

Response to:

**PRVD2022-18: The proposed re-evaluation decision
regarding Predacide Uses of Strychnine and Sodium
Monofluoroacetate and their Associated End-use Products**

Submitted by:

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On behalf of:

**Animal Alliance of Canada
Animal Protection Party of Canada
Humane Society International/Canada
Zoocheck**

RECOMMENDATION

The Animal Protection Party of Canada, Animal Alliance of Canada, the Humane Society International/Canada and Zoocheck strongly recommend that the PMRA discontinue all uses of Compound 1080 and strychnine. Our recommendation is based on the Alberta government's failure over 10 years to comply with the requirements of the labels, and without testing other available options for wildlife management as is the requirement for licensing. Amending the labels to tighten and clarify requirements will not ensure compliance.

INTRODUCTION

Strychnine and Compound 1080 are highly toxic chemicals currently approved by Health Canada to poison wildlife. Not only do they cause significant harm to targeted animals, they often have detrimental downstream impacts on non-target animals and the ecosystem at large. The purpose of this report is to examine the current use of the chemicals Strychnine and Compound 1080 in Canada, and to determine whether their use is justified based on the available scientific and regulatory information.

In this report, the Animal Protection Party of Canada (APPC) will review the regulatory status of these pesticides. APPC will also review the requirements set out in the *Pest and Nuisance Control Regulation of the Agricultural Pests Act (2001)* of Alberta as referenced in the Compound 1080 label and one of the two Strychnine labels. Alberta is our focus because it remains the only province that continues to use these chemicals. The report also uses Animal Alliance of Canada's (AAC) Freedom of Information (FIOP) requests to various Alberta government departments. Our research indicates the regulatory requirements for these chemicals are not being enforced

As well, APPC examines research used by Health Canada's Pest Management Regulatory Agency (PMRA) to approve the use of these methods of removing predators

from the environment. We also examine additional research on these chemicals to determine their animal welfare and ecological implications.

Based on the documents acquired through the PMRA and through ATIP and FOIP requests, this report concludes that it is not possible to assure compliance with label requirements since violations of those requirements regularly occur, and therefore the only environmentally safe option is to remove these chemicals from the market altogether.

This report also serves as a follow-up to APPC's 2020 report highlighting scientifically determined deficiencies of the PMRA's regulatory decisions for Strychnine and Compound 1080, as well as Sodium cyanide prior to the discontinuation of this product in 2020.

BACKGROUND

STRYCHNINE

Since 1928, strychnine has been registered in Canada for use in poisoning of: northern pocket gophers, coyotes, wolves, skunks, pigeons, American Black bears and various ground squirrel species. However, in 2020, the PMRA decided to phase out the poisoning of Richardson's Ground Squirrels.^{1,2} Though previously used to poison wolves across much of Canada and the United States (Mech 1970), current labels limit the regulated use of strychnine to Alberta.^{3,4}

In its current form, strychnine was first registered for use in Alberta in 1987 to kill black bears, wolves, and coyotes. Since 2005, strychnine has been used to poison wolves in the Little Smoky caribou range in response to the government's assertion that reduction of predator populations would help that region's depleted caribou populations to recover. (Hervieux et al 2014).⁵ However, few critically important mitigation measures - such as bans on clear cutting mature and old growth forests, clearing vegetation for

snowmobile trails and banning the exploration of oil and gas in caribou territory – are being implemented by the Alberta government to support and protect the caribou population. In fact, targeting natural predators for reduction or elimination cannot attain the claimed conservation objective for caribou.

Also notable is the fact that human disturbance is more of a threat to caribou populations than are wolves. A meaningful effort to actually protect and restore the region's caribou population cannot succeed without a suite of very clearly identified initiatives that protect habitat essential to supply their needs.

Yet it is the wolf population that is mainly blamed and are shot and poisoned. Moreover, the label on strychnine stipulates its use only “when there is no other practical alternative control measures.” Clearly robust protection of caribou would include broadly based and strictly enforced protection of their habitat. These are measures that PMRA should require as a first line of defence of the caribou, instead of allowing the Alberta government to demonize the wolves.

