

Environmental Protection Agency National Water Event 2019

Risk Assessment of Drinking Water



**Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive**

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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

Drinking Water regulations 2014 (S.I. 122)

Protection of Human Health Regulation 9 (1)

- (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.....

Drinking Water regulations 2014 (S.I. 122)

Protection of Human Health Regulation 9 (2) Direction

- (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.....



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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*
- *Infectious Disease Regulations 1981 (S.I. No. 390 of 1981) as amended*

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))

Danger Electricity



Radiation



Biohazard



Hazardous/Toxic



IPCS: Risk Assessment as part of Risk Analysis

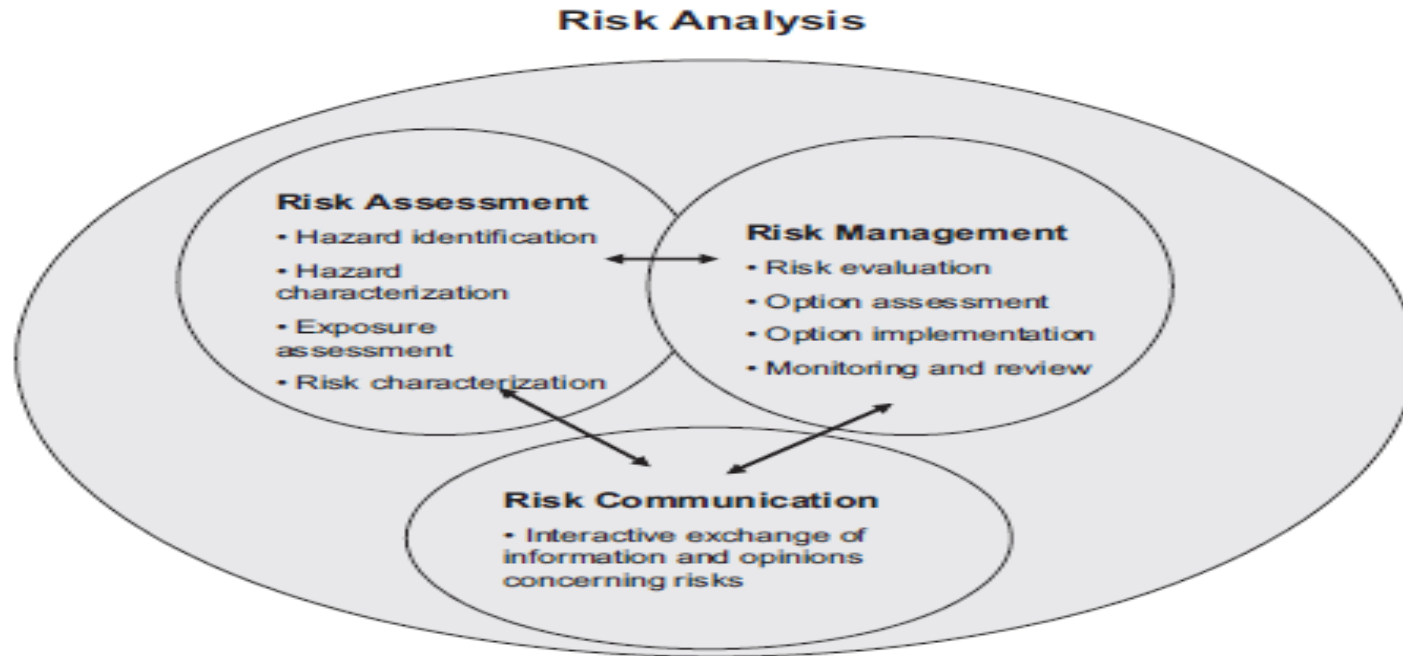


Fig. 2.1. Risk analysis (adapted from FAO/WHO, 1997)

IPCS

INTERNATIONAL PROGRAMME ON CHEMICAL SAFETY



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



Food and Agriculture
Organization of
the United Nations



World Health
Organization

IPCS 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))*

WHO Chemical Guideline Values for Drinking Water (4th Edition 2011, amended 2017)

