CANCER REPORT 2010:

the need for PHYSICAL rather than CHEMICAL water treatment

ISSN 1178-2994

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Copies may be ordered from the above @ $12.00 incl. P&P.
RRP $18.00 Online distribution $0.00

Fourth Edition: December 2010

ISSN 1178-2994

CANCER REPORT:

the need for Physical rather than Chemical water treatment.

Towards the end of this year I was able to access data from the Cancer Registry which had been backed up into the Wellington City Library archives. This has made possible the graphing of increased cancer incidence for a number of areas to illustrate, at a finer scale, the correlation between chlorination of electrically live water systems and cancer incidence.

As a step towards lobbying for physical rather than chemical treatment of water supplies, the following submission has been prepared for presentation to a local authority, Masterton District Council, early next year.

The inclusion of this submission saves duplication of time on my part and shows that it is now apparent that the formula established last year can be updated such that the previously assumed base rate can be read as base rate x 2, that is, chlorination of electrically live water systems will approximately double cancer and heart failure rates and this doubling is modified upward according to the equation for the factors of conductive waterpipe length and pH.

Presentation to
Masterton District Council Policy and Finance Committee:

"Policy changes to reduce water treatment mortalities."

Water Treatment Mortalities

Masterton avoided the cancer epidemic until 1968 despite the epidemic having been extant in most New Zealand towns and cities since 1950. In 1969 cancer registrations in Masterton doubled in a single year.

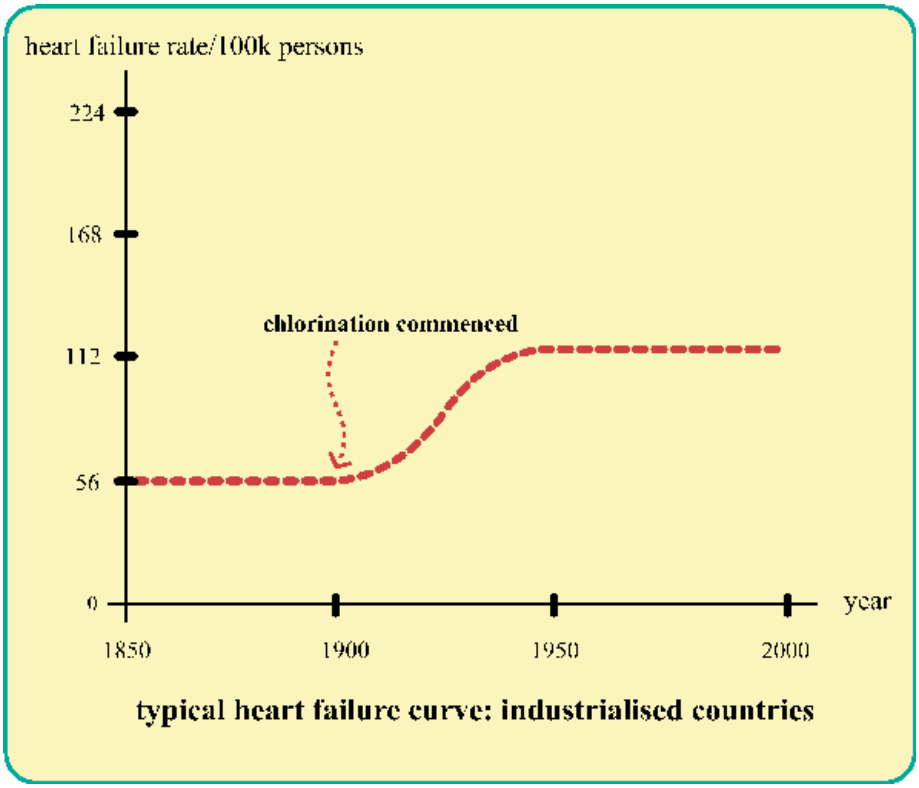
International research shows that chlorinating drinking water doubles cancer registrations, and there is now sufficient historical data to confirm that this also applies to New Zealand, and to Masterton.

While chlorination of drinking water is causal to the cancer epidemic, my research shows that the epidemic requires two environmental factors and one of these is easily reversible.

