Department of Conservation
Te Papa Atawhai

OIA 19-E-0468 / docCM 6035427

12 August 2019

s9(2)(a) [redacted]

Dear s9(2)(a) [redacted]

Thank you for your Official Information Act request to the Department of Conservation, dated 15 July. You requested the following:

> *In your reply you name the following researchers Eason, Booth, Ogilvie, Wright, Fisher and Suren, who supposedly "addressed the degradation of 1080 in water".*
> *Now that I have had a chance to read all their research reports I see that they all say that 1080 will cause no danger in water. However nowhere could I find any evidence to show that 1080 is safe in water or that it breaks down. It is confirmed through this research that 1080 does pollute the waterways under a 1080 drop and that the toxin can be detected for a few hours after baits have landed in stream water. Where it goes to after that appears to be speculation.*
> *You say that "Independent research has confirmed 1080 presents very little risk to waterways." All the above mentioned researchers work in-house. None of them are independent and none of them have showed that 1080 breaks down in water. All they showed was dilution . . . contamination and dilution.*
> *If I have missed something would you please high-light and send me the parts of these reports which explain how the researchers measured the breakdown of 1080 in water.*

In a previous OIA request you had asked about 1080 in landfill, and in answering that request we supplied you with supplementary references about environmental effects and degradation of 1080 in water (Eason et al. 1992, 1993; Ogilvie et al. 1996; Booth et al. 1999; Eason & Wright 2001; Fisher et al. 2003; Suren 2006).

You do not believe these papers have supplied evidence that 1080 is safe in water and wish us to explain how the researchers measured its breakdown.

Firstly, we apologise for not sending you the full references in the earlier response. This must have made it difficult for you to track down the research papers.

Conservation House - *Whare Kaupapa Atawhai*
PO Box 10 420, Wellington 6143
Telephone (04) 471 0726, Fax (04) 381 3057

Biodegradability of 1080

The information you seem to be missing is that sodium fluoroacetate is biodegradable. It can be metabolised by various micro-organisms that live in water and soil, which break it down into harmless elements. It is also highly soluble so it may leach to unmeasurable and toxicologically insignificant concentrations before it gets to biodegradation (as described in Suren 2006). Either way, it does not accumulate in, or "contaminate," the environment.

The Environmental Protection Authority's predecessor, ERMA, undertook a transparent public review of 1080 in 2007. After reviewing the research, it considered that the risk to aquatic species was very small, because bait deposited in water results in extremely low concentrations of 1080 and organisms would be able to metabolise and/or excrete the substance over a short period after exposure.

The articles mentioned in our previous response build on this research about degradation, providing citations in the text which you can follow up. For example:

Eason CT, Wright GR & Fitzgerald H. 1992. Sodium monofluoroacetate (1080) water-residue analysis after large-scale possum control. New Zealand Journal of Ecology. 16(1):47-49.

> *"The fate of 1080 in the soil has been well-established by research defining the degradation of this naturally-occurring fluoroacetate, which has evolved in plants apparently as a deterrent to browsing herbivores (Oliver, 1977). Sodium monofluoroacetate is water soluble and residues from uneaten baits leach into the soil where they are degraded to non-toxic metabolites by soil microorganisms, including bacteria (Pseudomonas) and the common soil fungus (Fusarium solani) (David and Gardiner, 1966; Bong, Cole and Walker, 1979; Walker and Bong, 1981)"* (p.47).

Eason CT, Gooneratne R, Wright GR Pierce, R & Frampton, CM. 1993. Sodium monofluoroacetate (1080) in water, mammals and invertebrates. Proc. 46th N.Z. Plant Protection Conf. 297-301

> *"The fate of 1080 in the soil has been extensively studied. It is water soluble and residues from uneaten baits leach into the soil where they are degraded to non-toxic metabolites such as glycolate by soil micro-organisms, including the bacterium Pseudomonas and the common soil fungus Fusarium solani (Walker and Bong 1981; Marion-Meyer et al 1990, Wong et al 1992)"* (p.297).

Ogilvie SC, Hetzel F & Eason CT. 1996. Effect of temperature on the biodegradation of sodium monofluoroacetate (1080) in water and in Elodea canadensis. Bulletin of Environmental Contamination and Toxicology. 56(6):942-947.

