

# WATER QUALITY MONITORING IN RELATION TO A POSSUM CONTROL OPERATION ON MOUNT TARANAKI/EGMONT

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## ABSTRACT

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Public concerns about a possum control operation on Mount Taranaki/Egmont in 1993 and 1994 included issues relating to potential effects of the use of 1080 poison on water quality and water usage; in particular domestic water supplies from catchments draining areas within the aerial poison application zones. A comprehensive water quality monitoring program was undertaken in response to these concerns. Natural surface waters within and outside the operational zones, major water supplies (raw and treated), and groundwaters were sampled and analyses for residues of 1080 and fluoride (a principal breakdown product) in the waters were undertaken. A total of 473 tests were performed. Sampling commenced in advance of the first aerial application of 1080 and extended throughout the operational periods with two sites sampled more intensively to monitor any immediate impacts of the initial aerial poisoning operations within the National Park. The results showed no measurable impact of the possum control operation on 1080 and fluoride concentrations measured in any of the natural waters draining both the National Park and the buffer zones within the operational poisoning area, or in the raw and treated domestic water supplies, or groundwaters monitored. The results of this intensive monitoring program may provide guidelines for the assessment and establishment of appropriate monitoring of any future possum control operations of this nature.

KEYWORDS: 1080 - sodium monofluoroacetate - Mount Taranaki - possum control - water quality - fluoride.

## INTRODUCTION

Sodium monofluoroacetate (1080) has been widely used throughout New Zealand for the control of brushtail possums (*Trichosurus vulpecula*) which have been found to cause forest ecosystem degradation (Brockie 1992). 1080 is a white, tasteless, odourless substance that can be incorporated into cereal, carrot or paste baits that are often applied aerially. This is a cost-effective method of treating large areas with 1080 toxin.

1080 is highly water soluble and is readily broken down by many soil and water bacteria. 1080 is quickly absorbed into soil and is not likely to be carried far by rainfall leaching through the soil (Atzent 1971). Any 1080 leaching out of a bait is rapidly taken

up and broken down by bacteria (King *et al.* 1994). In water, 1080 is rapidly solubilised and subsequently metabolised into its non-toxic degradation products, including fluoride (Walker 1994).

In the interest of maintaining conservation values, several possum control operations involving the use of 1080 bait have been carried out. As a result of these operations, public concerns have been expressed regarding possible water contamination. However, following a possum control operation involving aerially sown 1080 baits in and adjoining Tararua Forest Park, a monitoring operation was conducted and results showed that significant contamination of waterways by 1080 was unlikely (Meenken & Eason 1995). This confirmed an earlier study during the 1991 treatment of Rangitoto

Island (Hauraki Gulf) with 1080, where results showed no 1080 in ground or surface water samples, even though a method with a sensitivity of 1 part 1080 per billion parts of water ( $0.001 \text{ g m}^{-3}$ ) was used (Eason *et al.* 1992).

## MATERIALS AND METHODS

A possum control operation in 3 stages involved the treatment of a large area of bush in and adjoining Egmont National Park with 1080 bait. Stage 1 took place during 1993 and Stages 2 and 3 during 1994. Surface water sampling sites (S1-15) and treated water supply sources (T1-10) are shown in Figure 1 and detailed in Tables 1 and 2.

### STAGE 1

The possum control area for the first stage of the operation was sited mostly within the boundary of Egmont National Park. It incorporated the Kaitake and Pouakai ranges and included some adjacent areas of bush on private land. The total treatment area was 17190 ha with the natural boundaries of the operation being the Waiwhakaiho River (to the east) and Stony River (to the west). These major waterways were also expected to act as barriers to the migration of possums into the area after poisoning. Aerial application of the 1080 bait was performed over several days - 23 to 25 May, 28 May, and 30 June to 3 July 1993, at a rate of 5 kg of 0.15% cereal bait per hectare.

### STAGES 2 & 3

The area involved during Stages 2 and 3 of the operation covered approximately 40500 ha. Aerial application of the 1080 bait took place during 26 to 28 April, and 4 to 6 May 1994.

The design of the program recognised that a small number of catchments representative of the surface waters and ground-water draining the operational area should be monitored together with the principal water supplies within this area.

The only scenario that could conceivably result in contamination of water supplies

would have been the dumping of a complete load of poison baits into a river or stream near a water supply intake. To avoid this remote possibility, flight paths for the aerial applications of bait were chosen such that streams and rivers were not crossed near these intakes.