As background:

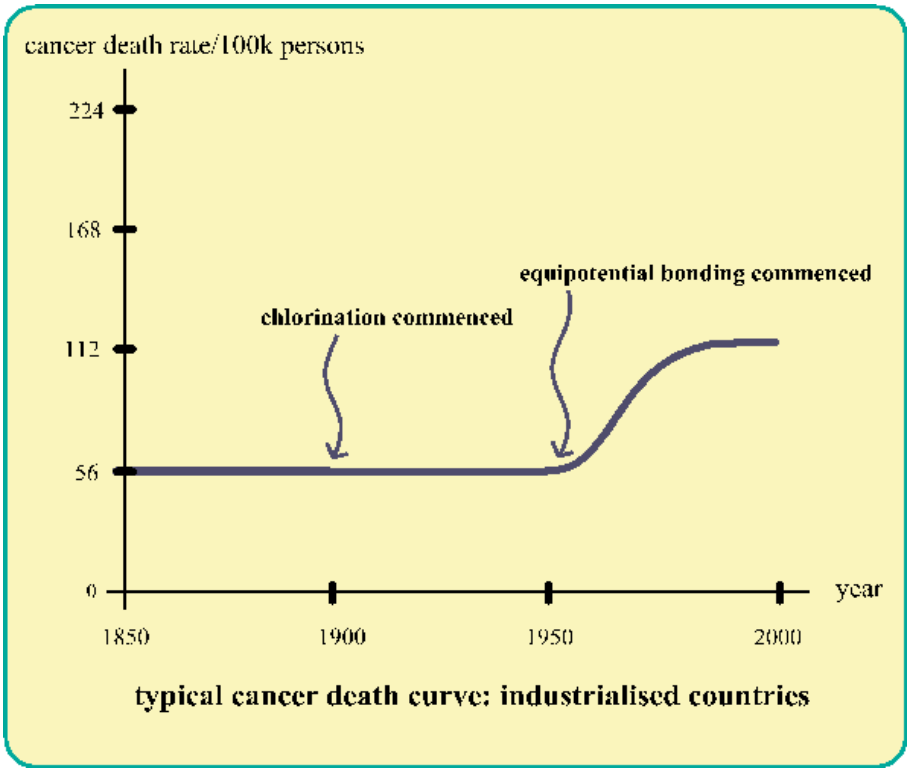
Heart failure and cancer have chlorination as a common factor because ischaemic heart failure is a precursor to cancer. Both ischaemic heart failure and cancer epidemics are presentations of environmentally induced illness rather than diseases *per se*.

The heart failure epidemic began in industrialised countries in the early 1900s when chlorination began to be used to disinfect drinking water supplies:



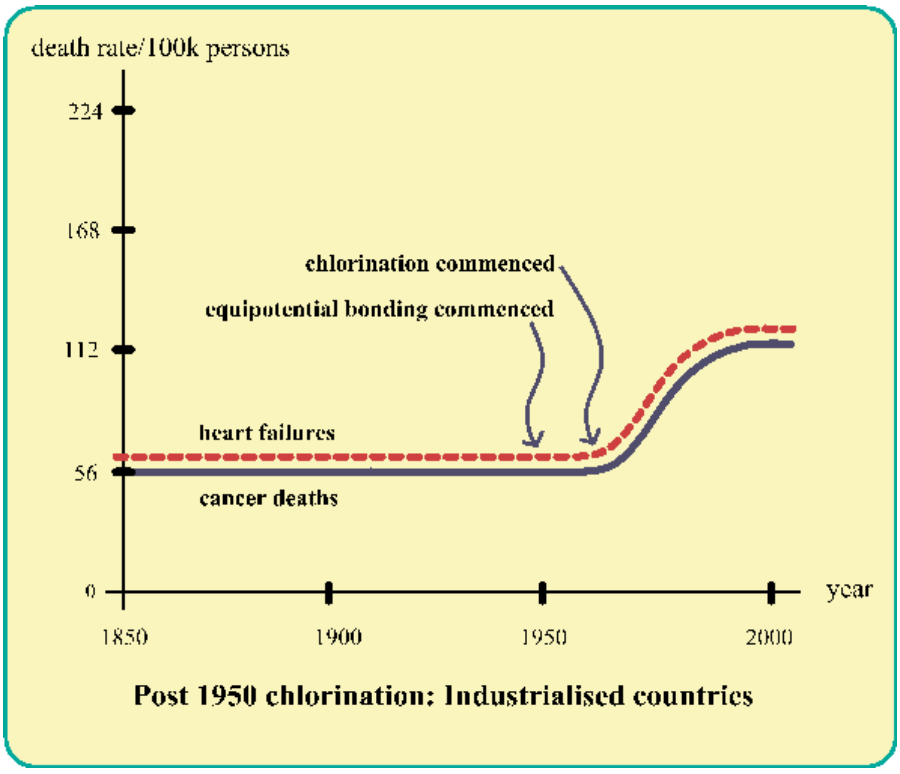
typical heart failure curve: industrialised countries

