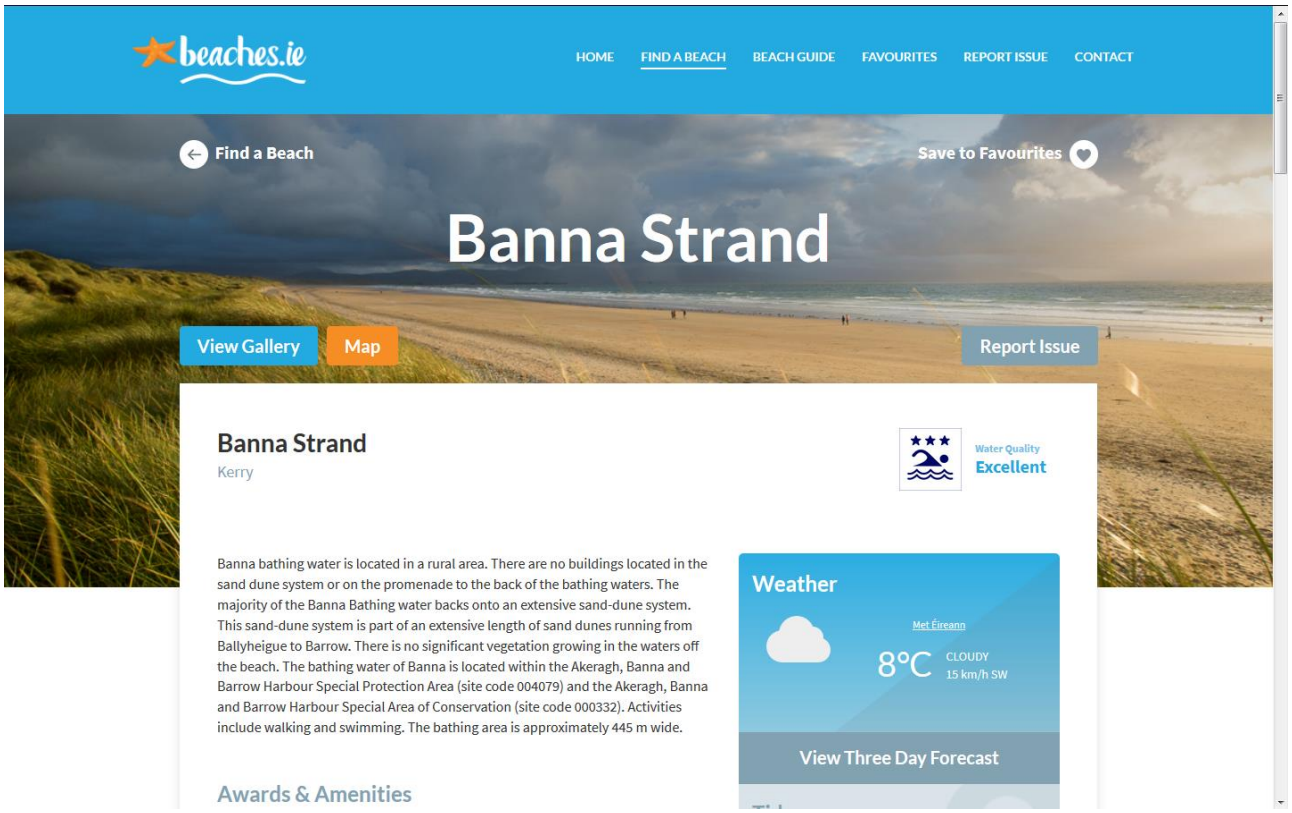
Step 1: Log onto the Beaches website. The home page looks like this.



Step 2: Right click on the 'Find a beach' orange button in the centre of the page. A search function and map will open. Type in the name of your beach and the search function will suggest options for autofill. Alternatively click 'Go' to browse all beaches.



Step 3: The Page for your chosen Bathing Water looks like this. On scrolling down you will see a description of the beach and a full water quality profile including historical results. There is also a facility to download the profile should you wish.



Appendix 11 – Sea Water Sampling - Safe Work Practice Sheet

	Environmental Health Service Health and Safety Management System General Safe Work Practice Sheet	
Title:	**Seawater Sampling Safe Work Practice Sheet**	
Activity:	**All Work Activities involving Seawater Sampling.**	**Page:**

1.0 Purpose

To establish a safe work practice for staff involved in seawater sampling.

