

**BEFORE THE CANTERBURY REGIONAL COUNCIL HEARINGS PANEL**

**In the matter** of the Proposed Canterbury Regional Air Plan

**Between** Environment Canterbury

**And** Synlait Milk Limited

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**STATEMENT OF EVIDENCE OF PETER CAREY**

**18 September 2015**

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## Introduction

- 1 My name is Peter Carey. I am a soil scientist at Land Research Services Limited. I have been working as a contract research specialist for over 10 years. Formerly with AgResearch I have specialised in product testing and problem solving in a variety of agronomic areas and for a variety of clients. One area of interest has included monitoring the physical, chemical and biological handling of dairy effluent and its use as a valuable resource.

## Scope of evidence

- 2 My evidence addresses Rule 7.68 of the Proposed Canterbury Air Plan, and in particular clauses 4 and 5 of this rule.

### **Rule 7.68(4) – *The PH range of the liquid or slurry effluent is between PH6.5 and PH8.***

- 3 Most dairy effluent storage systems rely on at least a 2-pond system whereupon, after separating out solid material, the effluent moves into an anaerobic pond to undergo a 3-stage process; hydrolysis, fermentation and methanogenesis. The chief reason for maintaining the pH of effluent in an anaerobic pond at 6.5-8 is to ensure the methanogens responsible for methanogenesis can metabolise the volatile acids and other fermentation products that might produce odour to methane [Dairy Australia, 2008 #3308]. The issue with stipulating that the pH of pond effluent must be between 6.5-8 is that it does not, in itself, determine whether a pond will have odour or related problems. The chief determinant should surely be whether the pond has odour issues and then, determining the cause whereupon measuring pH may aid in determining the cause, particularly where pH is <6.5 and methanogenesis is being inhibited. This might be due to effluent loading issues or some other inhibitory substances such as ammonia or sulphide but to stipulate that pH, *per se*, is the causal issue is probably not accurate and would appear to be “putting the cart before the horse”. Pond pH may well fluctuate over a period of time without any actual drop or issue in pond performance.
- 4 Measuring pond pH is also likely to be highly problematic as it will differ from point to point and depth to depth and also depend on what type of treatment the effluent is undergoing. For instance, the upper depths of facultative ponds tend to maintain a lower pH whilst the lower layers will generally have a higher pH. Conversely, if the pond is being mechanically agitated then

effluent pH may well be homogenised over a greater depth and ammonia levels may well push pH above 8 but in the process of agitation the suspended solids are metabolised and activity increases resulting in increased ammonia volatilisation. I am not convinced that there is a clear link between ammonia levels, a pond pH >8 and pond performance (e.g. odour issues). If a pond is well designed and situated and organic loading is not so excessive as to inhibit methanogenesis, then there is no reason to think that a pond should have major issues relating to pH.

**Rule 7.68(5) – Dissolved oxygen is present in liquid or slurry effluent at concentrations greater than 1ppm.**

- 5 Having been involved in investigative studies measuring dissolved oxygen (DO) under a range of anaerobic and facultative pond conditions, using DO as a tool to predict pond performance and related odour issues is likely to be even more problematic than pH. The concentration of DO in the effluent will almost be entirely related to when and where it is measured in the effluent. For instance, if spray irrigated it will almost certainly exceed 1 ppm by the time it reaches the pasture surface but this will not demonstrate an odour-free pond. A facultative pond may well have higher DO concentrations in its surface water as the upper layers are less disturbed and oxygen can diffuse in but as depth increases, it will decrease to below 1 ppm. A poorly performing pond could, under this scenario, still have a DO concentration > 1 ppm in its upper depths. Conversely, where mechanical agitation or aeration is used in a pond to improve effluent characteristics or issues, the pond's microbial activity and BOD will likely increase as a result but because this activity will likely be limited by the rate of O<sub>2</sub> diffusion it will very likely result in DO concentrations <1 ppm. Consequently, I believe using an arbitrary level of 1 ppm DO will be too prescriptive and the value of any measurement will depend very much on how and when you measure.

**Summary**

- 6 The use of effluent pH and DO as prescriptive measures of pond condition, I believe, is flawed and in themselves they are not causal indicators of pond performance and odour issues. They may be considered supplementary measures to assist in investigating and/or understanding pond performance but by themselves are of limited use and almost entirely dependent on when and how they are measured.