APPENDIX 5

TREATMENT FORMS

[1] As noted in Part 5 of this report, the Inquiry has concluded that all networked supplies and specified self-supplies should receive appropriate and effective treatment prior to distribution to consumers.

[2] Following international best practice, a multi-barrier approach to treatment of water supplies should be utilised at all times. A “source to tap” regime should be implemented which begins with the protection of source water quality and ends with the supply of wholesome water to the consumer’s tap with adequate residual disinfectant in the reticulation, such that consumers are protected from infectious agents.

[3] There is a plethora of methodologies used to treat water prior to its distribution to consumers and it is not within the scope of this report to describe all forms of treatment in detail.

[4] In New Zealand, all surface waters are required by the DWSNZ to receive adequate treatment to remove pathogenic microorganisms including bacteria, viruses and protozoa.

[5] For groundwater supplies, the DWSNZ allow for no treatment if the source is deemed to be “secure”. For reasons described in Part 15 of this report, the Inquiry has concluded that the secure status shall be abolished.

[6] During the August hearings, the Inquiry heard evidence from a panel of experts comprising Drs Fricker, Deere and Nokes and Messrs Rabbits and Graham who agreed that treatment of groundwater sources was desirable.

[7] Water treatment essentially has three fundamental purposes: to make it aesthetically acceptable, to remove harmful chemicals (where present) and to inactivate or remove pathogens.

[8] For groundwater sources, inactivation or removal of pathogens is the most important aspect of water treatment, although for some sources additional specialised treatment may be required, for example, for the removal of arsenic, iron or nitrates. The
requirement for these forms of treatment appears to be uncommon and will not be
discussed further.

[9] Traditionally, groundwater sources have been treated with chlorine to inactivate
pathogenic microbes such as bacteria and viruses. The conditions required for
effective disinfection (pH, turbidity, chlorine contact time, temperature and
concentration) are described in the DWSNZ and the Inquiry finds these requirements to
be satisfactory.

[10] Both the installation of equipment for disinfection by chlorination and ongoing
running costs are relatively inexpensive and the Inquiry can see no credible reason to
avoid chemical disinfection given its important dual benefits. Not only is the raw water
treated to inactive pathogens but a residual disinfectant is provided to protect against
deterioration of water quality in the distribution system.

[11] During the course of the Inquiry there have been statements made in the press
that disinfection using chlorine results in the formation of toxic compounds such as
trihalomethanes and haloacetic acids which have been linked to some forms of cancer.
The Inquiry has sought advice on this matter and is satisfied that with groundwater
sources the formation of these compounds is likely to be at an extremely low level and
well below the World Health Organisation guideline level for lifetime exposure.
Acceptable levels for the compounds are included in the DWSNZ.

[12] Within the past 30 years, cryptosporidium has become recognised as a
waterborne pathogen that has been responsible for a number of outbreaks of disease
across the globe.

[13] While originally it was thought that cryptosporidium was a problem associated
with surface water, it has become clear that disease associated with this organism has
also been linked to groundwater. Dr Fricker has provided evidence to the Inquiry that
groundwater-associated outbreaks of cryptosporidiosis are not uncommon.
Consequently, the Inquiry has formed the opinion that groundwater sources under the
influence of surface water should also be treated to remove or inactivate
cryptosporidium.

[14] Cryptosporidium is unusual in respect of waterborne pathogens in that it is
almost completely resistant to chlorine disinfection.
[15] Cryptosporidium can be removed from water supplies by filtration (either conventional or by the use of membranes). Chemical disinfection for cryptosporidium can be achieved using chlorine dioxide or ozone but these forms of treatment can be difficult to apply and costly to install and run.

[16] The application of ultraviolet light to drinking water supplies is in common use to inactivate cryptosporidium across the globe. Furthermore, by applying the correct intensity of UV, bacteria and viruses can also be inactivated, providing a further barrier to these organisms.

[17] Inactivation of microorganisms using UV can be applied to any size of water treatment facility.

[18] New Zealand has a large number of small water supply systems (both groundwater and surface water). Notwithstanding the size of the community being supplied, the Inquiry has formed the opinion that all systems should receive treatment in order to make drinking water safe. For groundwater sources this can be achieved by a combination of UV and chlorination. For surface water systems, some other form of treatment (for example, coagulation and filtration in various forms) may be required.

[19] Upon installation of treatment facilities, it is incumbent upon the engineers performing the installation that they demonstrate adequate performance of the equipment (particularly with respect to UV and filtration systems) and adequate contact time for chlorine disinfection where this is the primary process used to disinfect.

[20] The DWSNZ provide requirements for water treatment plant performance and it is the responsibility of the water supplier to maintain records of parameters that can impact the effectiveness of treatment such as turbidity, UV intensity, pH, chlorine concentration and chlorine contact time.

[21] Failure to maintain adequate records or to ensure satisfactory performance of treatment facilities is a breach of the DWSNZ and should invoke action by the DWA and where appropriate the Ministry of Health.

[22] The Inquiry finds that the evidence in favour of treatment of all water supplies is compelling and recommends that adequate treatment be mandatory for all water supplies.