In the matter of the Resource Management Act 1991

And

In the matter of Applications for Resource Consents by Canterbury Aggregate Producers Group for the deepening of quarries within greater Christchurch

STATEMENT OF EVIDENCE OF DR WAYNE TEMPLE ON BEHALF OF CANTERBURY AGGREGATE PRODUCERS GROUP

27 May 2016

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INTRODUCTION

Qualifications and Experience

1 My name is Dr Wayne Temple. I am a consultant toxicologist having recently retired as the Director of the National Poisons Centre in Dunedin. The main purpose of the centre is to collect and provide information on the health and safety aspects of chemicals and medicines used in this country. My work in the centre involved regular contact with the public, health professionals and various organisations to provide advice on the adverse effects of chemical substances.

2 I hold the following Qualifications and professional memberships

BSc(hons), PhD	University of Otago
Fellow	New Zealand Institute of Chemistry
Fellow and Chartered Chemist	Royal Society of Chemistry
Fellow	IUPAC
Member	American Academy of Clinical Toxicology

Titular member of Chemistry and Human health Division, International Union of Pure and Applied Chemistry.

Member of Toxic Substances Board (1990 - 1998).

Regional Secretary, World Federation of Associations of Clinical Toxicology and poison Control centres (1990- 1995).

Board member of Asia Pacific Association of Medical Toxicology (since 1990).

Consultant to several government agencies on health and safety aspects of chemicals

(Ministry of Health (Member Water Quality Standards Committee 1994) MBIE, EPA, MPI).

Consultant to UN agencies including WHO and UNEP.

3 I have produced over 70 publications (papers, monographs chapters and books) in the fields of chemistry and human toxicology.

Code of Conduct

4 Whilst this is a Council Hearing, I acknowledge that I have read and am familiar with the Environment Court's Code of Conduct for Expert Witnesses, contained in the Environment Court Practice Note 2014, and agree to comply with it. My qualifications as an expert are set out above. Other than where I state that I am relying on the advice of another person, I confirm that the issues addressed in this statement of evidence are within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

SCOPE OF EVIDENCE

5 The scope of my evidence is to review the PDP reports on groundwater effects arising from the deepening of quarries near Christchurch with a focus on the possible changes to the chemical determinants in the drinking water supplies and their significance to human health.

6 I have read the reports produced by PattleDelamore Partners Ltd concerning the potential groundwater effects arising from the deepening of quarries near Christchurch, visited some of these quarry sites and have had discussions with both Neil Thomas and Peter Callander from PDP Ltd.

BACKGROUND TO DRINKING WATER STANDARDS AND WORLD HEALTH ORGANISATION GUIDELINES

7 The DWSNZ prescribes maximum acceptable values (MAVs) for chemical, radiological and microbiological contaminants acceptable for public health in drinking-water. A MAV is the concentration of a determinand below which there is no significant risk to a consumer over a lifetime of consumption. MAVs have been based on the latest WHO guideline values. The WHO calls their guideline values provisional when there is a high degree of uncertainty in the toxicology and health data, or if there are difficulties in water treatment or chemical analysis.

8 The DWSNZ adopt the same approach. Most chemicals arising in drinking water are of health concern only if levels exceed MAVs for months or years rather than days or weeks.

9 Guideline values (GVs) (differing in criteria from MAVs) are derived for many chemical constituents of drinking-water. A guideline value normally represents the concentration of a constituent that does not result in any significant risk to health over a lifetime of consumption. The GVs for aesthetic determinands given in the DWSNZ are largely based on the World Health Organization (WHO) document *Guidelines for Drinking-water Quality, 2004* and subsequent editions. The WHO GVs were developed to be acceptable internationally. The GVs should ensure that drinking-water is aesthetically pleasing and will not cause corrosion or physical problems in the reticulation or domestic plumbing. The GVs are not absolute values, but have been derived from the consideration of a number of factors. Exceeding the aesthetic GVs for a short period will not necessarily render the water unacceptable. Feedback from the public should provide guidance as to what the customers consider to be acceptable.

CLEANFILL MONITORING RESULTS

10 The PDP reports authors found that monitoring of groundwater quality indicated no significant changes due to quarrying in the McLeans island area, but in the Miners Road area showed increases in the alkalinity, electrical conductivity and hardness of the shallow groundwater. The report noted that the groundwater quality generally complies with the Drinking Water Standards NZ (DWSNZ) with the exception of two monitoring wells at the Miners Road quarry boundary which showed breaches of the aesthetic guideline value (GV) for hardness.

11 The total hardnessin drinking water should not exceed 200 mg/L as $CaCO_3$ (calcium carbonate), the GV set in the DWSNZ, in order to reduce effects on taste, soap wastage/scum formation, and to minimise undesirable build-up of scale. Dr Scott for CRC (para 31) describes the total hardness taste threshold as 100mg/L as $CaCO_3$. However the taste threshold is actually described in the NZ Drinking-water Standards as being in the range of 100 – 300mg/L as $CaCO_3$. This means that most people will notice the water has a different taste above 300mg/L as $CaCO_3$. Some people may notice a taste in the range of 100 – 300mg/L as $CaCO_3$ depending on other chemicals associated with the hardness and an individuals sensitivity to taste. The World Health Organisation information regarding hardness notes that water with very few dissolved minerals (i.e. low hardness) tends to have a flat taste and producers of bottled water often add minerals to it to address that issue. Some epidemiological studies have found that hard water may have a beneficial effect on health, particularly on some types of cardiovascular disease, but the data are inadequate to conclude that the association is causal.