The cancer epidemic followed some 50 years later because chlorination on its own is insufficient to cause cancer. Although chlorination is a "causal factor," it requires another "interactive factor." That interactive factor is water pipe ionisation created by connecting, or bonding, power lines to water pipes, a practice which began around 1950:



typical cancer death curve: industrialised countries

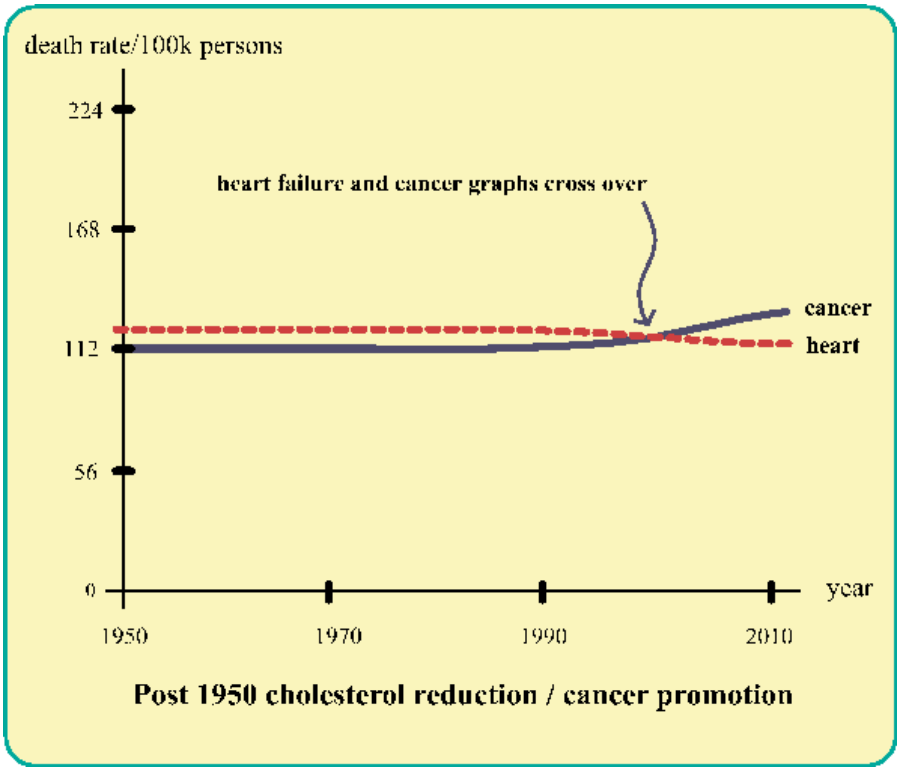
When chlorine is added to a water supply in the post-1950 period, the cancer and heart failure epidemics start concurrently because both the causal and interactive factors are extant:



