# Masterton Water Treatment

# Update November 2012

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## Introduction

I have previously demonstrated that the use of chemicals at the Masterton water treatment plant and the connection of power lines to water mains has two adverse effects on public health, which are increases in ischaemic heart failures and cancer deaths.

Two factors, one causal and one interactive, contribute to these effects.

First, oxidising chemicals such as hypochlorous acid when used in water treatment produce cellular damage, both killing bacteria and causing damage to cells in people. To defend itself, the human body produces cholesterol which in turn leads to oxygen starvation of the heart muscle and heart failure.

Secondly, ionisation of water species leads to cancer. For example, where an electron has been removed from DNA by oxidation, an hydroxyl component of water can be added where its valency has been changed by ionisation within electrically conductive water pipes.

As the heart failure and cancer epidemics are limited to those domicile areas supplied with chlorinated water, using filtration alone without chemical dosing offers the most practical and comprehensive corrective action.

## Sites most affected by chlorination (Yang et al)

I have drawn Council's attention to the work of Yang et al who demonstrated that the increases in cancer rates which comprise the cancer epidemic are limited to those domicile areas served by chlorinated water supplies. Yang et al also demonstrated that chlorinated water affects some "sites," i.e. parts of the body, more than others. They showed "a positive association between (the) consumption of chlorinated drinking water and cancer of the rectum, lung, bladder, and kidney." These parts of the body relate to water consumption and respiration.

## Ages most affected by chlorination (Cancer Atlas of New Zealand)

More recently I have found, from the first Cancer Atlas of New Zealand produced in 1982 by Barry Boorman, that the greatest increase in urban cancers is in the 30-50 age group.

Barry Boorman is an epidemiologist with a background in geography who was Manager of the Public Health Intelligence Unit from 2000 to 2008 and then Associate Professor at the Centre for Public Health Research.

The 1982 Atlas identifies the increases in cancer spatially. It supports the Yang report in that it notes an urban/rural split in cancer incidence although it leaves the subject open as to cause, saying that "although the aetiology of most human neoplasms remains elusive, the majority are believed to be attributable, directly or indirectly, to environmental factors. One initial approach to identifying these carcinogens, and hence facilitate primary prevention, is to describe the demographic, geographic, and temporal distributions of cancer in populations. Often this will provide clues to the underlying disease causative process." Yang et al has pointed the way since then. Importantly, the Atlas shows how cancers of the major sites, i.e. the rectum and the bladder, affect different age groups. Although the Atlas, having been produced in 1982, may seem to be old news, it does contribute an important insight into the age groups of those most affected by the cancer epidemic in New Zealand.

The following charts are from the Cancer Atlas. The rectum and bladder are common to the Yang report. The lung is open to the "confounder" of cigarette smoking so cannot be regarded as reliable even though the results are supportive at face value. The kidney was not included separately in the NZ Atlas. I've added cancer of the liver, although it is not common to the Yang report, as it seems to be prevalent in New Zealand, probably for reasons of dietary differences in antioxidants.

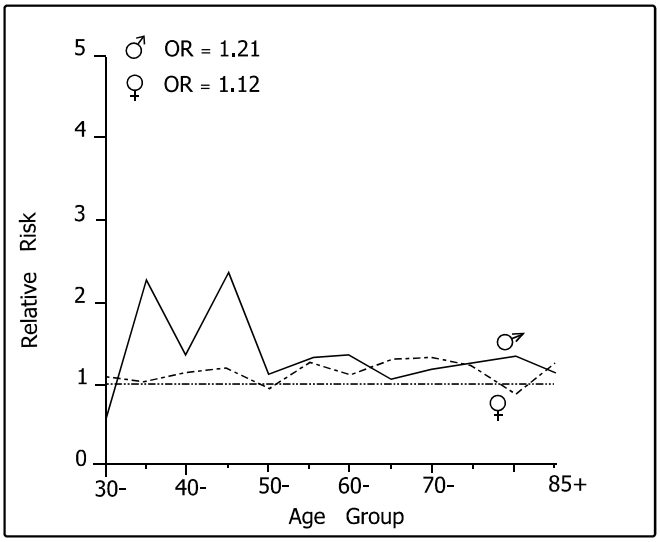



Fig. 7 e. Age - sex specific relative risks of death, 1969 - 78 compared with 1949 - 58.