2.0 Scope

Applies to all persons involved in and managing work activities involving seawater sampling.

3. 0 Definitions

Seawater sampling is defined as the taking of a sample of seawater in a container from a predetermined location called the sampling axis at a depth of 30cm. *(Refer to Sampling Procedure – Bathing Water)*.

A sampling axis is an agreed line from the shore of each beach along which a sample must be taken.

4. 0 Hazards

The principal hazards associated with seawater sampling are

1. Slips, trips and falls
2. Drowning.

5.0 Personal Protective Equipment

Life Jacket, Dry Suit, Mobile Phone, Personal Alarm, Sample Grabber.

6.0 Procedure

- First line managers / supervisors and employees who are involved in seawater sampling are responsible for ensuring that they/their staff are familiar with the safe work procedure.
- Only staff who are able to swim should be involved in seawater sampling.
- Staff engaged in seawater sampling must wear a life jacket.
- If any issues arise during seawater sampling which cause a member of staff distress, they should report it to their Line Manager.
- The manager of the bathing water programme shall carry out a risk assessment of all bathing water sites with regard to the following factors: severe currents, acute beach gradient, isolated location and any other known specific local hazards. Where the need arises it may be necessary to assign two officers to the sampling of specific beaches.
- Personal alarms are issued all staff due to the isolated nature of some beaches and the periodic need for early morning sampling. When sampling on off shore islands, the EHO concerned should telephone the main office, while they are awaiting the return ferry / plane, to confirm that all is well.
- Health and safety factors always take precedence in determining whether or not to take a sample. Sampling officers should not put their own personal safety at risk. Factors such as inclement weather and knowledge of the topography of a sampling location, e.g. incline of beach, strong currents etc., on the intended day of sampling should be taken into account. Please liaise with officers who have experience of sampling the beaches in question. Buoyancy aids are available and must be utilised in line with good health and safety practice *(Marine Notice No 36 of 2005 - Guidance on the use and periodic inspection of Inflatable PFD/Life jackets http://www.transport.ie/viewitem.asp?id=7914&lang=ENG&loc=2013).*

7.0 Training

Training is required to ensure employees have a clear understanding of the risks associated with seawater sampling. Employees must understand the correct systems of work with seawater sampling and the consequences of not adhering to the procedure.

8.0 Applicable Regulations and Legislation

- Safety Health and Welfare at Work Act 2005
- Safety Health and Welfare at Work Act (General Application) Regulations 2007
- Local Government (Sanitary Services) Act 1948 (as amended)
- Bathing Water Quality Regulations 2008

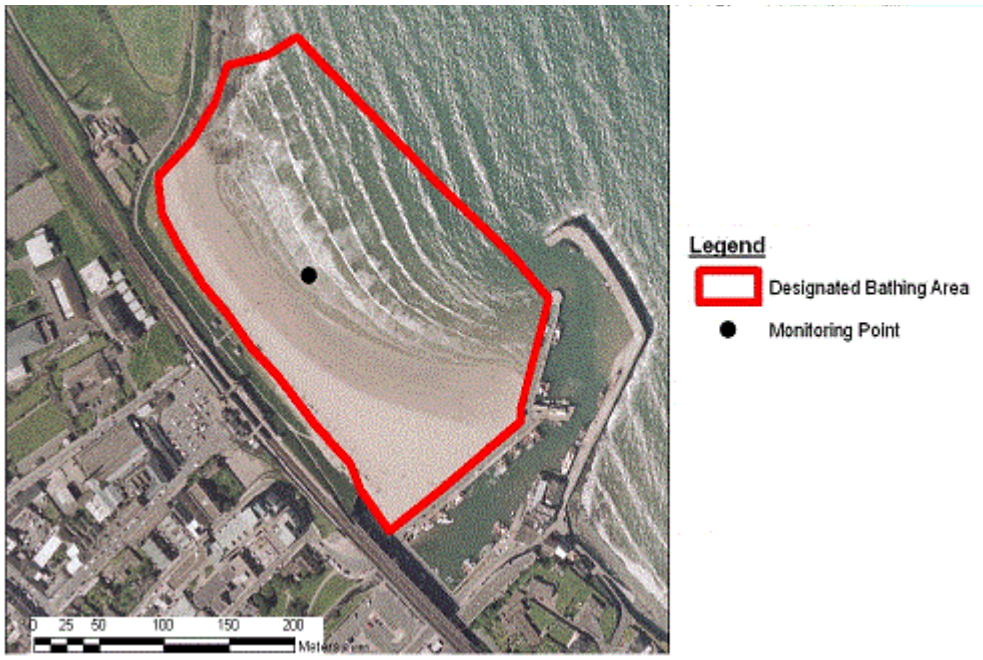
Appendix 12 - Taking a Sample of Bathing Water – rules on handling of micro samples