12 Values of hardness found in New Zealand water supplies range from less than 5 mg/L to 475 mg/L as $CaCO_3$. Typical values lie between 5 mg/L and 80 mg/L as $CaCO_3$. Some of the monitoring bores at the downgradient quarry boundaries show elevated hardness concentrations during high rainfall periods (close to, or above 200 mg/L as $CaCO_3$). This is likely due to the disposal of concrete slurry, which is authorised by current consents.

13 The naturally occurring hardness concentrations in many bores in this area are in the range of around 20-100 mg/L $CaCO_3$, which is outside the recommended range for aesthetic determinants. This can make the water corrosive, due entirely to its natural characteristics so that it may dissolve metals from pipework and tap fittings. In such situations, the Ministry of Health provides the following advice for groundwater users:

> *"Some plumbing fittings have the potential to allow minute traces of metals to accumulate in water standing in the fittings for several hours.*

Although the health risk is small, the Ministry of Health recommends that you flush a mugful of water from your drinking-water tap each morning before use to remove any metals that may have dissolved from the plumbing fittings.

We are recommending this simple precaution for all households, including those on public and private water supplies."

14 It is important to recognise that the low hardness that is outside the aesthetic criteria for the NZ Drinking Water Standards is due entirely to the natural characteristics of the groundwater system. However, if the quarries were to cause an increase in hardness into the range of 100-200 mg/L $CaCO_3$ they would actually make the groundwater more compliant with the NZ Drinking Water Standards than is currently the case.

15 The evidence of Mr Callander states that the occasional breaches of the DWSNZ aesthetic GV for hardness (at the Miners Road area) was most likely due to cement slurry or cement materials associated with concrete batching plants. Rigorous controls on cleanfill material have been proposed to ensure that the materials that are placed below the currently authorised excavation depths will not contain cement slurry. Other strategies included maintaining a buffer zone of 50m around spring fed streams and limiting the duration of the deeper excavations to enable backfilling before groundwater inundation is likely to occur. These proposals should minimise the potential for elevating groundwater hardness.

16 PDP also observed some fluctuations in alkalinity and electrical conductivity parameters in monitored sites which like hardness probably reflects disposal of concrete slurry. The DWSNZ only provide a GV for hardness, no MAV or GV is given for alkalinity or electrical conductivity. However electrical conductivity is directly related to Total Dissolved Solids. The measured values at these sites is well below the GV for TDS, thereby representing good quality water.

HYDROCARBONS

17 Spillage of hydrocarbons (e.g. diesel fuel) was addressed in the PDP report and using a conservative application of the USEPA hydrocarbon spill screening model, which indicated that the limit of contamination from a 320L diesel fuel spill would be around 150m downgradient of the source. The evidence by Neil Thomas notes there is one domestic supply bore within 150 m of the Isaacs Quarry at McLeans Island (M35/1739) and a 150 m exclusion zone has been placed around that bore where deepening will not occur. The exclusion zone will protect the integrity of the water quality in the unlikely event of a large hydrocarbon spill.

MONITORING

18 PDP recommends that monitoring of groundwater quality should be undertaken to quantify any changes in groundwater quality that might occur. This would involve at least

one real time groundwater level monitoring bore with a recording transducer and telemetry at each of the quarry areas, other monitoring bores and sampling at least 3 private water supply wells in an area 1 km down gradient of each quarry. Sampling is to occur at quarterly intervals at all sites for the duration of the consents, although this may become more frequent if trigger levels are exceeded. The trigger levels specified are based on the results of groundwater quality monitoring. For the majority of the chemicals which have an impact on human health, the trigger levels proposed are ½ X MAV. Based on the WHO guideline values which are conservatively derived from both human and animal observations and include substantial safety margins these trigger levels are entirely appropriate for the protection of public health. It should be noted that short-term exposure to levels exceeding the MAV is not a cause for concern, provided the individual's intake averaged over longer periods of time does not appreciably exceed the level set. In light of the substantial safety margins incorporated by WHO in deriving MAVs and that short-term exceedances are not a cause for concern, it would not seem to be meaningful to further lower trigger levels to ¼ X MAV as indicated by council.

19 CRC has proposed the inclusion of Total Suspended Solids in the monitoring programme and a trigger level being set for arsenic. These inclusions seem reasonable but setting a level of ¼ X MAV for arsenic is inconsistent with the approach used for other parameters i.e. 50% of the MAV (and in keeping with schedule 8 of the LWRP). WHO refer to the practical quantification limit in the region of 0.001 – 0.01 mg/L for the analysis of arsenic in drinking water, so a ½ X MAV is better from this perspective (i.e. 0.005 mg/L).

20 The quarterly frequency of water sampling is adequate to detect seasonal changes in water quality and as indicated would be increased if trigger levels were exceeded.

21 In the unlikely event of groundwater contamination breaching drinking water standards, PDP have proposed mitigating action including the quarry operators modifying their operating procedures, or the provision of water treatment and/or alternative water supplies (possibly drilling new wells).These steps are sensible in order to maintain the basic quality of drinking water supply.

CONCLUSION

22 The PDP analysis of the potential groundwater effects from the proposed quarrying indicates that these are likely to be very minor in the context of quality of drinking water supply. They have proposed sensible measures to minimise the likelihood of raised levels of chemical determinants. PDP has also proposed that monitoring of water quality be undertaken and in the event of trigger levels being exceeded that mitigating procedures would be undertaken. Given their analysis, I would not expect any potential

effects on public health from the perspective of elevated chemical determinants in the drinking water.

Name: Dr Wayne Temple

Date: 27 May, 2016