ROOF-COLLECTED WATER

Environmental Health Perspective

In New Zealand, more than 10% of the population depends on roof-collected rainwater systems for their drinking-water. This is mainly in rural areas that are not served by municipal town water supplied. In urban areas, the use of roof-collected water is seen as a sustainable practice to reduce loading on the urban stormwater system. Roof-collected water is also popular because of the general public perception that rainwater is ‘pure’.

However, a recent survey in New Zealand (Abbott et al., 2007) conducted over a five year period showed that at least half of roof-collected rainwater samples of 560 private dwellings exceeded the Drinking Water Standards for New Zealand (DWSNZ) Maximum Acceptable Value (MAV) for E.coli contamination. 30% of the samples were heavily contaminated by faecal bacteria. It is believed that the faecal contamination was due to a range of factors including poorly designed intakes and storage tanks, inadequate disinfection of the water and failure to conduct routine maintenance.

Pathogens (disease causing micro-organisms) can contaminate water supplies which have inadequate treatment. The presence of pathogens in roof-collected water presents a health risk to consumers and to neighbouring properties (pathogens can be spread by aerosols). Bacteria such as E.coli and Campylobacter, and protozoa such as Cryptosporidium and Giardia, are some of the pathogens that have been found in roof-collected water. These pathogens can cause diarrhoea, vomiting, stomach pains and fever. The main source of microbiological pathogens is birds, cats, possums, rodents, lizards and skinks.

In March 2006, three cases of legionellosis (one of which resulted in death) in Beachlands (a small community in East Auckland) were linked to contaminated roof-collected water storage tanks. Water from a contaminated tank was used to wash a boat, and the aerosols spread and contaminated three other roof-collected water supplies. The water supplies were all untreated. Legionella bacteria affect the respiratory system, usually after inhaling organisms with water vapour or droplets. Legionella bacteria can grow well in water when the temperature is in the range 25 - 60°C. Therefore, the storage tank should be located in a shaded location.

Chemical contamination of roof-collected water can also occur due to contaminants on roof surfaces, e.g. deposits from industry or pesticides, and leaching of lead paints / flashings and copper piping / construction materials. One study in Auckland (Simmons et al., 2000 & 2001) identified that 16% of roof-collected rainwater samples of 16 supplies exceeded the DWSNZ MAV for lead. The study also identified the presence of arsenic in one of the supplies.

In addition to the above, the nature of roof run-off, specifically in urban areas of New Zealand, has also been investigated (Kennedy & Gabb, 2001). It has been shown that a range of pollutants are present in urban roof runoff, including several as a result of vehicle gas emissions and house fires in winter (i.e. PAHs).

- Rural properties that are unable to be connected to a municipal drinking-water network can install a roof water collection system as a drinking-water source. However, a number of preventative measures are recommended to ensure that the water supply is safe for consumers.
- Auckland Regional Public Health Service (ARPHS) does not support roof-collected water for potable uses, e.g. drinking, food preparation and personal hygiene (e.g. teeth brushing), when the property is serviced by, or has access to, a municipal drinking-water network.
**Technical Summaries**

ARPHS has reservations in supporting, and would not normally support, the use of roof-collected water for non-potable uses inside premises, e.g. for toilet flushing, where the roof-collected supply forms part of a dual supply. This is due to the health risks associated with possible cross-connections with the potable drinking-water supply. Even when high quality non-potable water is used as part of a dual supply, the risk would need to be considered and assessed as part of a drinking-water supply Public Health Risk Management Plan.

ARPHS considers that the use of roof-collected water for non-potable uses outside premises, e.g. garden watering, where the roof-collected water has no potential for cross-connection to, or cross-contamination of, the potable drinking-water supply is acceptable as long as the system is maintained appropriately.

**Legislative requirements for roof water supplies**

Drinking-water supplies serving less than 25 persons for 60 days of the year, e.g. household supplies, do not fall under the Health Act. Household supplies must comply with the Building Act 2004 in regards to their drinking-water. The Building Act 2004 requires that household supplies have a ‘potable’ water supply that is microbiologically and chemically safe. This Act is enforceable by Local Territorial Authorities. Requirements for potable and non-potable water supplies for households are covered in the Building Code G12.

For dual supplies (i.e. roof-collected water for non-potable uses inside the dwelling, and a separate drinking-water supply for potable uses inside the dwelling) the risk arising from cross-contamination of the potable supply needs to be considered and assessed as part of a drinking-water supply Public Health Risk Management Plan.

**ARPHS recommendations:**

**For use as a rural drinking-water supply**

- If roof-collected water is likely to become regularly contaminated, as an alternative to roof-collected water, investigate the use of a bore water source.
- Undertake a site assessment to determine potential sources of contamination prior to the installation of a roof-collection system, e.g. overhanging vegetation, industry, aerial spraying.
- Use roofing materials and paints that are suitable for roof-collection systems, e.g. lead-free paints and roof flashings.
- Use plastic pipes and guttering.
- Consider the use of meshing, guttering guards, first flush diverters and other preventative measures to reduce leaves / debris and pathogens entering the supply.
- Install self-cleaning water storage tanks, or put in place a programme to undertake frequent tank clearing (at least annual).
- Ensure tanks have secure lids, and that all vents / openings are mesh screened to prevent access by small animals and mosquitoes.
- Ensure storage tanks are suitable, i.e. light in colour and of impervious material, and are located in a shaded area.
- Install water filters.
- Disinfect the supply, e.g. using UV or chlorine.
- Carry out ongoing maintenance of the roof and gutters, storage tank and treatment system.
- Regularly sample the water supply to determine microbiological quality.

**For use as an urban non-potable supply inside the premises**

ARPHS generally does not support this. However, if you choose to do this, to reduce public health risk;

- Install a testable backflow prevention device at the boundary of each property. Arrange for the device to be tested annually.
• Ensure outside taps are at a height inaccessible to children.
• Erect appropriate signage at each tap advising that the water is not potable and is unsafe to drink.
• Adopt colour-coded piping and labels as per the Building Code G12.

For use as an urban non-potable supply outside the premises (separate system with NO potential cross-connection to the drinking water supply)
• Ensure outside taps are at a height inaccessible to children.
• Erect appropriate signage at each tap advising that the water is not potable and is unsafe to drink.
• Adopt colour-coded piping and labels as per the Building Code G12.

Situations likely to be of interest to the ARPHS
• Subdivisions and urban developments where domestic use of roof-collected water is proposed and where the municipal drinking-water supplied could be used.
• Event centres or public facilities where roof-collected water is proposed for potable or non-potable use.
• Water supply contamination events of public health concern.
• Adequacy assessment of Public Health Risk Management Plans for roof-collected drinking-water supplies.

Framework for assessment
• Health (Drinking Water) Amendment Act 2007
• Drinking Water Standards for New Zealand 2005 (Revised 2008)
• Draft Guidelines for Drinking Water Quality Management for NZ
• Ministry of Health Public Health Risk Management Plan Guides

Where to find more information
The Ministry of Health website (www.moh.govt.nz/water) provides information relating to drinking-water supplies, including the following documents;
• Water Collection Tanks and Safe Household Water
• Household Water Supplies: Selection, Operation and Maintenance of Individual Water Supplies
• Draft Guidelines for Drinking-water Quality Management in New Zealand - Chapter 19 Small, Individual and Roof Water Supplies
• Public Health Risk Management Plan Guide – Roof Water Sources

References
• Abbott, S.E. et al. (2007). The microbiological quality of roof-collected rainwater of private dwellings in New Zealand. 13th International Rainwater catchment Systems Conference. Sydney