Regulation 9 of the Bathing Water Quality Regulations 2008 states:
"A local authority shall, subject to paragraph (2), ensure that the analysis of bathing water quality takes place in accordance with … the rules specified in Schedule 5".

The following is a synopsis of Schedule 5.

Schedule 5
Rules on the handling of samples for microbiological analyses

1. **Sampling point**
Where possible, samples are to be taken 30 centimetres below the water's surface and in water that is at least one metre deep.
The location on the beach where the sample is to be taken or the 'monitoring point' is clearly shown on the Beach Profile.



2. **Sterilisation of sample bottles**
The sample should only be taken in a sterile bottle or container.

3. **Sampling**
The volume of the sampling bottle/container is to depend on the quantity of water needed for each parameter to be tested. The minimum content is generally to be 250 ml. Sample containers are to be of transparent and non-coloured material (glass, polyethene or polypropylene). In order to prevent accidental contamination of the sample, the sampler is to employ an aseptic technique to maintain the sterility of the sample bottles. There is no further need for sterile equipment (such as sterile surgical gloves or tongs or sample pole) if this is done properly. The sample is to be clearly identified in indelible ink on the sample container and on the sampling form.

4. **Storage and transport of samples before analysis**
Water samples are to be protected at all stages of transport from exposure to light, in particular direct sunlight. The sample is to be conserved at a temperature of around 4 □C, in a cool box or refrigerator (depending on climate) until arrival at the laboratory. If the transport to the laboratory is likely to take more than four hours, then transport in a refrigerator is required. The time between sampling and analysis is to be kept as short as possible. Samples are to be analysed on the same working day where possible. If this is not possible for practical reasons, then the samples shall be processed within no more than 24 hours.

Appendix 13 Estimating Normal Background Levels

'Normal Background Level'

The 'Normal Background Level' of *E coli* and intestinal enterococci should be considered when deciding whether or not to lift an Advisory or Prohibition Notice. For example, when assessing the quality of bathing water where almost all previous *E. coli* levels for that bathing area were consistently low, a sample result of 495 cfu/100ml *E. coli* does not indicate that the bathing water quality has returned to normal, despite the fact that it is below the recommended level of 500 cfu/100ml.

In order to determine what the 'Normal Background Level' is for an individual bathing area it is important to look at previous results when bathing water quality was considered normal. The most common result over the previous **3 seasons** is a good indication of the normal level of both E.coli and I.E. however this can be difficult to calculate due to the nature and spread of microbial results (see Table A11.1 below).

Table A11.1 Scenario of previous bathing water results in determining normal background levels

Date	*E.coli* /100ml	IE/100ml
01/06/2011	31	115
15/07/2011	201	1
29/08/2011	1	11
11/06/2012	20	2
25/07/2012	185	21
08/08/2012	60	145
22/06/2013	93	118
29/07/2013	230	121
06/08/2013	152	132

As can be seen in Table A11.1, while there are similar results, no result is repeated so it is not clear what the normal background level is.

A suggested approach is to put the data into ranges or bands of results and determine the 'Normal Background Level' as the most common band. The band for E.coli may not be the same as the band for intestinal enterococci for any given beach. Suggested bands are given in Table A11.2.

Table A11.2: Suggested bands to use when determining 'Normal Background Levels' for particular bathing water

	E.coli /100ml	IE/100ml
Band A	<250	<100
Band B	250- 400	100-150
Band C	> 400	>150

If we apply these bands to Table A11.1 then the normal background level for this beach is the most frequent band as seen in Table A11.3.