A summary of sampling dates and events is provided in Table 3. The Oakura River site at Carrington Road (site S1), and the Patea River site at Barclay Road (site S15) were used for more intensive monitoring immediately following Stage 1 and Stages 2 & 3, respectively. A Manning 4900 auto-sampler was used at these sites and programmed to collect subsamples at 15 minute intervals commencing on the first day of the drop and continuing for 8 days after the aerial application of bait. These subsamples were composited daily into four 6-hour samples for subsequent analyses of 1080 and fluoride.

Analyses of 1080 were performed at the Christchurch laboratory of Landcare Research NZ Ltd, following appropriate storage and batching of samples in the Taranaki Regional Council laboratory, Stratford. Spiked samples were included with water samples for quality control purposes. The Landcare laboratory assayed 1080 in water, soil and tissue by gas liquid chromatography, with detection limits of  $0.0003 \text{ gm}^{-3}$  during Stage 1 and  $0.0001 \text{ gm}^{-3}$  during Stages 2 & 3 of Operation Egmont.

## RESULTS

A summary of 1080 and fluoride levels measured in all samples is provided in Table 4. All samples had concentrations of 1080 less than the detection limits. Only one of the four spiked samples in Table 5 showed a difference between the known 1080 concentration ( $0.003 \text{ gm}^{-3}$ ) and the measured amount ( $0.004 \text{ gm}^{-3}$ ). These results were considered to be within acceptable limits of laboratory precision ( $\pm 0.001 \text{ gm}^{-3}$ ).

No significant increases in fluoride concentrations in excess of natural fluctuations were recorded at any time during or following the operation, except in the Hawera treated water supply (site T9) where

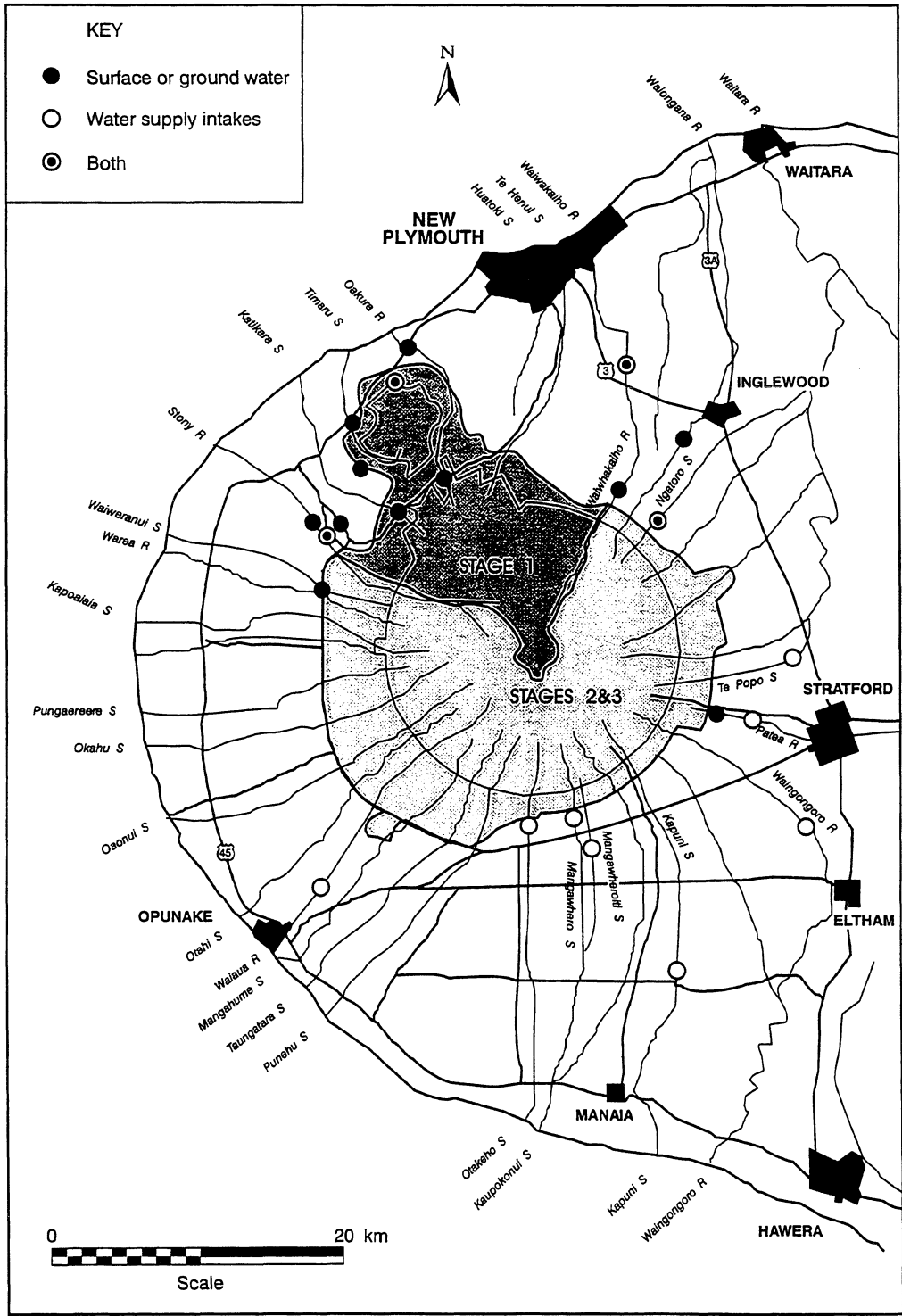


Figure 1. Locations of surface and ground water sampling sites and water supply intakes.