> *"Various micro-organisms have the ability to catalyse the cleavage of the C-F bond of fluoroacetate, degrading fluoroacetate to glycolate and fluoride ions (e.g., Goldman 1965, Goldman et al. 1968, Bong et al. 1979, Wong et al. 1992). For aquatic systems, degradation of 1080 has been shown in aquaria containing plants and invertebrates, where the concentration of 1080 declined by approximately 70% in 24 h and to below detectable levels (0.0003 μg/mL) after 100 h (Eason et al. 1993)"* (p. 942).

Booth LH, Ogilvie SC, Wright GR & Eason CT. 1999b. Degradation of sodium monofluoroacetate (1080) and fluorocitrate in water. Bulletin of Environmental Contamination and Toxicology. 62:34-39.

> *"Previous research has shown that 1080 was degraded in stream water, but degradation can be affected by many environmental factors. Parfitt et al. (1994) showed that 1080 was degraded in biologically active water in 2-6 days while Eason et al. (1993) showed that 1080 declined by approximately 70% in 1 d and to below detectable limits (0.0003 ppm) in 4 d in aquaria containing plants and invertebrates. Ogilvie et al. (1995, 1996) showed that temperature significantly enhanced the rate of 1080 degradation, and that this was further enhanced in the presence of aquatic plants and microorganisms. Some microorganisms have been shown to degrade 1080 by cleavage of the C-F bond (Goldman 1965; Goldman et al. 1968; Walker and Bong 1981; Wong et al. 1992) using the adaptive enzyme haloacetate halidohydrolase to produce glycollate (Fig. 1a)"* (p.34).

Microbial activity degrades 1080

The exact mechanism of biodegradation has not been researched in these papers. Nevertheless, the findings are consistent with evidence that micro-organisms with the ability to break down 1080 are present in aquatic ecosystems in New Zealand and that biodegradation does in fact take place.

A review summarising this research concluded:

> *"There have been recent suggestions that further research on 1080 degradation in water would be useful (Weaver 2003). However, since dilution to undetectable concentrations is likely to occur before significant biodegradation, a focus firstly on more information about the fate of baits in streams and operational improvements to avoid watercourses might be more fruitful. Water monitoring since 1990 has shown that significant water*

contamination is unlikely when safety procedures are adhered to. In the amounts used either in ground or aerial application, exposure of individuals living near possum control areas is most unlikely to occur."

Eason, C., Miller, A., Ogilvie, S., & Fairweather, A. (2011). An updated review of the toxicology and ecotoxicology of sodium fluoroacetate (1080) in relation to its use as a pest control tool in New Zealand. *New Zealand Journal of Ecology, 35*(1), 1-20.

As suggested in the above review, recent research has focussed on improving bait quality, reducing sowing rates and reducing risk to non-target species. For example:

Northcott G, Jensen D, Ying L, Fisher P. 2014. Degradation rate of sodium fluoroacetate in three New Zealand soils. Environmental Toxicology and Chemistry. 33:1048–1058.

Crowell M, Booth L, Cowan P, Fairweather A, Westbrooke I.2016a. Stability of bird repellents used to protect kea (*Nestor notabilis*) during aerial 1080 cereal operations. New Zealand Journal of Ecology. 40:42–48.

Crowell M, Martini M, Moltchanova E. 2016b. Effect of the addition of bird repellents to aerially applied 1080 baits on rat and possum abundance. New Zealand Journal of Ecology. 40:49–59.

Scientific credibility

In conclusion, we wish to point out that the papers you have read should be regarded as credible sources of scientific knowledge. None of it was commissioned for private enterprise. Researchers were employed by universities, government agencies and Crown Research Institutes (CRIs) such as *Manaaki Whenua* Landcare Research, and NIWA, which carry out scientific work for the benefit of New Zealand. The research has been published in reputable, independent, scientific journals and conference proceedings, and has therefore been subject to rigorous peer review.

Please note that this letter (with your personal details removed) will be published on the Department's website.

Yours sincerely

s9(2)(a)

[redacted]

Amber Bill
Director, Threats, Biodiversity Group
for Director-General