Table A11.3: Applying bands to the scenario of results in Table A11.1 to determine the 'normal background level' for a bathing water

Date	*E.coli* /100ml	IE/100ml
01/06/2011	Band A	Band B
15/07/2011	Band B	Band A
29/08/2011	Band A	Band A
11/06/2012	Band A	Band A
25/07/2012	Band A	Band A
08/08/2012	Band A	Band B
22/06/2013	Band A	Band B
29/07/2013	Band B	Band B
06/08/2013	Band A	Band B
Most frequent band	**Band A = 7**	**Band B = 5**

Conclusion:

In this case it would be prudent to reopen the beach only if the sample result indicates that *E.coli* levels are < 250 cfu /100 ml and IE levels are 100-150 cfu/100ml.

In scenarios where Band C is the most frequent band then the default values of < 500 *E.coli* /100 ml and < 200 IE /100ml should be used when removing an Advisory or Prohibition Notice.

Appendix 14 Bathing Water and COVID-19: supplementary information and references

Extract from National Health Library and Knowledge Service Evidence Team literature review 01 March 2021

What is known about the survival of SARS-CoV-2 in open water — sea and fresh water; waste water and sewage. What are the implications to human health of recreational activities in open water such as kayaking or swimming?

Main Points

1. The risk of transmission of SARS-CoV-2 from fresh or coastal waters contaminated with faeces is thought to be very low.
2. Conventional treatment by wastewater treatment plants should be sufficient to inactivate SARS-CoV-2.
3. SARS-CoV-2 RNA has been detected by qPCR testing in wastewater, but no samples have yet been found to contain infectious virus.
4. Coronaviruses in general are not thought to survive well in aqueous environments.

Summary of Evidence

The risk of transmission of SARS-CoV-2 from swimming or engaging in water sports in fresh or coastal waters contaminated with faeces is very low ([1,2,3,4,5,6,7]). The risk of transmission may increase if people visiting beaches, river or pools do not practice adequate social distancing in small, crowded conditions such as changing rooms ([1,2]).

Best practice wastewater treatment that is standard in developed countries should be sufficient to inactivate the virus ([3, 5, 6, 7, 8, 9, 12]). The use of chlorine in waste water treatment plants has been suggested as an optimal way of inactivating the virus ([5, 7, 10, 12]). It should be noted that the risk of SARS-CoV-2 being present in wastewater may be higher in developing countries with poor sanitation networks ([6, 8, 10]).

SARS-CoV-2 RNA has been detected by qPCR testing in wastewater ([6, 10]), but no samples have yet been found to contain infectious virus ([6]). One study found that SARS-CoV-2 RNA was significantly more persistent than infectious SARS-CoV-2 in wastewater, indicating that detection of RNA does not confirm a risk of infection (11).

Coronaviruses, in general, are not believed to survive well in aqueous environments in comparison to other viruses ([6, 7, 9, 12]).

References

[1] World Health Organization (2020). Water, sanitation, hygiene, and waste management for SARS-CoV-2, the virus that causes COVID-19. https://www.who.int/publications/i/item/WHO-2019-nCoV-IPC-WASH-2020.4 [Accessed 25 February 2021].
[2] European World Health Organization (2020). FACT: Water or swimming does not transmit the COVID-19 virus. https://www.facebook.com/WHO/photos/a.167668209945237/3760096377369051/ [Accessed 25 February 2021].

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Recreational waters – A potential transmission route for SARS-CoV-2 to humans?

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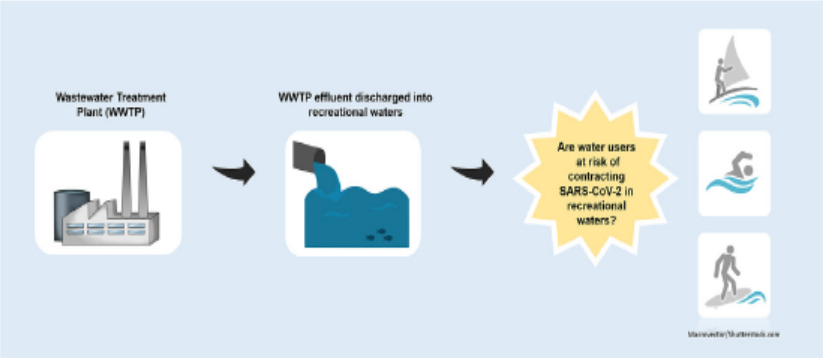
HIGHLIGHTS

- SARS-CoV-2 has been detected in faeces and wastewater in recent months.
- Wastewater is a potential dissemination route for SARS-CoV-2 to recreational waters.
- Limited data on the presence and viability of SARS-CoV-2 in water bodies exists.
- The risk of SARS-CoV-2 exposure to recreational water users is believed to be low.
- Further research investigating SARS-CoV-2 in recreational waters is required.