Table 1. Surface and ground water sampling sites in Taranaki.

Site	Site Description	Map Reference
S1	Oakura River, Carrington Road	P19 966225
S2	Waiongana Stream, Bedford Road	Q19 116245
S3	Waiwhakaiho River, Lepper Road	P19 078228
S4	Oakura River, SH45	P19 930321
S5	Timaru Stream, SH45	P19 897273
S6	Katikara Stream, Carrington Road	P20 936197
S7	Stony River, Mangatete Road	P20 875196
S8	Waiweranui Stream, Wiremu Road	P20 881157
S9	R J Donaldson, Oxford Road, 7 m deep well	P20 901193
S10	L Bredin, Upper Pitone Road, 37 m deep bore	P19 909235
S11	Ngatoro Stream, end of Dudley Road	P20 087194
S12	Waiwhakaiho River, Mangamahoe weir	P19 078297
S13	Wairau Stream, end of Wairau Road	P19 933298
S14	Mangatete Stream, 200 m upstream of Saunders Road	P20 883200
S15	Patea River, Barclay Road	Q20 127083

fluoridation was carried out sporadically by the South Taranaki District Council. This was associated with equipment recommissioning trials following water supply upgrading investigations during the monitoring period, and resulted in fluoride levels of  $0.70 \text{ gm}^{-3}$  and  $0.92 \text{ gm}^{-3}$  being recorded in mid-May 1994. Very minor fluctuations in fluoride concentrations in other samples recorded during the intensively monitored period were within the limits of analytical precision.

## DISCUSSION

Levels of 1080 found in water samples would not be expected to impose a toxic burden on the aquatic environment or a health risk to human or stock consumption. Even at concentrations in the order of the detection limit ( $0.0003 \text{ gm}^{-3}$ ), a 60 kg human would have to consume over 200000 l and a 25 kg dog over 3300 l of water at one time to obtain a fatal dose (Parfitt *et al.* 1993). Sampling following significant rainfall events (e.g., during mid May 1994) also indicated that no 1080 had leached into rivers from pellets in detectable concentrations.

Fluoride concentrations measured in samples from sites within the operational area during or subsequent to the poisoning operation ranged from  $<0.05 \text{ gm}^{-3}$  to  $0.19 \text{ gm}^{-3}$ . There were no significant increases in fluoride levels in relation to background levels which ranged from  $<0.05 \text{ gm}^{-3}$  to  $0.20 \text{ gm}^{-3}$  (47 samples) in samples taken either prior to the operation or outside the operational zone. Fluoride concentrations in 32 surface water samples from the Patea River prior to, during, and following Stages 2 and 3 of the operation ranged from  $0.07 \text{ gm}^{-3}$  to  $0.14 \text{ gm}^{-3}$ .

In relation to the background level of  $0.12 \text{ gm}^{-3}$  recorded prior to the operation, these do not represent significant increases in fluoride concentration. It should also be noted that the maximum acceptable fluoride concentration for water treated for domestic consumption is  $1.5 \text{ gm}^{-3}$  (Ministry of Health 1995). No samples of treated water contained fluoride at concentrations close to this value. Our results confirm that no significant increase in fluoride levels could be attributable to the 1080 poisoning operations.

The results of this study reinforced those of earlier New Zealand work, which

Table 2. Treated water sampling sites in Taranaki.

