A 2009 survey by the Water Quality and Health Council (WQHC) in the United States revealed that:

17% of bathers urinate in swimming pools.
83% of bathers do not shower before swimming.
63% are unaware of illnesses associated with swallowing, breathing or having contact with contaminated pool water.
CONVENTIONAL AQUATICS STANDARDS

- Assumes that water will be recirculated (assuring high organic loading)
- Focuses on a process, rather than a health result
  - Filtration,
  - Circulation rates
  - Disinfectant use
  - Other chemical parameters
- Specifies maximum occupancy rates in keeping with the above
- Very little emphasis on the disinfection byproducts, thus allowing (from combination of organics and halogens)
  - Chloramines/Bromamines
  - Tri-Halomethanes
- Usually not effective against cryptosporidium
Don't worry. Technology will save you.
# CONVENTIONAL AQUATICS MICROBIOLOGY PARAMETERS

<table>
<thead>
<tr>
<th>Microorganism</th>
<th>Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. Coli</td>
<td>&lt; 1 cfu / 100 ml</td>
</tr>
<tr>
<td>Pseudomonas Aerginosa</td>
<td>&lt; 1 cfu / 100 ml</td>
</tr>
<tr>
<td>Thermophylic Naeglia</td>
<td>zero</td>
</tr>
<tr>
<td>Legionella pneumophila</td>
<td>&lt; 1 cfu / ml</td>
</tr>
</tbody>
</table>

# NATURAL RECREATION WATER BODY PARAMETERS

| Enterococci (indicator)      | 40-200 cfu/100 ml (Australian Standard) |
THERMAL HOT SPRINGS BEST PRACTICE?

• Differences:

  • Health benefits of the water itself
  • Preferences not to manipulate the water chemically
  • The approach of flushing contaminants from the pool, rather than intervening with chemicals
THERMAL HOT SPRINGS BEST PRACTICE?

• PRINCIPLES
  • Sterile incoming water?
  • Pool loading criteria?
  • Flushing rates?
  • Cleaning practices?
  • Monitoring practices?
ISSUES FOR A THS STANDARD / THS BEST PRACTICE

• Know your source water; Take measures to ensure it is sterile
• Design for dilution of contaminants
• Design for through-flow short residency time (plug flow ideal)
• Design for draindown & cleaning
• Design for drying of the entire system
• Design for through-flow short residency time (plug flow ideal)
• Is a no / low oxidant regime desirable or even possible
• Patron management (instantaneous and daily limitations, showering, child restrictions?, no submersion?, advice on restrictions after illness?)
• Water quality management & monitoring / Validation of water quality
• Management of potential external contamination routes
THE SEARCH FOR A STANDARD

- New Zealand example
- British Columbia Example
- Victoria Example
- Italy?
  - 
  - 
- Limited information for practical application in most of these
- A duty of care would override all other considerations
GOALS:

1. Compile a library of standards which reference specific thermal hot springs design and operation.

2. Compile evidence of acceptable alternatives to conventional aquatics water treatment processes.

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GEOTHERMAL HOT SPRINGS SANITATION PRACTICES
A PATH WAY TO A STANDARD?

Thank You