MANGANESE CONTAMINATION INCIDENT AT TIMARU WATER SUPPLY

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ABSTRACT

The Timaru water supply is partly sourced from a shallow gallery adjacent to the Opihi River near Pleasant Point which has two limbs, a riverside limb oriented parallel and adjacent to the river and a landward limb, extending perpendicular to, and away from, the river. The gallery was being used as the main source of supply during December 2020 and January 2021 when complaints of discoloured water were reported by residents. Investigations by Timaru District Council (TDC) demonstrated that the discolouration was caused by elevated manganese (Mn) concentrations. Measured concentrations exceeded aesthetic guidelines for staining and taste, with a maximum measured concentration of 0.36 g/m^3. There were no reports of adverse health effects and the Maximum Acceptable Value of 0.4 g/m^3 was not exceeded in any of the gallery water samples.

There were no known anthropogenic sources of manganese in the area, but groundwater sampling from monitoring bores indicated that organic matter in the groundwater was causing sub-oxic conditions. Subsurface bacteria obtain energy through redox reactions involving electron donors (typically organic matter) and a variety of electron acceptors that generally occur in a sequence from high energy release to lower energy release. First, oxygen is depleted, and anaerobic respiration becomes dominant. Oxygen depletion is typically followed by depletion of nitrate through denitrification, then release of manganese and iron into solution, followed by the depletion of sulphate. The source of manganese and iron is the manganese and iron oxides that are present in or on the sediments of the alluvial gravel aquifer used for the water supply.

The organic matter in the aquifer appeared to be from agricultural activities in the area ~0.5–1 km upgradient of the gallery, including a silage storage area and intensive stocking. The contamination coincided with heavy rainfall events of 160-240 mm/month, which could have pushed the low-oxygen groundwater toward the gallery, and also caused a change in gallery operations whereby all the water was drawn from the landward limb, since the riverside limb was shut down due to turbid river conditions.

The silage stack has now been removed from the area. TDCs response has been to more actively monitor water quality using continuous pH and electrical conductivity probes and handheld testing meters for manganese, and to improve the ability to separate off different sections of the gallery to avoid drawing in contaminated water. In the longer term, the proposed new Timaru Urban Water Treatment Plant will enable the treatment and use of water that is more turbid than that which currently can be used.

This is an example of commonplace farming activities within a drinking-water source water risk management area causing a change in groundwater conditions leading to contamination. The challenge in the future is to identify these circumstances and manage them before they become a problem.

KEYWORDS

drinking-water, contamination, manganese, agriculture, redox