Site	Site Description	Water Source	Map Reference
T1	Oakura township, NPDC motor camp	Wairau Stream, end of Wairau Road	P19 933298
T2	Okato township, opposite Coastal Motors, SH45	Mangatete Stream, 200 m upstream of Saunders Road	P20 883200
T3	New Plymouth, Mangorei Road reservoir	Waiwhakaiho River, Mangamahoe weir	P19 078297
T4	Inglewood, Taranaki Farmers service station	Ngatoro Stream, end of Dudley Road	P20 087194
T5	Midhirst township, BP garage	Te Popo Stream, adjacent to dairy factory	Q20 190122
T6	Stratford, TRC cafeteria	Patea River, downstream of Cardiff Road	Q20 164071
T7	Eltham, STDC office	Waingongoro River, Finnerty Road	Q20 188014
T8	Kaponga township, Town Hall	Otakeho Stream, near Wiremu Road	P20 019010
		Mangawhero Stream, near Wiremu Road	P20 041016
		Mangawhero-iti Stream, near Wiremu Road	P20 044992
T9	Hawera, STDC office	Kapuni Stream, 1.5 km upstream of Skeet Road	Q20 112917
T10	Opunake, STDC office	Waiaua River, 6 km upstream of Opunake	P20 881972

indicated that levels of 1080 used in 1080 possum control operations were unlikely to result in the significant contamination of natural waters or urban water supplies.

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Table 3. Summary of events and sampling dates.

Date	Sites Sampled	Other Events
4 May 1993	S1-5, S7-8, S11-14	
6 May	S1-5, S7-8, S11-14	
21 May	S6	
23-25 May	S1 <sup>1</sup>	<b>Aerial poisoning</b>
26 May - 2 June	S1 <sup>1</sup>	
24 May	S11-S14	
26 May	S1-8, S11-S14	
28 May	S1-8, S11-S14	<b>Aerial poisoning</b>
30 May	S11-S14	
1 June	S11-14, T1-2	
3 June	S1-8, S11-14, T1-2	
4 June	S6	
9 June	S1-8, S11-14, T1-2	
17 June	S9-10	
30 June - 3 July		<b>Aerial poisoning</b>
1 July	S1-8, S11-S14	
9 July	S1-14, T1-3	
6 August	S1-14	
30 March 1994	S15, T3-10	
26-28 April		<b>Aerial poisoning</b>
28 April	T10	
29 April	T8	
4-6 May		<b>Aerial poisoning</b>
5-6 May	S15 <sup>1</sup>	
6 May	T8-10	
7 May	T3-T7	
7-13 May	S15 <sup>1</sup>	
13 May	S15, T3-10	
16 May	S15, T3-7, T9	
27 May	T8, T10	
7 June	S15, T3-7, T9	

<sup>1</sup>Continuous sampling

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Table 4. Summary of 1080 and fluoride concentrations.

Site	1080 (gm <sup>-3</sup> )			Fluoride (gm <sup>-3</sup> )		
	No. of Samples	Median	Range	No. of Samples	Median	Range
S1	43	<0.0003	<0.0003	44	<0.05	<0.05-0.08
S2	8	<0.0003	<0.0003	9	0.13	<0.05-0.18
S3	8	<0.0003	<0.0003	9	0.11	<0.05-0.19
S4	8	<0.0003	<0.0003	9	0.05	<0.05-0.08
S5	8	<0.0003	<0.0003	9	<0.05	<0.05-0.14
S6	9	<0.0003	<0.0003	9	0.07	<0.05-0.09
S7	8	<0.0003	<0.0003	9	0.11	<0.05-0.15
S8	8	<0.0003	<0.0003	9	0.13	<0.05-0.18
S9	3	<0.0003	<0.0003	3	0.11	0.06-0.16
S10	3	<0.0003	<0.0003	3	0.09	<0.05-0.12
S11	11	<0.0003	<0.0003	12	<0.1	<0.1
S12	11	<0.0003	<0.0003	12	<0.1	<0.1
S13	11	<0.0003	<0.0003	12	<0.1	<0.1
S14	11	<0.0003	<0.0003	12	<0.1	<0.1
S15	32	<0.0001	<0.0001	32	0.12	0.07-0.14
T1	4	<0.0003	<0.0003	4	0.07	0.05-0.07
T2	4	<0.0003	<0.0003	4	0.08	0.07-0.09
T3	6	<0.0001	<0.0001	6	0.92	0.83-1.04
T4	5	<0.0001	<0.0001	5	0.09	0.09-0.10
T5	5	<0.0001	<0.0001	5	0.09	0.08-0.09
T6	5	<0.0001	<0.0001	5	0.09	0.08-0.10
T7	5	<0.0001	<0.0001	5	0.06	0.05-0.07
T8	5	<0.0001	<0.0001	5	0.08	0.06-0.10
T9	5	<0.0001	<0.0001	5	0.08	0.07-0.92
T10	5	<0.0001	<0.0001	5	0.10	0.08-0.12

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Table 5. Known and measured 1080 concentrations in spiked samples.

Spiked Samples		Known 1080 Concentration (g m <sup>-3</sup> )	Measured 1080 Concentration (g m <sup>-3</sup> )
Stage 1	Sample 1	0.002	0.002
	Sample 2	0.003	0.003
Stages 2 & 3	Sample 1	0.003	0.004
	Sample 2	0.006	0.006