Post 1950 chlorination: Industrialised countries

If the rate of heart failure is reduced by diet, the rate of cancer shows a

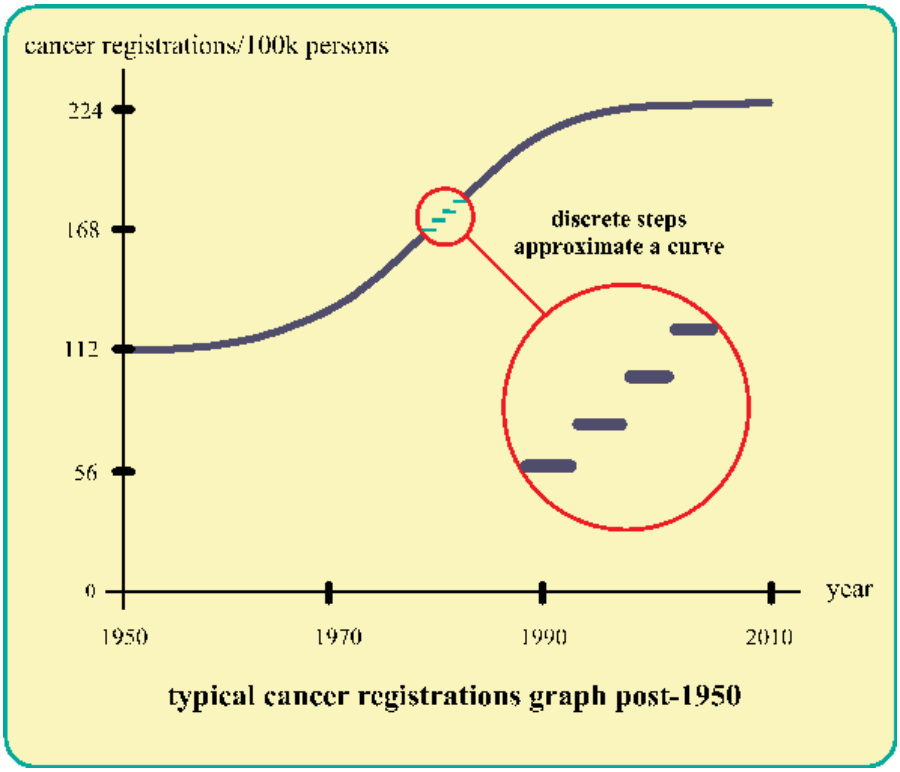
proportionate increase to the extent that where the heart failure rate is dominant it can be overtaken by the cancer rate:



Post 1950 cholesterol reduction / cancer promotion

In more detail:

The apparently smooth graph line of the post 1950 cancer epidemic includes a series of small discrete steps:



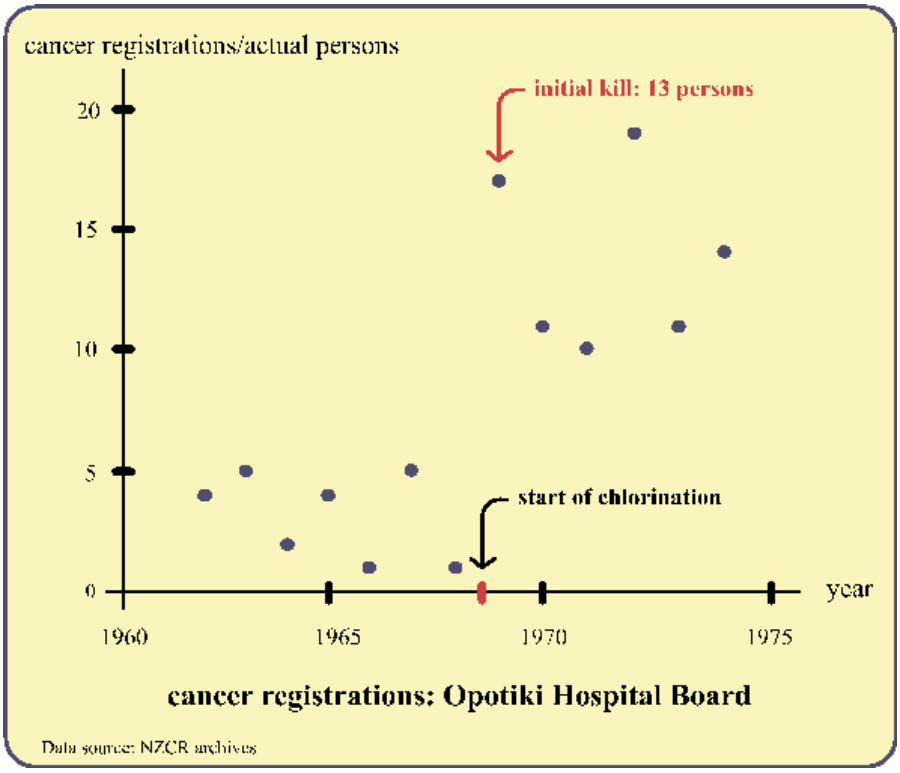
typical cancer registrations graph post-1950

Each discrete step occurs when a water supply is chlorinated. In New Zealand, these steps are evident in cancer registrations within individual Hospital

Board areas of domicile up until around 1980. Since then chlorination has been almost universally practiced and where it hasn't the water is most often from bores with hard water which gives similar results.