Figure 7: Cancer of the Rectum

This graph for the rectum makes a comparison between ~1950 and ~1970. It demonstrates that the increases in cancers of the rectum are mostly in the 35 to 45 years age group for men. To read the graph, y = 1 is a horizontal base line. It is used to show the "odds ratio." For example, if cancer of the rectum has a certain probability in 1950 and the same probability in 1970 then the odds ratio is 1 (y=1). If the probability of cancer of the rectum in 1970 is double that in 1950 then the odds ratio is 2 (y=2), which it is for the 35 - 45 age group for men.

Figure 19: Cancer of the Bladder

The graph for the bladder demonstrates that the increases in cancers are mostly in the 40 to 50 years age group for women, peaking at age 45 with a four fold increase in cancer deaths. It is worth noting that these graphs

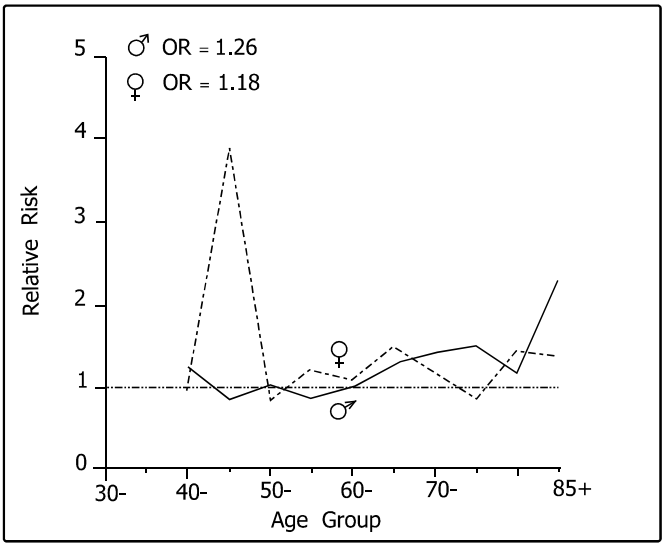



Fig.19 e. Age - sex specific relative risks of death, 1969 - 78 compared with 1949 - 58.

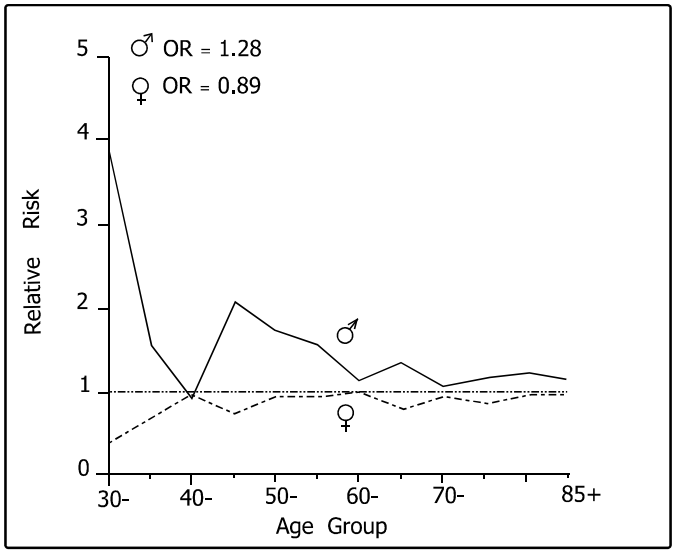



Fig. 9 e. Age - sex specific relative risks of death, 1969 - 78 compared with 1949 - 58.

use mortality data and represent deaths after any improvements in early diagnosis or better treatment methods.

Figure 9: Cancer of the Liver.

