



September 14 2010

Summary and interpretation of virology results for Waitara River sampling programme.

The programme undertook baseline monitoring of the occurrence of viruses in shellfish and river water from the Waitara Embayment as part of a risk assessment of the potential effects of consuming shellfish in the Waitara Embayment as a result of the discharge of human sewage.

The aim of the assessment was to:

- determine the presence of selected viruses in shellfish from the Waitara river mouth;
- determine the presence of selected viruses in the waters of the Waitara river;
- indicate whether sources of viruses (if present) are human/non-human; and assess the relative contributions to potential virus contamination of water and shellfish of the Waitara WWTP discharge and the Waitara River.

Results

ESR Reports were sent out on 7 September 2010. Results for adenovirus infectivity in effluent were reported on 20 September 2010.

Shellfish samples:

The results show that enteric viruses from both human and animal sources were detected in the shellfish samples. The control shellfish were positive on both occasions for norovirus Genogroup III (GIII), which is an animal virus found in cattle and sheep faeces.

The reef shellfish samples (but not the control shellfish) were also all positive for human norovirus Genogroup II (GII). In New Zealand, most human strains identified from outbreaks belong to Genogroup II. One shellfish sample was also positive for human norovirus Genogroup I (GI). Human norovirus levels in shellfish were generally low (<80 genome copies/g of shellfish gut tissue), but moderate levels (80-320 genome copies/g) of norovirus GII were observed in the shellfish collected from Tuaranga Reef on 10 August.

The presence of noroviruses in these shellfish samples indicates a risk of infection for those consuming these shellfish. The infectious dose for norovirus is low (believed to be approximately 10-100 particles); shellfish accumulate enteric viruses to high levels when they filter feed. Enteric viruses are not depurated as are bacteria but persist in the shellfish for many weeks or even months and can remain infectious during this time.

The presence of F-RNA phage Genogroup I is indicative of animal pollution, whereas presence of F-RNA phage Genogroup II is frequently associated with human pollution. F-RNA phage belonging to Genogroups III and IV were not detected in the samples. Genogroup IV is uncommon and has not been identified in New Zealand yet.

River water samples

Human noroviruses were not detected in either river water sample. However GIII animal norovirus was detected in the 24 August sample, indicating possible animal pollution. This

was further supported by the identification of an ovine adenovirus in the same water sample. F-RNA phages were not detected in either sample.

Sewage influent and effluent samples

The viral load is dependent on the size of and the level of virus excretion from the local population served by the WWTP. In small populations such as at Waitara, the level of virus input can fluctuate from week to week depending on the level of viral disease and the excretion rates in the local community. For NZ communities of varying sizes, infectious enterovirus and adenovirus levels in influent range between 2-4 log₁₀/L in magnitude. At Waitara, infectious human enteroviruses and adenoviruses were detected in the influent samples, as would be expected for raw sewage. Generally virus levels were low compared those reported in influents from other communities, apart from the sample collected on 24 August which showed a high titre for adenovirus.

Infectious enteroviruses were also detected low concentrations in the effluent samples. Infectious adenoviruses were not detected in the effluent collected on 24 August. For other NZ communities of varying sizes, infectious enterovirus and adenovirus levels in effluents range between 0.5-3.0 log₁₀/L in magnitude.

Conclusions

- Infectious enterovirus and adenovirus levels in the influent of the WWTP were generally low
- Infectious enterovirus levels in effluent were low.
- River water was impacted by animal pollution (possibly sheep) on one occasion
- Shellfish from the reefs were impacted by both human and animal pollution.
- Control shellfish were impacted by animal pollution

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Summary of results

Sample No.	Sample type/site	Sampling date	Human NoV GI	Human NoV GII	Bovine NoV GIII	F-RNA phage GI	F-RNA phage GII	F-RNA phage GIII	F-RNA phage GIV	Enterovirus culture (PFU/L)	Adenovirus culture (IU/L)	Other tests (Adeno VTB I & II)
FEV10/73	Control Mussels	10/08/10	neg	neg	pos	pos	neg	neg	neg	NA	NA	
FEV10/74	Airdale reef	10/08/10	neg	pos low	pos	pos	pos	neg	neg	NA	NA	
FEV10/75	Tuaranga Reef	10/08/10	pos low	pos mod	pos	pos	pos	neg	neg	NA	NA	
FEV10/76	River Waitata East Bank	10/08/10	neg	neg	neg	neg	neg	neg	neg	NA	NA	VTB I and II negative
FEV10/77	Influent week 1	10/08/10	NA	NA	NA	NA	NA	NA	NA	6	29 (9.6-86)	
FEV10/78	Effluent week 1	10/08/10	NA	NA	NA	NA	NA	NA	NA	13	29 (9.6-86)	
FEV10/83	Control Mussels	24/08/10	neg	neg	pos	neg	neg	neg	neg	NA	NA	
FEV10/84	Airdale reef	24/08/10	neg	pos low	pos	pos	pos	neg	neg	NA	NA	
FEV10/86	Tuaranga Reef	24/08/10	neg	pos low	pos	pos	pos	neg	neg	NA	NA	
FEV10/85	River Waitata East Bank	24/08/10	neg	neg	pos	neg	neg	neg	neg	NA	NA	Ovine Adenovirus positive
FEV10/79	Influent week 2	23/08/10	NA	NA	NA	NA	NA	NA	NA	64	460 (100-2100)	
FEV10/80	Effluent week 2	23/08/10	NA	NA	NA	NA	NA	NA	NA	8	Not detected	

RT-PCR results : Low : <80 copies/g; Mod 80-320 copies/g