As an example:

Opotiki began chlorinating its water supply around 1969 by dosing with HTH chlorine. Cancer registrations in the Opotiki Hospital Board area of domicile immediately doubled:



The first year of chlorination gives an "initial kill." Typically this is followed by an "ebb kill" for a year or so and then a climb to the "final kill" rate, which may take a number of years. The terms initial, ebb and final kill are applicable to both registrations and deaths.

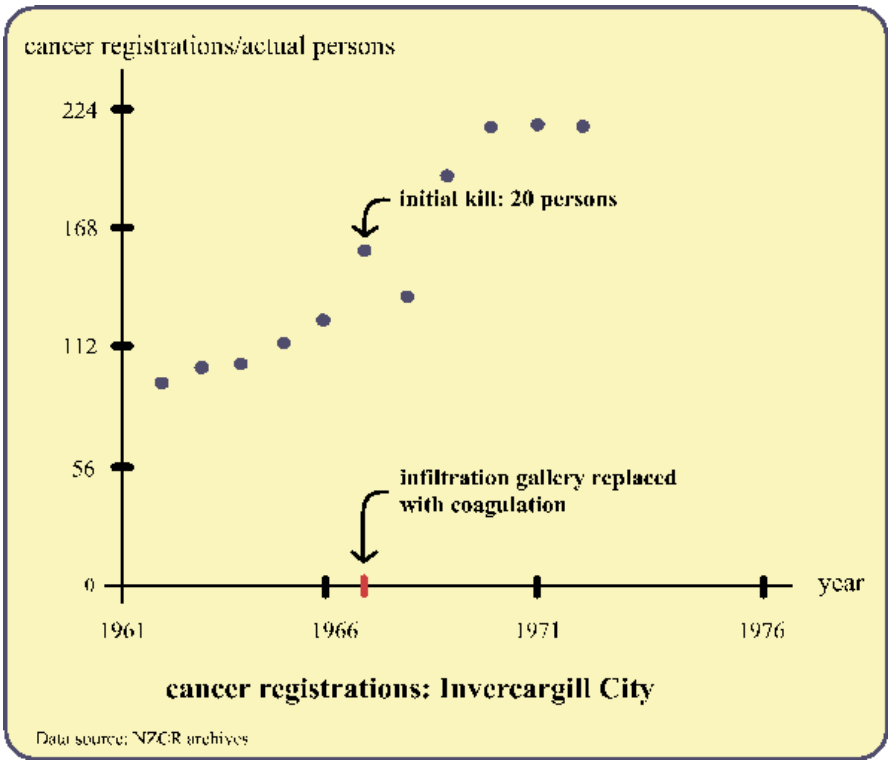
The climb in cancer rates may occur in several discrete steps in a domicile area, each step corresponding to a change in water treatment.

As a further example:

Invercargill has had several steps in cancer registrations, each step corresponding with changes made to the water treatment plant.

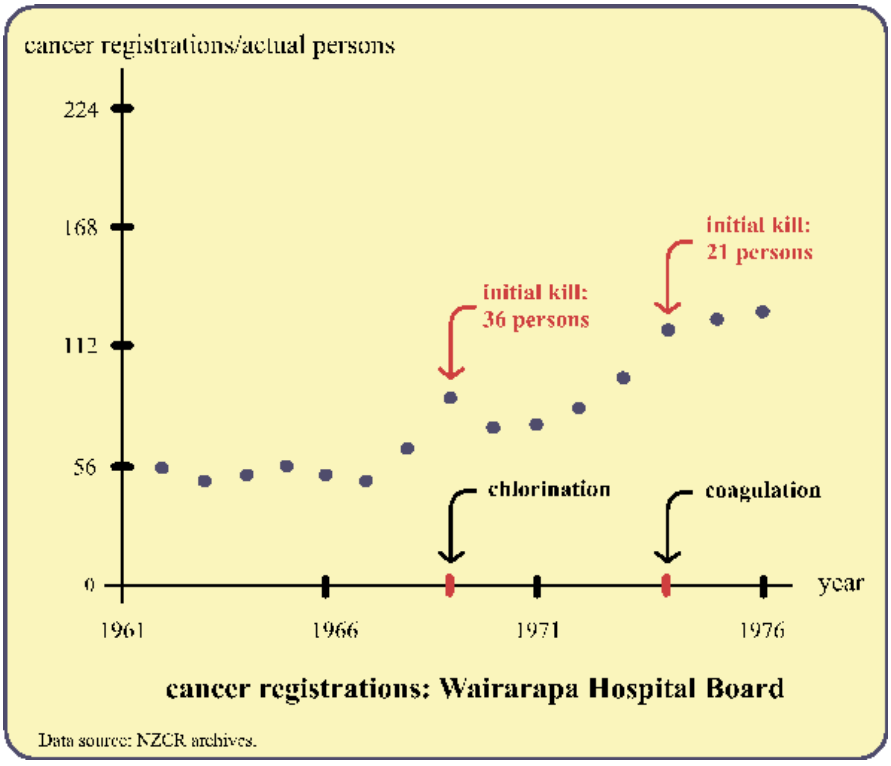
Chlorination began when the water supply intake was moved from the City to the Oreti River. Initially an infiltration gallery was used but by the late 1960s

