Environmental Protection Agency
National Water Event  2019

Risk Assessment of Drinking Water

Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

Ray Parle  M.Sc., Principal Environmental Health Officer
Chair HSE National Drinking Water Group
Topics to be covered in this presentation

- HSE role in drinking water
- Who does what in HSE
- What is ‘Risk’ and ‘Risk Assessment’
- Concepts as applied to drinking water
- Some practical examples
- Guidance and resources
(1) Where Irish Water or a local authority, in consultation with the Health Service Executive, considers that a supply of water intended for human consumption constitutes a potential danger to human health, Irish Water or the authority shall, subject to agreement with the Health Service Executive, ensure that—

(a) the supply of such water is prohibited, or the use of such water is restricted, or such other action is taken as is necessary to protect human health.............
(2) For the purposes of paragraph (1), and subject to agreement with the Health Service Executive, where a supervisory authority is of the opinion that non-compliance with a water quality standard or the presence of any substance or micro-organism or the inefficiency of related disinfection treatment constitutes, or may constitute, a risk to human health, the supervisory authority shall issue such direction to the relevant water supplier as it considers necessary.....
Drinking Water and Health
A Review and Guide for Population Health
Health Service Executive
December 2008
HSE Disciplines involved in Drinking Water

Environmental Health Service

- Normally first point of contact between Water Service Authority and HSE
- Regulation (EC) No 178/2002 of the laying down the general principles and requirements of food law
- Monitoring of water supplies serving food businesses
- Monitoring of fluoridated public water supplies (S.I. 42 of 2007)
- Supervision of bottled water plants (S.I. 282 of 2016)

Public Health Departments

- Ongoing surveillance of communicable disease & enhanced surveillance in the event of an outbreak
- Identification and epidemiological investigation of an outbreak of waterborne illness
- Provision of public health medical advice to other health professionals, other agencies and the public
- Assessment of risk to public and identification of vulnerable groups
HSE National Drinking Water Group Membership

- Drawn from Public Health, Environmental Health, Laboratories, Health Protection Surveillance Centre
- Reports to Assistant National Directors (Dr. Kevin Kelleher and Ms. Ann Marie Part)
- Terms of Reference initially set out in 2008 and revised in 2010 and 2013
- 6 plenary meetings a year
- A number of joint position papers with EPA
HSENDWG Current Terms of Reference

- (1) To support best practice and promote competence among HSE personnel who have a role in the protection of public health in relation to drinking water.
- (2) to review communications within the HSE and between HSE and other agencies in relation to drinking water and health
- (3) to act as the HSE expert group and resource on drinking water and health issues
What is Risk?

• ‘a function of the probability of an adverse health effect and the severity of that effect, consequential to a hazard(s) in food’ (Codex Alimentarius Committee FAO/WHO, 2004)

• ‘the probability of an adverse effect in an organism, system or (sub)population caused under specified circumstances by exposure to an agent’ (IPCS, 2004)

• ‘combination of the likelihood of an occurrence of a hazardous event or exposure (s) and the severity of injury or ill-health that can be caused by the event or exposure’ (BS 18004:2008)
What is Risk?

- ‘Risk can be regarded as a social construct of modern society’ (p. 9 WHO Europe regional office ‘Health and Environment: Communicating the Risks (2013)')
IPCS: Risk Assessment as part of Risk Analysis
Environmental Health Criteria 240
Principles and Methods for the Risk Assessment of Chemicals in Food

Chapter 2
RISK ASSESSMENT AND ITS ROLE IN RISK ANALYSIS

A joint publication of the Food and Agriculture Organization of the United Nations and the World Health Organization
IPCIS Approach

- **Risk Assessment**: a scientifically based process consisting of the following steps:
  1) **hazard identification** (evidence for adverse effects);
  2) **hazard characterization** (‘dose – response’);
  3) **exposure assessment** (‘likely intake’);
  4) **risk characterization** (estimation of risk under different exposure scenarios)
Risk Assessment BS:1804:2008

‘Process of evaluating the risk(s) arising from a hazard(s), taking into account the adequacy of any existing controls, and deciding whether or not the risk is acceptable’

There is always an element of subjectivity in the risk assessment process!
Deriving a health-based guidance value (HBGV) for ‘threshold effect’ chemicals

- No observed adverse effect level (NOAEL) or Benchmark Dose (BMD) = POD / Reference Point
- Uncertainty Factor (UF) / Safety Factor

\[
\text{HBGV} = \frac{\text{POD}}{\text{UF}}
\]

- Historically UF = 100 for using animal NOAEL data to convert to HBGV for humans
Risk Assessment and Drinking Water