In this last graph there are serious increases in cancer of the liver over the 1950 to 1970 period, with a large increase in liver cancer in men under 35 years of age and another significant increase in men between the ages 45 and 60.

So the research by Yang et al and Barry Borman confirm and expand on my work, demonstrating that the chlorination of drinking water produces a measurable increase in cancers and identifies those cancer sites and age groups most affected.

**Masterton: heart failure and cancer deaths increase with water pH:**

In Masterton the factors affecting heart failure and cancer are chlorination, water pH and metal pipes.

Looking in more detail at the pH factor, pH describes the amount of active species in water by using a logarithmic scale. Active species are, for example, hydronium ($H_3O^+$) produced by the dissociation of hydrochloric acid formed by chlorination:

$$H_2O + HCl \text{ dissociates to } H_3O^+ + Cl^-$$

These water species, being paired, are able to be buffered by the human body and therefore do not represent a problem. However, if the pH is adjusted alkaline then $H_3O^+$ increasingly appears as a single unpaired ion, or "reactive" species which, when electrically modified by metal water pipes, is unable to be buffered. Unlike active species, reactive species are long lived.

As pH is a base 10 logarithmic scale, even slight shifts toward alkaline result in big increases in long lived reactive species. The pH of Masterton water has shifted from an average of 7.1 for the years 2001 - 2004 to an average of 7.4 for the years 2005 to 2009. This is an increase in pH of 0.3, but as the scale is a base 10 logarithm then the actual increase in reactive species is a doubling (x2):

$$pH = \log_{10}(1/a_H)$$

so, if $\textit{delta}\ \log pH = 0.3$

then $\textit{delta}\ a_H = 2.0$

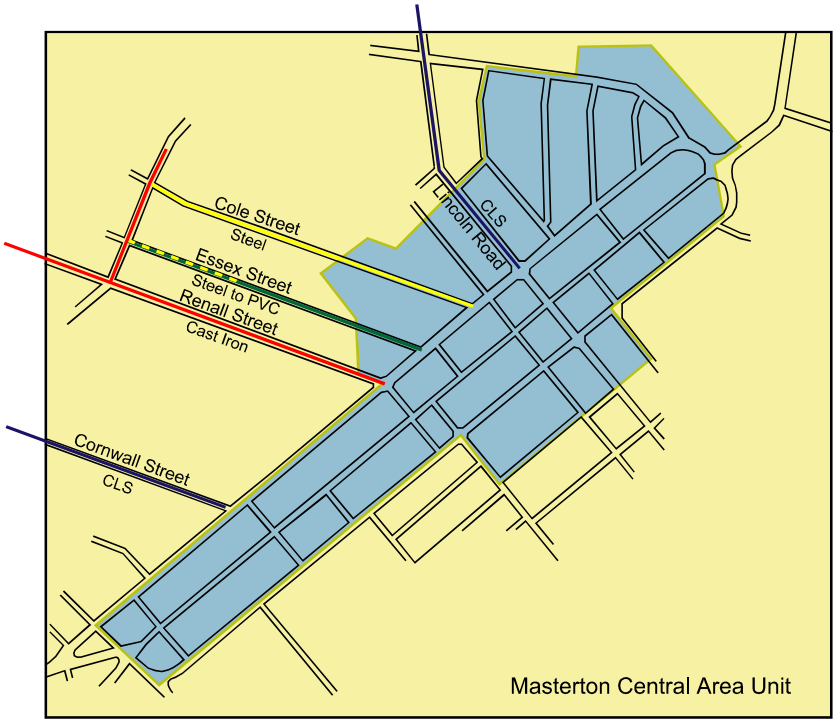
The shift toward an alkaline pH has pushed up the incidence of heart failure and cancer in Masterton as a whole but more so in Masterton Central Area Unit as this domicile is supplied through pipes which are predominantly electrically conductive metal:

| *year* | *pH* | *Isch. heart* |
|---|---|---|
| 2001 | 7.082 | 20 |
| 2002 | 7.191 | 8 |
| 2003 | 7.210 | 16 |
| 2004 | 7.131 | 23 |
| average | 7.1 av. | 17 av. |
| 2005 | 7.343 | 29 |
| 2006 | 7.285 | 29 |
| 2007 | 7.414 | 37 |
| 2008 | 7.408 | 31 |
| 2009 | 7.392 | 37 |
| average | 7.4 av. | 33 av. |

The shift of 0.3 in pH which doubles the reactive species correlates with a doubling of ischaemic heart failure. Cancer rates follow a similar increase. This is the sort effect which needs monitoring in real time.

