QMRA
Quantitative Microbial Risk Assessment

Streamlined Environmental's Dr Chris Dada has developed and applied QMRA for a variety of virus, protozoa and bacteria pathogens.

Faecal pollution is a major threat to water quality and human health worldwide. Through contact recreation and/or consumption of contaminated food, pathogenic viruses, bacteria and protozoans can cause serious illness and even death. Sources of microbial contamination include discharges from wastewater treatment plants (WWTP), agricultural effluent, and accidental spills or overflows.

QMRA – quantitative microbial risk assessment – is the technique of estimating the public health risk due to exposure to pathogenic micro-organisms, such as faecal bacteria and various viruses (e.g., adenoviruses, noroviruses, enteroviruses) that may be present in discharges to water.

How QMRA works

QMRA models the "source to receptor" pathway, which can include influent pathogens, mitigations, dilution, inactivation, ingestion and human response to micro-organism doses.

Applications

✓ **Landuse intensification and change**: compare risk under present landuse to risk under proposed future landuse.

✓ **Wastewater treatment plants**: determine levels and types of in-plant treatment needed to reduce swimming and shellfish-harvesting risk to acceptable level.

✓ **Wastewater overflow during heavy rain**: determine risk to population to analyse case for investing in network upgrades.

✓ **Agricultural effluents**: evaluate efficacy of proposed on-farm mitigation measures.

Steps in QMRA

Key to a robust and defendable QMRA is populating the model with good data. The steps in the QMRA are:

(1) Identify hazards. Which micro-organisms have potential to cause harm?

(2) Assess exposure. In what ways is the population exposed to the hazardous micro-organisms (e.g., inhaled during contact recreation or ingested while consuming raw shellfish)?

(3) Specify dose–response. What is the probability of infection/illness given uptake of pathogen particles?

(4) Characterise risk. What is the extent of infection/illness in a population/individual exposed to pathogens in the specified way (e.g., inhalation or ingestion)?

The QMRA assembles all of this information within a "Monte Carlo" simulation to evaluate risk of infection or, more usefully, individual's illness risk (IIR).

STREAMLINED ENVIRONMENTAL HAS A TRACK RECORD IN QMRA

Based on accepted mathematical methods and making use of his specialist knowledge as a microbiologist, Streamlined Environmental's Dr Chris Dada has developed and applied QMRA for a variety of virus, protozoa and bacteria pathogens.

Past projects include QMRAs for the discharge of:

- treated human wastewater into Whitford Estuary, Auckland
- treated human wastewater into Lake Waikare, Waikato
- treated human wastewater into coastal waters of Army Bay, Auckland
- treated animal wastewater into the Mataura River, Southland.
- wastewater overflows into rivers and coastal waters in the Gisborne region (on-going)
- treated human wastewater into coastal waters in the Gisborne region (on-going).

Chris also has experience as an expert witness in RMA hearings.

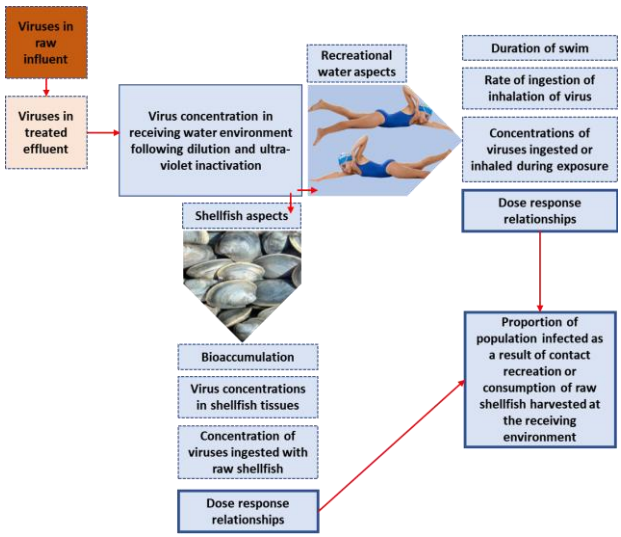
ADVANTAGES OF QMRA

✓ To assist planners and decision-makers, risk profiles under different management scenarios, such as different levels and types of treatment in a WWTP, can be evaluated and compared.

✓QMRA can investigate many different combinations of influent and environmental condition (e.g., rainfall, wind, daylight) which otherwise might not be readily encountered in field-based risk assessments.

✓Risk associated with extraordinary events, such as breakdown of equipment resulting in treatment bypass, can be evaluated.

✓ QMRA isolates the effect of the discharge being studied from all other possible sources of contamination.



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