Understanding the risk of Cryptosporidium in drinking water catchments:
Case Study from Western Australia

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watercorporation.com.au
**Service area:** 2 million km²

**Annual supply:** 366 billion litre

**DW pipeline length:** 34,000 km

**IWSS** – largest scheme (290 billion L/year) from: Desalination (41%), groundwater (42%) and storage dams (17%).

**Country localities:** 130 sources

Groundwater, surface dams and six regional desalination plants

**Country schemes:** GAR (600km long), GSTWS, WPWS

**81 water treatment plants**

[Source: watercorporation.com.au]
Background: water sources, regulation & governance in WA

OVERVIEW: our catchments and recharge areas:

**Groundwater**: Proclaimed and gazetted Water Reserves

**Surface catchments**: Proclaimed, State Forest and national parks

Land Classification: P1  P2  P3

Use of prohibited zones

WA Planning Commission: State-wide Planning Policies

Operational Policy 13 (DoW) recreation activities and access

Overall level of development in DW catchments: LOW (increasing recreation)
Pathogens pose the greatest acute risk to public health

Source: waste from sheep, cattle and humans
Native animals(?)

Cryptosporidium oocysts:
Very small
Ubiquitous, long lasting
Highly infectious
Low infectious dose
Serious medical implications for ICP

ISSUES:
No ADWG (2015) guideline value
Routine method available locally (?)
Health WA allow WC to use risk-based management:

1. **Understand the catchment** – land use information, review max. *E. coli* data and surveillance information
2. Assess key activities: type, location and intensity
3. Compatible activity with Land Classifications?
4. Illegal access to prohibited zones?

Undertake **sanitary survey** (for every source):
- Identify hazards
- Assess source vulnerability
- Assess likelihood and consequence
- Determine maximum pathogen risk
- Assess controls and barriers
- Define residual micro risk
- Document ...
Risk-based management – implementation

Catchment Management Strategy (CMS) developed for each source

Review: either routinely, or triggered by land use or WQ change

CMS defines:
- monitoring program for micro', chemical and physical surveillance hours (existing approach)
- observational monitoring at key locations, cameras mitigation measures
- capital and operational works (gates, fences, signs) ...
Management of protozoan parasites

If have high risk & low risk sources – abandon high risk source

If risk exists and no other source:
1. Provide at least one barrier (short term response)
2. Remove sources of human waste - remove septic tanks / land purchase
3. Remove domestic animal waste - fencing-off areas / relocate
   - land purchase
4. Prevent recreation in, or near, waterbody
5. **Long Term Response:** locate another source, or design WTP & SP

**Least preferred option:** use of high risk source and pathogen removal treatment
The Corporation developed a position paper. It describes our strategy on: monitoring and managing the risk posed by Cryptosporidium and Giardia in the supply of DW. Guidance is given on:
- water testing,
- risk assessment, and
- risk mitigation.
1. Key Considerations:

1. No guideline in ADWG (2015) set for Crypto or Giardia

2. No routine bulk method available locally to identify human infectious strains

3. Relatively large sample volume

2. As no alternative to testing, ADWG endorses:

- Use source with lowest risk
- Protect catchment from human/animal waste
- Manage: catchment-to-tap
- Use multiple barriers ...
3. Current Position:

**ADWG (2015) & Health WA** don’t recommend routine monitoring

**Risk assessments** done for all 160 sources

**If risk exists**, reduce risk to lowest practical level

**Only sample** if directed by Health WA

**Investigatory sample** if a pathogen barrier exists
Used to validate risk assessments

**Denmark R.** Found peak oocyst counts in August

**Recreation:** found clear link with pathogens ...
Water Treatment and Cryptosporidium

The surface WQ source risk is used as input to the Water treatment matrix to define the level of treatment.

Table 5: The Water Treatment Matrix

<table>
<thead>
<tr>
<th>Raw water challenge to downstream barriers</th>
<th>Maximum microbiological challenge (raw water monitoring results for E.coli or thermotolerant coliforms)</th>
<th>Raw water challenge to downstream barriers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacterial and Viral risk</td>
<td>Protectied; impounded upland water; essentially free of faecal contamination</td>
<td>Cryptosporidium and Giardia risk</td>
</tr>
<tr>
<td></td>
<td>Unprotected; impounded water or upland run of river source; faecal contamination present</td>
<td></td>
</tr>
<tr>
<td>&lt;20 MPN/100 mL plus storage</td>
<td>20-2,000 MPN/100 mL</td>
<td></td>
</tr>
<tr>
<td>2,000-20,000 MPN/100 mL</td>
<td>&gt;20,000 MPN/100 mL</td>
<td></td>
</tr>
</tbody>
</table>

- **Extreme**
  - Further investigation required to determine why E.coli results are unexpectedly low
  - Level I

- **High**
  - Level II
  - Level III
  - Level IV (Not preferred as a drinking water source)
  - Unsuitable
  - Level II

- **Medium**
  - Level III
  - Unsuitable

- **Low**
  - Level II
  - Unsuitable

- **Very Low**
  - Level I
  - Level II
  - Level III
  - Level IV (Not preferred as a drinking water source)
  - Unsuitable

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Learnings

1. Protozoan parasites can pose a major risk to public health

2. Monitoring not the total answer

3. Use risk based management – moderate data requirements, robust, and effective

4. Aligns with how we manage catchments

5. Provides input to the Water Treatment Matrix – robust tool

6. R&D – sample protozoans to understand risk and transport

7. Way forward – risk-based observational monitoring and HBT ...
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Questions
References


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