23. PH ADJUSTMENT OF WATER

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The purpose of this report is to update Councillors on the situation in respect to the Council's (June 2001) resolution, which was to cease to pH adjust water at three of the Council's water supply pumping stations. Furthermore, Councillors are requested to consider rescinding the resolution pending further investigation and possible mitigation measures.

BACKGROUND

The Council at its June 2001 meeting endorsed a City Services Committees recommendation (amongst others re copper corrosion and water supply) to cease to undertake pH (i.e. acid/alkali balance) adjustment. This resolution only affected three out of 54 City water supply pumping stations, as the others do not undertake pH adjustment or any other form of water treatment.

A few days after the Council meeting a Community Board member contacted a Council officer. He had been speaking to a metallurgist associate of his, who expressed concern at the prospect of pH adjustment ceasing.

The metallurgist was contacted. He noted that the Council's deliberations in respect to ceasing pH adjustment had been centred on the issues of (cold water) copper pipe plumbing systems. His thoughts in this regard were consistent with previous expert advice sought on this subject. That is, copper pipe corrosion is very complex and not fully understood, but a reduction of pH to in the order of 6.7 to 6.8 is unlikely, on its own, to cause an increase in the incidence of copper pipe failure. (Note here that pH below 7 is acidic, 7 is neutral and above 7 is alkaline). However, he was concerned that such a decrease could result in a long-term increase in the rate of copper hot water cylinder failures. He had been involved in the early 1980s with the ex-Waimairi District Council investigating such failures and noted that the failure rate of hot water cylinders had dropped markedly after pH adjustment commenced. He believed that water swirl patterns as the water entered the bottom of the cylinder and the constant heating and cooling (thermal shock) imposed on the copper was a contributing factor.

As a result of this discussion, a management decision was made not to immediately cease pH adjustment, but to hold off for a short period, pending the results of further investigation.

SUMMARY

After the Council resolved to cease pH adjustment of water, some further technical comment was received that suggested doing so could result in a significant increase in hot water cylinder failure in the north-west suburbs of the City. Accordingly, an officer decision was made not to immediately cease dosing, but to continue for a short period while further investigation took place. It is now considered that, without mitigating action (drilling a deep well at each of two pumping stations and mixing water to achieve an pH of 7.0 or better), it is very possible that hot cylinder failures could increase, and if this was to occur the Council could be held liable for the damage. Accordingly, it is recommended that pH adjustment continue at two of the Council's 54 pumping stations, pending the acidity of the water being corrected by mixing the water from deep wells, or confirmation that the water is naturally above pH 7.0. One way to achieve this is to attempt to drill a deeper well at each of the two pumping stations to obtain water with a higher natural pH.

SUBSEQUENT EVENTS

The following have since occurred:

1. Local plumbing industry surveyed

A number of the plumbing firms involved with replacing hot water cylinders, and working in different areas of the city, were approached. Two hot water cylinder manufacturers were also approached. The findings of this survey were:

- The failure rate of hot water cylinders in the north-west area has been considerably less in recent years (after pH adjustment commenced) compared with the failure rate in earlier years. The rate of failure had been of concern.

- In recent years, premature failure of hot water cylinders does not appear to be a serious issue in any part of the City.

- The failure rate of hot water cylinders in the north-west area may still be higher than other areas of Christchurch at present, but only marginally so, rather than clearly so.

- No other area of Christchurch stands out as having a higher than average rate of cylinder failures.

2. Further expert advice received

The metallurgist, who had previously given advice to the Council on the copper issues, was requested to consider the issue in respect to hot water cylinders. He confirmed that copper corrosion in hot water cylinders is likely to increase if pH dosing was to cease. The reasons for this are:

- While a pH above 7.0 (i.e. alkaline) is preferred, it is not until the pH falls below 6.5 (below 7 is acidic) that the rate of copper corrosions increases rapidly.

- The pH of water changes with temperature, and as the temperature rises the pH reduces (i.e. water becomes more acidic)

Thus, while a cold water with pH of 6.8 (mildly acidic) is not likely to have significant corrosion problems, when heated in a hot water cylinder to in the order of 60 degrees Celsius the pH will fall to below 6.5 (more acidic) and corrosion is then likely.

3. Copper industry informed of decision

The Copper Research Council and the three main suppliers of copper to Christchurch were contacted, advising them of the Council's decision to cease pH adjustment. They were invited to comment on this decision. The only comment received to date was that if the City Council was to cease pH adjustment, with the knowledge that this action is likely to cause an increase in cylinder failures, the Council may then be held legally liable for the failures. This comment was referred to the Council's own legal staff, who have confirmed that such legal action against the Council may well be successful.

4. Deep wells

The June report to the Council indicated that in the order of $2.5M would be required to replace all shallow wells with “suspect” pH with deep wells. However, if one reliable deep well could be provided at each of the Burnside and Bishopdale stations, and these wells were used as the base supply at these sites, water from the shallow (suspect) wells could easily be mixed to achieve an overall pH from the stations (very likely) above 7.0. Thus, chemical adjustment would not need to be considered. This would result in the risk of copper corrosion in Christchurch being no higher than it is with the present dosing regime. It would not ensure all supplied water is 7.0 or better. With this in mind the ten-year capital works programme provisionally has nominated an (early) replacement well to be drilled at Burnside for the 2002/03 year. If this well is successful the programme could further be adjusted to drill another (replacement) deep well at Bishopdale in a following year.

This approach would not improve all water supplied in Christchurch to above pH 7.0 ($2.5M is likely to be required for this), but would result in pH dosing adjustment being able to cease without the possibility of copper failure rates increasing.

Cost implications

Drilling two deep wells at a capital cost of $250,000 (total) has an annual operating cost (depreciation, cost of capital, etc) of approximately $22,000. This is offset by a saving in supply of chemicals, etc of approximately $20,000 and saved depreciation charges (on the replaced wells) of approximately $2,000 per annum. In addition, there would be a one-off cost of $34,000 for writing off the residual value of the two wells replaced. Thus, the change in operating cost is neutral except for the one-off write off of the residual value of the replaced wells.

CHEMISTRY OF PH ADJUSTMENT

Adjustment of pH in recent years has only occurred at three pumping stations. However a replacement deep well at one of these sites (Auburn Avenue) has resulted in the natural pH of the water rising to above 7.0, thereby negating the need for chemical adjustment. Thus, Burnside and Bishopdale are the only two sites presently being pH adjusted.

The pH adjustment occurs by the addition of very small quantities of sodium hydroxide. Sodium hydroxide (NaOH) dissolves in water and reacts with carbon dioxide (CO_2) (the source of acid in well water) to form water (H_2O) plus sodium carbonate ($NaCO_3$). Sodium carbonate is a common salt present in most waters and the levels that result are well within the NZ Drinking Water Standards Guidelines.

ISSUES FOR CONSIDERATION

The issues for Councillors' consideration are:

- Legal action against the Council could be successful if pH adjustment is ceased with the knowledge that such an action may well increase the frequency of hot water cylinder failure.
- The desire of the community for the public water supply to be pure untreated water without added chemicals.
- On-going operating financial cost is neutral except for the one-off cost of having to write off the existing wells in a single year, rather than depreciating on the usual on-going basis.

Recommendation:

1. That pH adjustment of water at the Burnside and Bishopdale Pump Stations continue until it is clearly established that the pH of the water is above 7.0.

2. That the Sustainable Transport and Utilities Committee endorse the proposal to drill deep wells at each of the Burnside and Bishopdale Pumping stations in order to obtain water that has a suitable pH.

Chairman's Recommendation: That the above recommendation be adopted.