- 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
- $TDI = \frac{NOAEL \text{ or } LOAEL \text{ or } BMDL}{UF}$
- $Guideline \text{ Value} = \frac{TDI \times \text{body Wt.} \times P}{C}$
- 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



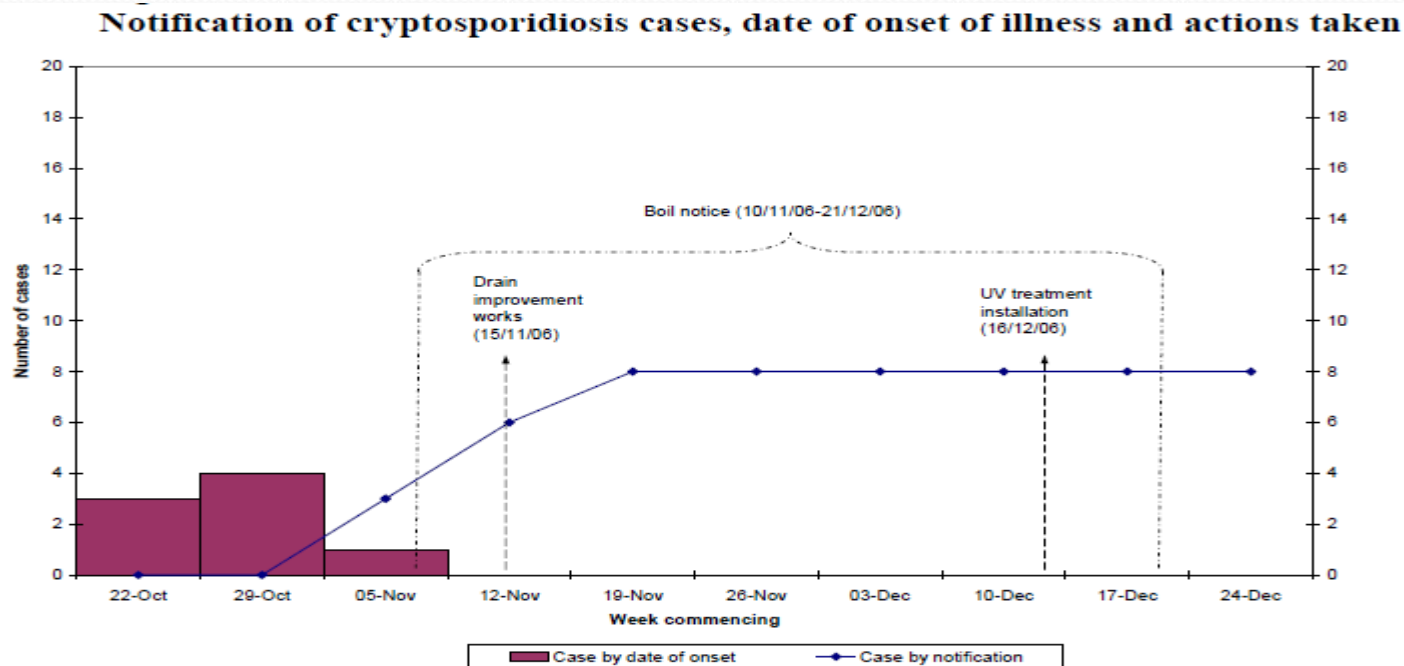
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Waterford County Council
Comhairle Chontae Phort Láirge