this was replaced with a flocculation plant. This last change correlated with a 28% increase in cancer registrations, as seen in the Invercargill City area of domicile:



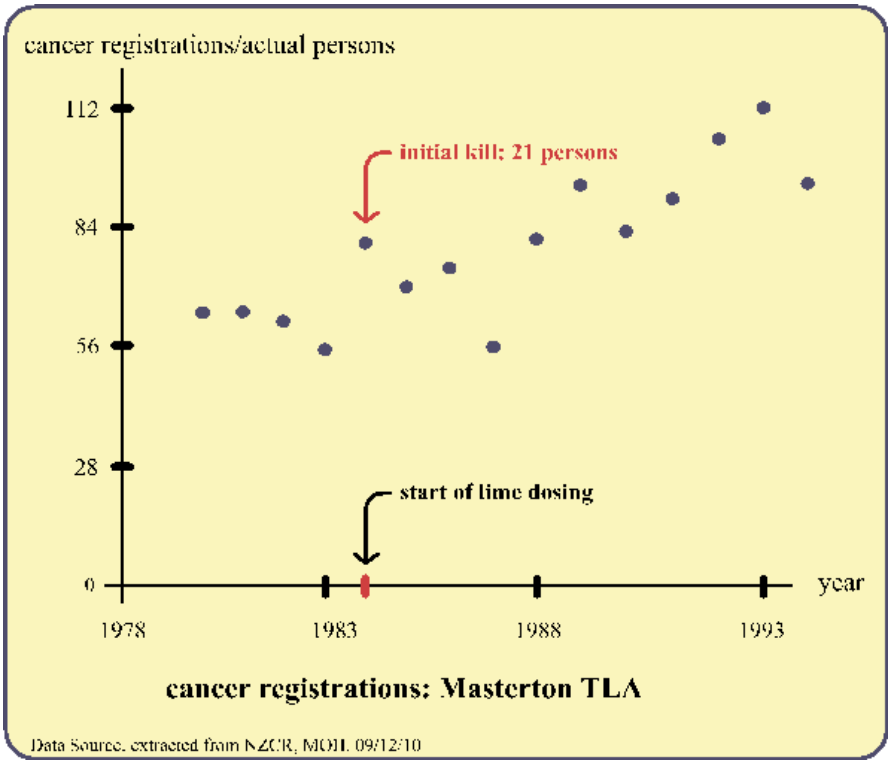
In Masterton:

Masterton's cancer registrations show the sudden onset of the epidemic at the commencement of chlorination where the interactive factor of electrical bonding was already extant, as seen at DHB level:



The initial kill was followed by an ebb and then a climb towards the final kill rate which correlated with new water treatment equipment being commissioned in 1974.

Later, in 1984, the installation of lime dosing equipment gave a further but smaller increase in cancer registrations. Lime was added to control corrosion in water pipes and hot water cylinders resulting from the earlier decision to chlorinate, and the resultant increase in cancer registrations can be seen in the TLA area of domicile:



Again the increase in cancer registrations follows the pattern of initial kill then ebb, but with a somewhat erratic increase toward the final rate.

As an extremely conservative estimation of the final kill rate in Masterton, there would be in excess of 47 persons killed by chlorination and a further 21 persons killed by the addition of lime, i.e. 78 persons annually, these figures including both ischaemic heart failure and cancer deaths. The latter is indiscriminate across all age groups.

<u>It must be understood that:</u>

There is a simple difference between industrial process and human biology.

Existing water treatment practice is an industrial process designed by industrial chemists and engineers. It is flawed because it takes a mechanical approach to a biological process.