- **Chemical Hazards** – *generally long-term manifestation of effects; may be difficult to attribute specific illness to exposure from drinking water*

- **Microbiological Hazards** – *generally acute effects, evident in the short-term after exposure (days to weeks), readily detectable by infectious disease surveillance and sampling*

- **Radiological Hazards** – ‘no zero effect’ level, other sources besides water; *Indicative Dose limit: 0.1 mSv/yr; 500 Bq/l limit value for radon in drinking water* (European Union (Radioactive Substances in Drinking Water Regs. S.I. 160 of 2016))

- Normally represents the concentration of a constituent that does not result in any significant risk to health over a lifetime of consumption.

- **Provisional guidelines:** where there is high degree of uncertainty re. health data
  
or
  level is reasonably achievable through treatment processes / lab analytical techniques (even where above calculated HBGV): example lead (Pb): 10 µg/l
Deriving guideline values for drinking water (threshold effect chemicals)

- Tolerable Daily Intake (TDI) mg/kg body weight
- \( TDI = \frac{NOAEL}{UF} \) or \( LOAEL \) or \( BMDL \)
- Guideline Value = \( TDI \times \text{body Wt.} \times P \\
   \times \text{C} \)
- Where \( P \) = fraction of TDI assigned to drinking water
  \( C \) = daily drinking water consumption
Deriving guideline values for drinking water (non-threshold effect chemicals)

- Mathematical model to estimate risk (at upper and lower bounds of confidence) of additional cancer cases over a lifetime of exposure

- **WHO**: $10^{-5}$ lifetime cancer risk (= 1 additional case of cancer per 100,000 of population over 70 years consuming drinking water at guideline value).

- **EU**: uses $10^{-6}$ lifetime cancer risk  (p. 14 Brussels, 1.2.2018 COM(2017) 753 final 2017/0332 (COD))
Portlaw cryptosporidiosis Outbreak

Report on Cryptosporidiosis Outbreak in Portlaw 2006
Cryptosporidiosis outbreak Portlaw 2006

Notification of cryptosporidiosis cases, date of onset of illness and actions taken

NB The average incubation period from infection to onset of symptoms of cryptosporidiosis is 7 days.
Glenary Cryptosporidium Incident

Report on
Cryptosporidium Incident
Glenary Water Supply, Clonmel
July - October 2007
Glenary Water Supply Catchment Area
## Glenary Cryptosporidium incident

### Table 6 (b). Cryptosporidium monitoring Glenary treated water 2007

<table>
<thead>
<tr>
<th>Date sampled</th>
<th>Location</th>
<th>Volume sampled</th>
<th>Results/10 Litres</th>
</tr>
</thead>
<tbody>
<tr>
<td>02.07.07</td>
<td>WTP Final</td>
<td>416</td>
<td>5.42 oocysts</td>
</tr>
<tr>
<td>03.07.07</td>
<td>WTP Final</td>
<td>267</td>
<td>1.84 oocysts</td>
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<tr>
<td>09.07.07</td>
<td>WTP Final</td>
<td>466</td>
<td>0.386 oocysts</td>
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<tr>
<td>11.07.07</td>
<td>WTP Final</td>
<td>417</td>
<td>&lt;0.01 oocysts</td>
</tr>
<tr>
<td>11 - 12.07.07</td>
<td>WTP Final</td>
<td>1345</td>
<td>0.02 oocysts</td>
</tr>
<tr>
<td>13 - 14.07.07</td>
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<td>1107</td>
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<tr>
<td>14 - 15.07.07</td>
<td>WTP Final</td>
<td>1356</td>
<td>2.06 oocysts</td>
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<tr>
<td>15 - 16.07.07</td>
<td>WTP Final</td>
<td>1618</td>
<td>0.94 oocysts</td>
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<tr>
<td>16 - 17.07.07</td>
<td>WTP Final</td>
<td>1429</td>
<td>0.50 oocysts</td>
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<tr>
<td>17 - 18.07.07</td>
<td>WTP Final</td>
<td>1516</td>
<td>0.01 oocysts</td>
</tr>
<tr>
<td>18 - 19.07.07</td>
<td>WTP Final</td>
<td>1532</td>
<td>0.01 oocysts</td>
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<td>19 - 20.07.07</td>
<td>WTP Final</td>
<td>1643</td>
<td>0.01 oocysts</td>
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<td>20 - 21.07.07</td>
<td>WTP Final</td>
<td>1484</td>
<td>&lt;0.01 oocysts</td>
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<td>21 - 22.07.07</td>
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<td>0.40 oocysts</td>
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<td>22 - 23.07.07</td>
<td>WTP Final</td>
<td>185</td>
<td>&lt;0.01 oocysts</td>
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<td>23 - 24.07.07</td>
<td>WTP Final</td>
<td>304</td>
<td>0.030 oocysts</td>
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<td>24 - 25.07.07</td>
<td>WTP Final</td>
<td>275</td>
<td>0.58 oocysts</td>
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<td>25 - 26.07.07</td>
<td>WTP Final</td>
<td>779</td>
<td>6.55 oocysts</td>
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<td>26 - 27.07.07</td>
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<td>25.32 oocysts</td>
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<tr>
<td>01 - 02.08.07</td>
<td>WTP Final</td>
<td>286</td>
<td>0.24 oocysts</td>
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</table>
Glenary Cryptosporidium incident