Report on Cryptosporidiosis Outbreak in Portlaw 2006

Cryptosporidiosis outbreak Portlaw 2006



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

Glenary Cryptosporidium Incident



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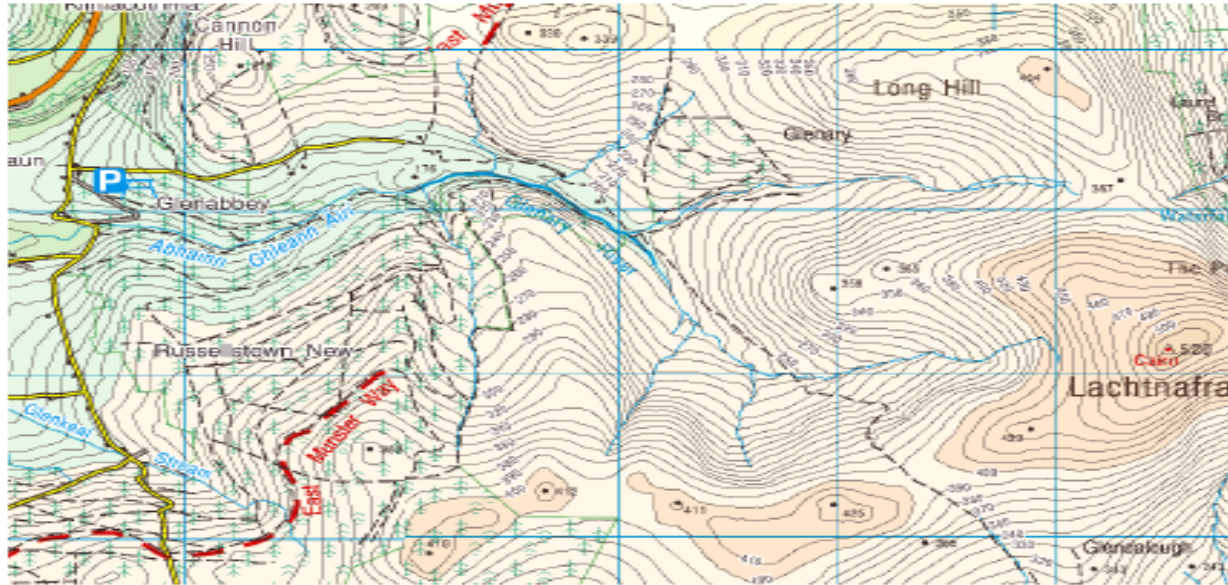
Clonmel Borough Council