The human body requires the pH of blood to remain within a very narrow range. This it does largely by buffering, which is the swapping of ions of a strong acid or alkali with those of a buffer. For example, hydrochloric acid consists of an hydrogen ion and a partner chloride ion and is buffered by bicarbonate, i.e. the ion pairs swap their partner ions to produce a weak acid and salt:

$$HCl + NaHCO_3 \longrightarrow H_2CO_3 + NaCl$$

This natural buffering occurs in the human body where the duodenum uses bicarbonate to buffer hydrochloric acid passing from the stomach. The weak carbonic acid produced by buffering largely decomposes to the harm-less byproducts of carbon dioxide and water:

$$HCl + NaHCO_3 \longrightarrow H_2CO_3 + NaCl$$
$$H_2CO_3 \longrightarrow CO_2 + H_2O$$

By contrast, the industrial process of adding chlorine to water produces hydrochloric acid and hypochlorous acid, which is the disinfecting agent, and a residual or freely available chlorine which cannot be buffered by the human body's buffering system.

Similarly, adding lime to water to force the pH alkaline creates further unpaired ions. Absorbed carbonic acid goes to carbonate and hydronium ions which cannot be buffered:

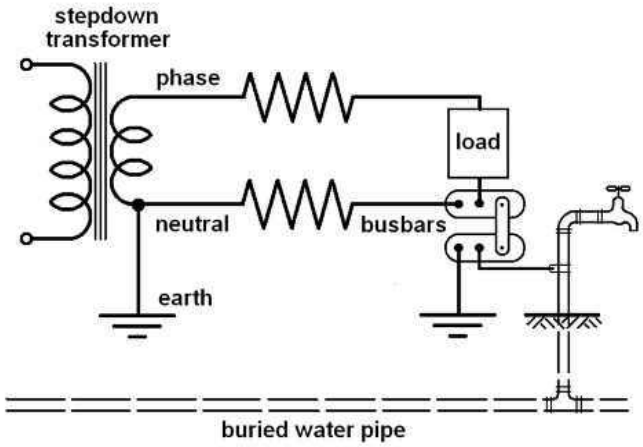
$$\underset{}{H_2O} + \underset{\text{(carbonic acid)}}{H_2CO_3} \longrightarrow \underset{\text{(carbonate)}}{HCO_3^-} + \underset{\text{(hydronium)}}{H_3O^+}$$

Buffering being unavailable as a defence, the human body employs either cholesterol or vitamin C to protect itself from cellular damage. While the body cannot manufacture vitamin C it can manufacture cholesterol and excess of the latter leads to ischaemic heart failure from oxygen starvation of the heart muscle.

To summarise, unpaired ions from water treatment are causal to the heart failure epidemic.

Further, these unpaired ions, once formed, enter a water reticulation system which includes metal pipes. These pipes are connected to AC electric power at every consumer's meter board by a process called equipotential bonding but this bonding is absent between the supply transformer earth cable and passing metal water pipes. The water pipes are cycled negative, and ionisation occurs. Unlike

gases, liquids require only a few millivolts to ionise and there is more than sufficient voltage on these pipes.



Ionisation voltages form deposits of iron and manganese within pipes and, pertinent to the cancer epidemic, impart a negative charge to any free positive ions in the water, converting them to radicals:

$$\underset{\text{(anion)}}{H_3O^+} + e^- \longrightarrow \underset{\text{(radical)}}{H_3O}$$

These radicals behave as if negatively charged and are repelled from the negatively charged pipe walls, so tend to follow the centre of flow.

In the human body these radicals are highly mobile. The hydronium radical is not simply a water molecule with an extra hydrogen attached. It forms a larger molecule with stronger internal bonds and weaker external bonds to the water matrix around it. So, while the radical is larger than a water molecule, it is more able to enter cells because it is not restricted by the water matrix.

Water in its natural state absorbs carbon dioxide to form a buffer in equilibrium. Water, then, is naturally slightly acidic. Any process which ignores this buffer or adds unpaired ions will increase cholesterol and ischaemic heart failure, and any unpaired ions entering the water reticulation system will form radicals and increase cancer.

Closer to home:

As the epidemiology shows, Masterton's water treatment plant creates unpaired ions. However, there are other problems with the plant which need addressing and it is possible to correct both sets of problems in one go.