Figure 8. Timeline of corrective actions taken on the Glenary treatment plant and Cryptosporidium results

- Cryptosporidium results from Glenary supply and timeline of corrective actions

- HSE/EPA notified
- Increase backwashing frequency
- Dump backwash
- Install turbidity monitors
- Heavy rainfall
- Start full upgrade of treatment plant
- Boil notice

Graph showing dates from 20th June to 06th August with various milestones marked along the timeline.
Some resources and position papers
Some resources and position papers

- INCIDENT MANAGEMENT DOCUMENTS

  Management of Initial Notification of Drinking Water Issues of Potential Danger to Human Health
  
  Author: HSE National Drinking Water Group
  
  Date: July 2016
  
  Available at http://www.lenus.ie/hse/handle/10147/618917

- Drinking Water and Health: a review and guide for population health (under revision)

  Author: HSE Population Health Water Group
  
  Date: Dec 2008
  
  Available at http://www.lenus.ie/hse/handle/10147/110534

- HSE WATER INTERNET

  www.hse.ie/water
Some resources and position papers

- **LEAD (Pb)** Available at [http://www.hse.ie/eng/health/hl/water/drinkingswater/lead/Lead.html](http://www.hse.ie/eng/health/hl/water/drinkingswater/lead/Lead.html)

- **Lead in Drinking Water FAQs**
  
  *Author*: HSE National Drinking Water Group  
  *Date*: May 2015

- **HSE advice for Schools and Crèches regarding Lead (Pb) in Drinking Water**
  
  *Author*: HSE National Drinking Water Group  
  *Date*: July 2015

- **Drinking Water Consumer Advice Note No. 1 – Lead (Pb)**
  
  *Author*: EPA and HSE National Drinking Water Group  
  *Date*: May 2015

- **Joint Position Paper Lead (Pb) in Drinking Water**
  
  *Author*: HSE National Drinking Water Group and EPA  
  *Date*: Dec 2013
Some resources and position papers

- **TRIHALOMETHANES (THMs)**
  

- **Trihalomethanes in Drinking Water – Information for Consumers**
  
  *Author:* HSE National Drinking Water Group and EPA  
  *Date:* Sept 2016

- **Joint Position Statement Trihalomethanes in Drinking Water**
  
  *Author:* HSE National Drinking Water Group and EPA  
  *Date:* Nov 2011

- **PESTICIDES**

- **Joint Position Statement Pesticides in Drinking Water**
  
  *Author:* HSE National Drinking Water Group and EPA  
  *Date:* March 2019

- **Pesticides in Drinking Water Frequently Asked Questions**
  
  *Author:* HSE National Drinking Water Group  
  *Date:* October 2018
  

- **NITRATES**

  **Joint Position Paper No. 1 Nitrates in Drinking Water** *(currently under revision)*
  
  *Author:* HSE  
  *Date:* Apr 2010
  
Some resources and position papers

- **PRIVATE WELL WATER**
  
  Available at [http://www.hse.ie/eng/health/hl/water/drinkingwater/well_water.html](http://www.hse.ie/eng/health/hl/water/drinkingwater/well_water.html)

- **Risk of illness for well water**
  
  Author: HSE National Drinking Water Group     Date: Jun 2013

- **Health risks associated with switching from a public to a private water supply**
  
  Author: HSE National Drinking Water Group     Date: Feb 2011

- **CRYPTOSPORIDIOSIS**
  
  Drinking Water Supplies, Cryptosporidiosis and Severely Immunocompromised Patients
  
  Author: HSE Consultants in Public Health Medicine     Date: May 2014
  

- Incident Response Team reports on Portlaw (2006) and Clonmel (2007) cryptosporidium incidents e-mail me at Ray.Parle@hse.ie if you want copies.