**<u>Masterton: heart failure and cancer deaths decrease with water pipe replacement:</u>**

James Li has been replacing water pipes in Masterton over the past two years. These replacements are in PVC which is electrically insulating and the effects of this are beginning to appear in provisional health data. Again, the effect is most apparent in the Central Area Unit where the Essex Street steel water main has been replaced with PVC.



The main supply pipes to the Central Area Unit are concrete lined steel (CLS), cast iron and steel. Water flows are determined by demand both in this area and elsewhere in the town, but it is reasonable to expect that flows into the Unit are largely through electrically conductive pipes. At face value this would be somewhere near 60%. The change in Essex Street (and to an extent, Michael Street) from steel to PVC represents a proportionate decrease to 40%. The average pH at the time of the change remained around 7.5, so the reduction in heart failure and cancer registrations can be attributed to this approximately 1/3 reduction in reactive species. Ischaemic heart failures reduced from 33 (average in preceding years) to 18 (in the year of change) and cancer registrations similarly from 26 to 18. These reductions are provisional but as they agree in trend it is unlikely that there would be any significant adjustment to them.

**The Choice:**

These two examples of pH adjustment and pipe replacements illustrate two philosophies or approaches. Both are legal. The former follows the guidelines in the Drinking Water Standards as an accepted protocol, which inadvertently kills people, and earns brownie points in the form of an Aa grading. The latter is based on an educated decision and a little gumption, which has the benefit of turning around our escalating heart failure and cancer epidemics. Right now James Li has a head start on Kevin G., who could well do with a green light on ceramic filters if he is to catch up.

The process of monitoring health effects would be more timely if data were available in real time from the Wairarapa DHB.

**Conclusion:**

We all know that an atomic bomb would result in large numbers of cancer deaths. However, we don't realise that radiation from an atomic bomb doesn't directly cause cancer. Radiation kills cells, which is why we use radiotherapy to kill cancer cells. Radiation does not cause cancer directly but does so by an intermediary; water. The human body is composed of a large proportion of water. Radiation forms cancer-causing ions within this water which oxidise and bond to DNA. The chemical and electrical processes associated with water treatment and reticulation have exactly the same effect. Rather than forming reactive water species in the human body directly, we simply drink these long lived species and get cancer.

The incidence of cancer in Masterton is 7 fold higher than it should be, that is, 6 out of 7 cancer registrations are directly attributable to Masterton's water treatment and reticulation systems and are easily preventable.

In early 2011, I submitted that filtration to 3 microns and maintenance of a buffer rather than chemical dosing would produce an immediate reduction in heart failures and cancer deaths. That is still the case. Lowering the pH and metal pipe replacement would mitigate some of the adverse effects of chlorination but these are partial answers compared to moving to filtration without chemical dosing.

The biggest increase in cancer deaths in Masterton is most likely to be in the under 50 age group. As Councillors many of you will be in the over 50 age group and it may be that you have personal experience of cancers in your own families or those of friends where this

increased cancer incidence for those under 50 years holds true. It is this age group that is raising families.

I reiterate my concern that the risks associated with chlorination are unacceptably high and no useful purpose is being served by the continuation of chemical dosing. The alternative of improved physical filtration provides a practical and safe alternative, is of comparable potability and, subjectively, better taste.

I request that urgency be given to this matter.

Date: 25 November 2012 Stephen G. Butcher (B.Arch, Dip.BS)