The existing sand filtration, at around 10 microns, is very porous and relies on the presence of a flock, trapped in the first layer of sand, to be able to filter out

bacteria, giardia, cryptosperidium and so on. The sand filters are backwashed daily but backwashing removes the flock therefore pathogens, such as the crypto-speridium cyst from sheep farming above the intake, are able to pass through the filters during the period of re-establishment.

After sand filtration the water pH is raised prior to chlorination, but effective chlorination requires a lower pH. The pH adjustment and chlorination are back to front in the Masterton plant and disinfection is compromised. There is a significant risk that pathogens can pass through the sand filters after backwashing and are then able to continue, alive, through the reticulation system.

Tackling both problems together:

There are simple changes which can be made without capital works.

Changing the media in the filters to reduce the pore size to 3 microns would largely prevent pathogens passing through after backwashing and would bring pathogen control up to the standard of slow filtration not requiring subsequent disinfection with chlorine. Ceramic beads, such as Macrolite, are able to filter down to 3 microns. Unlike sand, ceramic media are very uniform in size so pack more closely in the filter beds. This would allow the retirement of both chlorination and lime dosing by meeting the performance standards of Section 4.3.1 of the Drinking Water Standards as most pathogens are greater than 5 microns in size.

Turbidity is best controlled by pond management rather than flocculation so as to avoid a negative ion deficient water supply which cannot mitigate positive ions before the water enters the reticulation system.

In the longer term the siphon, which currently removes air from the extracted water, should be retired in favour of a weir or infiltration gallery.

Lastly, the Council must make known that Masterton has asbestos cement water pipes and also educate on the desirability of point-of-use filtration to control for asbestos fibre. Point-of-use filters should be ceramic cylinders, installed and maintained by homeowners.

To track progress:

Insight, which is the ability to judge the validity of changes, requires the open sharing of information between the DHB and the Council. When Masterton's cancer epidemic began in 1969 there would appear to have been no communication of that fact from the then Hospital Board to the Council. The Council, therefore, had no way of asking itself if chlorination might have been causing the epidemic.

I suggest that an Insight programme be implemented to provide real time feedback as water treatment changes are implemented. The programme should involve the District Council, the DHB, and Greater Wellington.

Taking a wider view:

The Insight programme should be available to Carterton and South Wairarapa District Councils with similar water treatment problems.

Carterton, for instance, has a similar cancer death rate to Masterton. At around 232 per 100k it is difficult to find higher rates, either in New Zealand or globally.

Greytown's microfiltration plant largely supplies Featherston rather than Greytown because of restricted flow, and the water is chlorinated twice. Greytown's reserve bore supplies most of Greytown's water without buffering.

Martinborough's water comes from two clean bores and one dirty bore. The supply pipe to the reservoir is used as part of the reticulation system so contamination shunts up and down the pipes in periods of increased demand rather than being flushed through. This results in a smell of rotten eggs from hot water taps on the eastern side of town.

The cancer epidemic requires two factors and the removal of either one is sufficient to stop it. The removal of the chemical factor is easily implemented and, because it is causal to the heart failure epidemic as well, it kills two birds with one stone.

Therefore:

Policy changes need to be made to state filtration to 3 microns as the Council's standard for pathogen control, to identify halogen group chemicals and pH adjustment as unacceptable in the water supply and to initiate an Insight programme for real time health feedback.

Addenda

The following equation can be used to predict the effects of water treatment changes. Although an approximation, it is accurate to within $^{+}/_{-}$ 6%.

For heart failure $y = (pH)^2 (2.5x + 125)$ all divided by 49,

Where y is the theoretical heart failure rate,
pH is the pH of the water,
x is the % of conductive pipe (60 for 60%), and
125 is the modified base rate x 2 where chlorine is present.

The equation is similar for cancer, and can be adjusted by average ratio.
Known exception is that where lime is not added, the y value falls 28%

Summing up

This year's work has clarified the modus operandi, the trade mark or tell tale signs, of chlorination: the sudden increase in registrations (the "initial kill"), the following trough (the "ebb") and then the climb to a stable rate (the "final kill").

My work has also clarified the two factors involved in the cancer epidemic: the "causal factor" of chlorination as a source of ions and the "interactive factor" which changes the valency of these ions.

This epidemiology provides a foundation for further research. While there can be argument over the mechanisms involved in the cancer process at a genetic level, that should not stand in the way of an urgent move away from chemical dosing of drinking water supplies to physical filtration alone and maintenance of a natural buffer.

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