

Recycled Water Quality - Long Term Monitoring Program

Over and above the on-line water quality monitoring that is being installed as part of the Epsom Spring Gully Recycled Water project, a long-term monitoring program has been prepared as part of the Recycled Water Quality Management Plan (RWQMP).

The parameters that will be measured on-line in the final water from the project are:

- pH
- turbidity
- electrical conductivity.

These parameters are over and above a number of process control instruments that will be used to monitor that the chlorine disinfection, UV disinfection, dechlorination, and membrane filtration processes are working as designed. In addition, there are a number of process control instruments within the existing Bendigo Water Reclamation Plant.

The objectives of the long-term monitoring program are to:

- monitor the concentrations of a number of parameters that will be used to indicate pathogens and chemicals of potential concern to human health and the natural environment that match the proposed uses of the recycled water;
- provide baseline data and trends for these indicator parameters to allow early detection of potential problems, and to allow consideration of other potential uses of the recycled water in the future.

The classes of pathogens and chemicals included in the long-term monitoring program are:

- bacteria
- protozoan (oo)cysts
- viruses
- nitrogen and phosphorus
- metals and metalloids
- non-metallic inorganics
- synthetic organic chemicals
- pesticides.

Endocrine disrupting compounds (EDCs) and similar chemicals are not currently the subject of specific state or federal guidance as “analyses of treated recycled water and associated water recycling schemes indicate that chemical quality generally complies with

drinking water quality requirements for most chemicals¹". EDCs have been detected in recycled waters and water bodies receiving recycled water discharges and have been shown to affect aquatic biota, but there is no evidence of human health effects via environmental exposure¹. In addition, there are two aspects of the process that will reduce EDCs:

- activated sludge plants, like the existing Epsom WRP, operating with long sludge resident times are very effective in removing EDCs (refer, for example, to work done in Queensland and New Zealand²)
- the fraction (typically 20 to 30%) of the recycled water that is passed through the UF/RO process will have EDCs and similar compounds effectively totally removed.

Despite the above mitigating factors in relation to EDCs, it is proposed to include these chemicals in the monitoring program to gain a better understanding of potential effects on human health and the environment, and to assist in reassuring the community about perceived health risks. There are examples where reuse schemes have been prevented from proceeding because of community perceptions related to these and similar chemicals³.

The proposed long term monitoring program is scheduled over. Although the EPA *Use of Reclaimed Water* Guideline advises weekly monitoring of pH, SS and E. coli; we have assumed that this guidance has been superseded by the HACCP approach of the *Dual Pipe Water Recycling Schemes* Guideline. We have accordingly adopted a lesser frequency of monitoring for SS and E. coli (pH is monitored continuously).

Sampling protocols, detection limits and etc are still to be determined.

¹ *National Guidelines for Water Recycling: Managing Health and Environmental Risks*. National Resource Management Council Environment Protection and Heritage Council, Draft October 2005.

² Leusch FDL, Chapman HF, van den Heuvel MR, Tana BLL, Gooneratnea SR, Tremblay LA, 2005. Bioassay-derived androgenic and estrogenic activity in municipal sewage in Australia and New Zealand, *Ecotoxicology and Environmental Safety*.

³ Chapman H and Leusch F, 2006. *Water Recycling: Endocrine Disrupting Compounds*, Water, Vol. 33, No. 6, September 2006.

Parameter	Existing Treatment Plant (downstream tertiary filters and UV)	Bendigo Mining Stream	Exiting Final Water Tank
<i>E. coli</i>	Monthly	Weekly	Weekly
Total coliforms	Monthly	Weekly	Fortnightly
Campylobacter			Monthly
Clostridium perfringens			Monthly
<i>Giardia & Cryptosporidium</i>			Monthly
Coliphage (FRNA)			Fortnightly
Coliphage (Somatic)			Monthly
Adenovirus			Monthly
pH	Monthly	Monthly (tcolm)	Fortnightly (tcolm)
Turbidity	Monthly	Monthly (tcolm)	Monthly (tcolm)
BOD ₅ and suspended solids	Monthly	Monthly	Fortnightly
Total N, Ammonia-N, TKN, NO ₃ -N, NO ₂ -N	Monthly	Monthly	Fortnightly
Total phosphorus	Monthly	Monthly	Fortnightly
Total dissolved solids, EC (tcolm)	Monthly	Monthly	Monthly
Sodium, potassium, calcium magnesium			Monthly
Arsenic		Weekly	
Metals and metalloids	Once every six months	Once every six months	
Cyanide		Monthly	
Radiological		Yearly	
Disinfection byproducts including NDMA	Once every six months (post dechlorination but before final water tank)		
PAH, BTEX, VOCs, Aliphatic HCs, SVOC, PCPs, pesticides, and industrial chemical signature compounds (NTA - nitrilotriacetic acid, APEC - alkylphenol carboxylates, NDC - naphthalene dicarboxylic acid)	Once every six months	Once every year	Once every six months ex UF/RO

Parameter	Existing Treatment Plant (downstream tertiary filters and UV)	Bendigo Mining Stream	Exiting Final Water Tank
Representative pharmaceutical compounds (e.g. Ibuprofen and Gemfibrozil)			Yearly ex UF/RO
Representative Endocrine Disrupting Chemicals (EDCs): <ul style="list-style-type: none"> ■ natural hormones – both human and animal ■ natural chemicals such as substances produced by plants – e.g phyto-estrogens ■ synthetic pharmaceuticals intended to be hormonally active – e.g. contraceptive pill ■ Other man-made EDC chemicals - including cosmetics, medical compounds, pesticides, and industrial chemicals, not covered elsewhere in sampling schedule. Alternatively, consider use of “Estradiol equivalents ⁴ ” to represent all the above	Yearly		Yearly ex UF/RO

Parameter	Both UV Disinfection Units	Chlorination Process	Dechlorination Process
UV transmittance	Monthly (tcolm)		
Chlorine free and total residuals		Weekly (tcolm)	Weekly (tcolm)

tcolm – to confirm on-line measurements

⁴ Chapman H and Leusch F (2006). “Water Recycling: Endocrine Disrupting Compounds”, Water, Vol. 33, No. 6