GRAPHICAL ABSTRACT



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ABSTRACT

Coronavirus disease 2019 (COVID-19), the respiratory illness caused by the novel virus, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which has lead to high morbidity and mortality rates worldwide, has been causing major public health concerns since first detected in late 2019. Following identification of novel pathogens, questions in relation to dissemination of the pathogen and transmission routes begin to emerge. This rapidly spreading SARS-CoV-2 virus has been detected in both faecal and wastewater samples across the globe, highlighting the potential for faecal-oral transmission of the virus. As a result, concerns regarding the transmission of the virus in the environment and the risk associated with contracting the virus in recreational waters, particularly where inadequately treated wastewater is discharged, have been emerging in recent weeks. This paper highlights the need for further research to be carried out to investigate the presence, infectivity and viability of this newly identified SARS-CoV-2 virus in wastewater effluent and receiving recreational waters.

1. Introduction

The newly identified coronavirus, SARS-CoV-2, known to cause respiratory illness, Covid-19, in humans, has now been declared a pandemic by the World Health Organisation. The virus, which was first detected in the Chinese city of Wuhan in the Hubei Provence in December 2019, has since spread rapidly across the globe, resulting in almost 7 million confirmed cases and over 400,000 deaths by the beginning of June 2020 (WHO, 2020a). SARS-CoV-2 is an enveloped virus belonging to the coronavirus family, which consists of six other coronaviruses known to cause human illness (Cascella et al., 2020; CDC, 2020a). This novel coronavirus is closely related to other coronaviruses known to have caused outbreaks previously such as the Severe Acute Respiratory

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Syndrome (SARS-CoV-1) and Middle East Respiratory Syndrome (MERS-CoV) related coronaviruses, both of which have the ability to cause severe illness in humans. SARS-CoV-2 is reported as being most genetically identical to SARS-CoV-1 in particular, with studies reporting a genetic relatedness of ~80% (Chan et al., 2020; Zhou et al., 2020).

The main route of transmission of SARS-CoV-2 between humans occurs via respiratory droplets and contact (Jin et al., 2020; WHO, 2020b). However, concerns regarding environmental transmission and the associated public health risk are beginning to emerge. In relation to SARS-CoV-2, the risk of transmission to humans through recreational water bodies is unclear, as there have been no reports to date on the detection of or the ability of this particular virus to remain viable in such water bodies. It is believed that the SARS-CoV-2 virus may behave in similar ways to other coronaviruses, therefore, data reported on previously identified coronaviruses in relation to transmission routes and viability in the environment may be comparable to this novel virus (WEF, 2020). Carducci et al. (2020) highlight the need for enhanced understanding of the fate of coronaviruses, including SARS-CoV-2, in the aquatic environment (Carducci et al., 2020).

2. Faecal-oral transmission - a potential route of transmission for SARS-CoV-2?

Studies reporting the detection of SARS-CoV-2 viral RNA in faecal samples from infected humans have been emerging in recent months (Cai et al., 2020; Holshue et al., 2020; J. Zhang et al., 2020a; Wölfel et al., 2020). Although viral RNA has been detected, this does not necessarily indicate the presence of the virus in its infectious state (Holshue et al., 2020). However, the isolation of the live virus from stool samples has also been documented recently (Wang et al., 2020; Xiao et al., 2020; Y. Zhang et al., 2020c). A number of studies have reported persistent viral shedding in faeces of previously SARS-CoV-2 positive patients following negative respiratory samples. The number of days, post negative respiratory swabs, in which viral shedding was noted in faeces ranged extensively from 7 days (Chen et al., 2020), to 10 days (T. Zhang et al., 2020b), to 20 days (Xing et al., 2020) to a surprising 33 days (Y. Wu et al., 2020).

In recent weeks, Medema et al. (2020) reported the first detection of SARS-CoV-2 viral RNA in untreated wastewater collected from wastewater treatment plants (WWTP) in the Netherlands. Since then, there have been further reports indicating detection of the viral RNA in WWTP influent in Australia, the U.S.A, and France (Ahmed et al., 2020; F. Wu et al., 2020; Wurtzer et al., 2020).