South Tipperary
County Council

**Report on
Cryptosporidium Incident
Glenary Water Supply, Clonmel
July - October 2007**

Glenary Water Supply Catchment Area



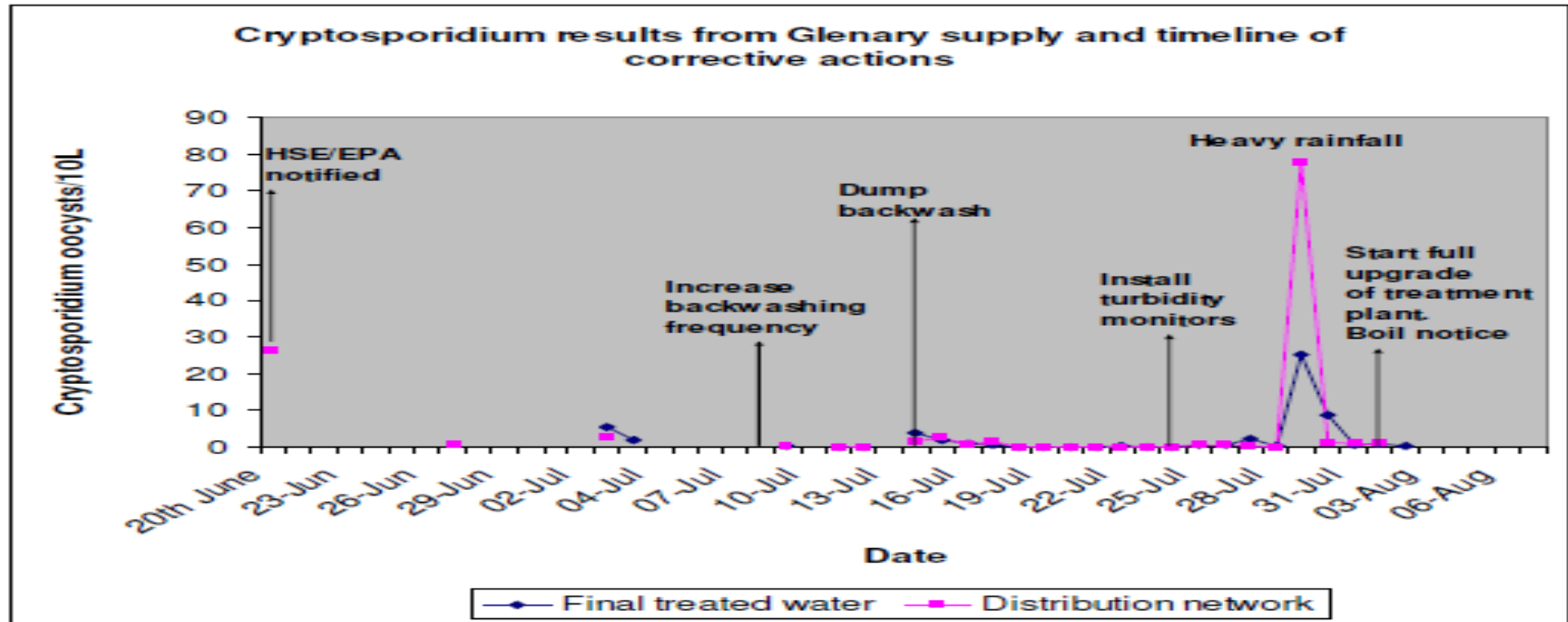
Glenary Cryptosporidium incident

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

Date sampled	Location	Volume sampled	Results/10 Litres
02.07.07	WTP Final	416	5.42 oocysts
03.07.07	WTP Final	267	1.84 oocysts
09.07.07	WTP Final	466	0.386 oocysts
11.07.07	WTP Final	417	<0.01 oocysts
11 - 12.07.07	WTP Final	1345	0.02 oocysts
13 - 14.07.07	WTP Final	1107	3.93 oocysts
14 - 15.07.07	WTP Final	1356	2.06 oocysts
15 - 16.07.07	WTP Final	1618	0.94 oocysts
16 - 17.07.07	WTP Final	1429	0.50 oocysts
17 - 18.07.07	WTP Final	1516	0.01 oocysts
18 - 19.07.07	WTP Final	1532	0.01 oocysts
19 - 20.07.07	WTP Final	1643	0.01 oocysts
20 - 21.07.07	WTP Final	1484	<0.01 oocysts
21 - 22.07.07	WTP Final	226	0.40 oocysts
22 - 23.07.07	WTP Final	185	<0.01 oocysts
23 - 24.07.07	WTP Final	304	0.030 oocysts
24 - 25.07.07	WTP Final	275	0.58 oocysts
25 - 26.07.07	WTP Final	779	6.55 oocysts
26 - 27.07.07	WTP Final	207	2.17 oocysts
27 - 28.07.07	WTP Final	326	0.34 oocysts
28 - 29.07.07	WTP Final	99	25.32 oocysts
29 - 30.07.07	WTP Final	107	8.70 oocysts
30 - 31.07.07	WTP Final	262	0.76 oocysts
31 - 01.08.07	WTP Final	265	1.02 oocysts
01 - 02.08.07	WTP Final	286	0.24 oocysts

Glenary Cryptosporidium incident

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



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/drinkingwater/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

- **TRICHALOMETHANES (THMs)**

Available at

- <http://www.hse.ie/eng/health/hl/water/drinkingwater/trichalomethanes/trichalomethanes.html>

- **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

Available at <http://www.hse.ie/eng/health/hl/water/drinkingwater/>

- **NITRATES**

Joint Position Paper No. 1 Nitrates in Drinking Water (currently under revision)

Author: HSE *Date:* Apr 2010

Available at

http://www.lenus.ie/hse/bitstream/10147/281453/1/HSE_EPA%20joint%20position%20paper%20Nitrates%20in%20drinking%20water%20Apr10.pdf

Some resources and position papers

- **PRIVATE WELL WATER**

- Available at 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

Available at <http://www.hpsc.ie/A-Z/Gastroenteric/Cryptosporidiosis/Publications/File,14628,en.pdf>

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