Water Safety
Plans for developing countries

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Water and Sanitation

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Outline of talk

• Background information on Water Safety Plans
• Limitations of traditional inspection and testing
• Risk management and WHO guidelines
• Example of implementing a Water Safety Plan
Water safety plans

• Developed by the water industry, international experts and WHO

• Designed to assess risks and identify ways in which risks can be managed

• Based on Hazard Analysis Critical Control Point (HACCP) model
Traditional approach - limitations

- Relies heavily on end product testing
- Wide range of parameters that could be monitored
- Not technically feasible
- Indicator organisms e.g. *E coli, coliforms*, provide a common measure of potential risk – do not correlate well with risks from protozoa and viruses
Water sampling – limitations

• Promotes reactive management – corrective actions are initiated after monitoring reveals that the water quality is unsatisfactory.

• Monitoring uninformative about the exact nature, location and timing of problem
Risk management

• Trend over past 10 years
• Good quality management systems
• Australians incorporated Hazard Analysis Critical Control Point (HACCP) into drinking water guidelines in 2002
• Harmonization of risk management approaches across water and food exposure routes is logical
Third Edition of the WHO Guidelines on Drinking-water quality

- Departure from previous editions
- Place emphasis on risk assessment and risk management
- Less emphasis on analysis of water quality
Guidelines – 5 key steps for water safety

• Health based targets
• System assessment
• Operational monitoring of the control measures in the supply chain
• Management plans
• A system of independent surveillance that verifies that the above are operating properly.
Water Safety framework

- First undertaken by the health sector
- 2-4 typically the responsibility of water supply agencies
- Final component form the basis of regulation
Similar approaches

• Australian risk management framework
• New Zealand Public Health Risk management plan
• Developing countries – Uganda, India, Bangladesh, Maldives
• European Union (EU) preferred approach
Basis of a Water Safety Plan

- Document and describe system
- Undertake hazard assessment
- Identify control measures
- Define monitoring for control measures
- Implement corrective actions – normal and incident conditions
- Verification
- Documentation
Example of implementation

- Maldives
- Water quality deteriorated after tsunami
- Rainwater harvesting kits provided
• Flow diagram to identify routes of potential contamination

• Water source, water treatment, distribution, storage.

<table>
<thead>
<tr>
<th>Code</th>
<th>Step</th>
<th>Description</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>Source (roof)</td>
<td>Community</td>
<td></td>
</tr>
<tr>
<td>R2</td>
<td>Transport (guttering)</td>
<td>Community</td>
<td></td>
</tr>
<tr>
<td>R3</td>
<td>Storage (tank)</td>
<td>Caretaker</td>
<td></td>
</tr>
<tr>
<td>R4</td>
<td>Tap</td>
<td>Caretaker</td>
<td></td>
</tr>
<tr>
<td>R5</td>
<td>Water collected in vessel</td>
<td>Villagers</td>
<td></td>
</tr>
<tr>
<td>R6</td>
<td>Water transported in vessel</td>
<td>Villagers</td>
<td></td>
</tr>
<tr>
<td>R7</td>
<td>Storage at point of use</td>
<td>Villagers</td>
<td></td>
</tr>
<tr>
<td>R8</td>
<td>Use</td>
<td>Villagers</td>
<td></td>
</tr>
</tbody>
</table>
Hazard assessment

- Chemical – e.g. chemicals from roof
- Biological – e.g. protozoa e.g. toxoplasma gondii cysts from cats
- Physical – debris from birds nest
Hazardous events

- Rainfall insufficient, biofilm in tank,
- Faecal contamination of roof by vermin and birds
- Leaching of chemicals from roof materials
- Chemical contamination of water by air pollution, contaminated buckets
- Tank – breeding site for mosquitoes
Control measures

• Control measures are any activities that can reduce levels of hazards within water either by preventing entry or reducing contamination

• Need to prioritize control measures

• Protection of water and treatment
<table>
<thead>
<tr>
<th>Process Step</th>
<th>Hazardous Event</th>
<th>Hazard Type</th>
<th>Control Measures Current and/or Planned</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rainwater tank</td>
<td>Contamination of tank from contaminated water in first flush</td>
<td>Microbial</td>
<td>First-flush diversion system used to divert first rainwater away from tank</td>
</tr>
<tr>
<td></td>
<td>Ingress of contaminated water through tank or tank base</td>
<td>Microbial</td>
<td>Tank must have a cover and be in good structural condition; base to be protected by proper drainage to prevent undercutting</td>
</tr>
<tr>
<td></td>
<td>Rainwater collection tank becomes a breeding site for mosquitoes</td>
<td>Biological</td>
<td>Ensure vents have mosquito meshing in good condition</td>
</tr>
<tr>
<td></td>
<td>Contamination of stored water through use of buckets to withdraw water</td>
<td>Microbial</td>
<td>Ensure tank has a tap as the outlet for water from the tank</td>
</tr>
</tbody>
</table>
Monitoring of control measures

- Sanitary surveys – condition of guttering etc
- Integrity of filters
- Turbidity
- Chlorine residual
Corrective action

- Backup disinfection
- Change to alternative water source
- Structural repairs
- Reporting to Maldives Water and Sanitation Authority (MWSA)
Verification

- Audit of Water Safety Plans
- Water quality tests
## Testing schedule - Risk assessment matrix

<table>
<thead>
<tr>
<th>Source of Water</th>
<th>Six monthly tests</th>
<th>Monthly tests</th>
<th>Microbiol.</th>
<th>Chemical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rainwater from community tanks/ schools</td>
<td>Chemical</td>
<td>Micro</td>
<td>Total and faecal coliform</td>
<td>Chlorides Nitrates Ammonia Phosphates EC/TDS</td>
</tr>
<tr>
<td>Rain water from domestic houses (designated locations)</td>
<td>Chemical</td>
<td>Micro</td>
<td>Total and faecal coliform</td>
<td>Chlorides Nitrates Ammonia Phosphates EC/TDS</td>
</tr>
</tbody>
</table>
Documentation

- Training of Community Health Workers
- Water Safety Plan records
- Sanitary surveys
- Water quality tests
Advantages of Water safety Plans

• Systematic assessment
• Minimize the chance of failure
• Contingency plans for unforeseen events
• Greater involvement of staff/ community
• Aid inspection by regulatory authorities
• More effective use of resources
Conclusion

• Water safety plans are “risk management tools” based on the Hazardous Analysis Critical Control Model (HACCP) model developed by the food industry

• New WHO Guidelines place emphasis on risk assessment and risk management

• Water Safety Plans have been implemented in a number of countries
Let us act together for Safe Environments and Sustainable Human Health!

Thank You!