At present, the viability of this novel virus in both faecal and wastewater samples is not known, however, data has been reported previously on the viability of the closely related SARS-CoV-1 virus in such samples. The SARS-CoV-1 virus, believed to be of zoonotic origin, which like SARS-CoV-2 causes respiratory illness, caused an outbreak in 2003 killing almost 700 people across the globe (Lam et al., 2004). Reports have indicated that the SARS-CoV-1 virus has been found to survive in faecal samples for up to 17 days at 4 °C, however at a higher temperature of ~20 °C, length of survival significantly reduced to 3–4 days (WHO, 2003; Wang et al., 2005). Similarly, in wastewater samples, the SARS-CoV-1 virus was found to survive for up to 14 days at 4 °C, however, only 2–3 days at an elevated temperature of ~20 °C (Wang et al., 2005; Gundy et al., 2009).

Following detection of new pathogenic microorganisms, such as SARS-CoV-2, concerns begin to arise in relation to transmission routes and generally, the risks associated with the spread of such pathogens through the environment (Brainard et al., 2017). To date, there have been no reports of humans contracting the SARS-CoV-2 virus via faecal-oral transmission (CDC, 2020b). However, where the SARS-CoV-2 virus is present in its infectious state following excretion from the body, the potential of faecal transmission cannot be ruled out. The importance of considering this route of transmission has been highlighted, especially where humans may become exposed to faeces or wastewater containing the virus i.e. in water bodies contaminated with raw discharge (Heller et al., 2020; Qu et al., 2020; Wigginton and Boehm, 2020; Xiao et al., 2020; Xing et al., 2020; Yeo et al., 2020; Yuen et al., 2020; Y. Zhang et al., 2020c).

3. The effect of wastewater treatment on SARS-CoV-2

Wastewater containing human excreta serves as a potential route for dissemination of pathogenic microorganisms in the environment. Therefore, the discharge of inadequately treated wastewater containing such microorganisms poses a risk to human health (EPA, 2019). In general, wastewater is treated at a WWTP prior to its discharge into the aquatic environment. In relation to SARS-CoV-2, very little research has been carried out on the effects of the wastewater treatment processes on the virus to date. A major challenge to understanding the role of wastewater in transmission of SARS-Co-V-2 is lack of standardised methodologies for detection and quantification in wastewater samples (Kitajima et al., 2020). Although Wurtzer et al. (2020) reported the detection of SARS-CoV-2 RNA in both untreated and treated wastewater samples collected from WWTP's in France, they did document a decrease in the viral load following wastewater treatment. It is important to note that as this was viral RNA detected in the wastewater samples, it does not indicate the presence of the infectious virus.

Although little data is available in relation to the effects of wastewater treatment on SARS-CoV-2, there is no evidence to suggest that this virus behaves in a different manner to other coronaviruses. A previous study which investigated coronavirus survival following primary and secondary wastewater treatment, but before disinfection, reported reduced viability of the virus in secondary effluent (Gundy et al., 2009). The inactivation of the closely related SARS-CoV-1 by common antiseptics and disinfectants, such as ethanol, chlorine and bleach, has been reported previously indicating susceptibility to such agents (Rabenau et al., 2005; Geller et al., 2012). According to the Water Environment Federation (2020) and World Health Organisation (2020c), previous studies have indicated that filtration and disinfection systems in place at municipal WWTP's should be sufficient for the inactivation of viruses. Although reports have indicated the disinfection process to be a crucial step in wastewater treatment for the reduction in viability of viruses, there is still a possibility of the virus remaining in the WWTP effluent (Wigginton et al., 2015). However, even if the virus does enter the aquatic environment, enveloped viruses, which include coronaviruses, are believed to have a short survival rate in such waters (Wigginton et al., 2015).

4. Conclusion

According to the Centres for Disease Control and Prevention (CDC) (2020a, 2020b), the expected risk associated with contracting the SARS-CoV-2 virus via water sources including wastewater and recreational water bodies' remains low. However, further research is warranted to investigate both viability and infectivity of this novel virus in wastewater and in receiving water bodies. Such research is important to gain a better understanding of the risk associated with contracting the virus in recreational waters and to assist public health authorities in the development and implementation of policies and guidelines for the protection of human health.

CRediT authorship contribution statement

Niamh Cahill: Conceptualization, Writing - original draft. **Dearbháile Morris:** Conceptualization, Writing - original draft.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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