Strychnine comes in the form of pellets and is mixed with an available food source to bait the species in question. Ground squirrels, for instance, are poisoned with baited grain placed in burrows. For use on predators, strychnine pellets are mixed with meat or fish and covered in loose dirt or snow as per the requirements of the Label. ^(Registration Number 20410) ⁶ Only farmers and employees authorized by government pest control programs are allowed to use strychnine products. ^(IBID)

The use of strychnine prompts significant concerns about animal welfare. Proulx et al. (2015), state clearly that strychnine is inhumane, causing “frequent periods of tetanic seizures, occasional cessation of breathing, hyperthermia, extreme suffering, and death from exhaustion or asphyxiation, which typically occurs within 1–2 hours of the onset of clinical signs (Khan 2010). ^{7, 8} However, death can take up to 24 hours or longer if the dose is low (Eason & Wickstrom 2001)”. ⁹

This level of suffering stands in total contrast to the Canadian Council of Animal Care's definition of humaneness, which requires "rapid unconsciousness and subsequent death without pain or distress."¹⁰ Animal welfare concerns as outlined above have been repeatedly raised by wildlife managers, animal welfare groups, and by 50 science experts and environmental leaders in a 2018 open letter to the Minister of Health.¹¹

COMPOUND 1080

Compound 1080, also called sodium monofluoroacetate, is currently registered for use in Alberta to kill wolves and coyotes. The predacide is administered either in the form of tablets that are paired with meat baits, or as a liquid in bladder collars placed around the necks of farmed animals.^{12, 13} Compound 1080 is toxic to both mammals and birds, putting non-target animals at risk if they consume the tablets in the baited meat, or should they scavenge the stomach contents and other tissues from carcasses of poisoned animals.^{10, 12}

Notably, Compound 1080 tablets are not permitted in the United States, where the US Environmental Protection Agency (EPA) restricts use of Compound 1080 to the aforementioned farmed animal collars.¹³ It should be noted that the collars have also been deregistered in Canada as of July 2022.

Compound 1080 has a thirty minute to two hour latency period between exposure and symptom onset, which includes nausea, vomiting and diarrhea. Compound 1080 also causes significant clinical symptoms of distress through seizures, respiratory issues and convulsions. Both strychnine and Compound 1080 are deemed inhumane by the Canadian Veterinary Medical Association.¹⁵

Nevertheless, Health Canada does not consider animal welfare issues caused by the effects of Compound 1080 ingestion. In a 2021 consultation summary focusing on predacides (*Consultation Summary- Humane Vertebrae Pest Control*) the Ministry stated that they "will not be taking steps towards incorporating humaneness

considerations into the pesticide risk assessment framework.”¹⁷ There are currently no internationally recognized science-based parameters to evaluate the humaneness of pesticides, and no new information on this topic was brought forward through the consultation process.”¹⁶

That assertion has been disputed by wildlife biologist Dr. Sara Dubois, who indicates that evidence-based animal welfare protocols do exist, for example in university labs. Dubois’ paper, “International consensus principles for ethical wildlife control”, further emphasizes the need for science-based parameters through seven principles: Modifying Human Practices (practices that cause conflict with wildlife); Justification for Control (having evidence of significant harms that need to be addressed); Clear and Achievable Outcome-Based Objectives; Animal Welfare (minimizing animal welfare harms); Social Acceptability (ensuring community values and practical information are considered); Systematic Planning; and Decision Making by Specifics Rather than Labels (such as labelling target species as “overabundant” or “pests”).¹⁸

REGULATORY STATUS OF POISONS

STRYCHNINE

REGULATORY DECISIONS

In 1992, the federal government restricted products to ready-to-use formulations of 0.4% strychnine in order to control field rodents (2% liquid was used prior).^{19, 20} Residential uses were prohibited. The government also recognized the high probability of strychnine use to cause secondary non-target poisoning.²¹ In 2005, the government put forward a Proposed Acceptability for Continuing Registration of strychnine, making reference to US EPA’s 1996 registration decision – along with other incident reports and field studies – to allow all uses assuming labels were amended to address toxicity concerns (PACR2005-08). Health Canada amended some labels to address primary and secondary poisoning. However, in the case of Richardson’s Ground Squirrels

(RGS), because of concerns about effective methods of control, Health Canada decided to allow the continued use of strychnine, pending research on integrated pest management.^{21,22}

In 2007, Health Canada issued a re-evaluation note indicating that strychnine use for RGS was under review. In their re-evaluation, they reiterated the decision proposed in 2005 to allow continued registration of use permits for non-RGS species, namely: pocket gophers, pigeons, wolves, coyotes, black bears, and skunks. They concluded that the use restrictions were sufficient to mitigate health and environmental risks in the PMRA document (REV2007-03). Notably it was a decision they took without performing environmental risk assessments (including the calculation of risk quotients) or value assessments for high concentration predacidal strychnine or strychnine used to kill skunks. The rationale for the decision was that “the use patterns for predator and skunk control are severely restricted and are only for use by trained provincial or municipal employees in the province of Alberta; these control measures are used very infrequently”.^{21, 23}

The most recent re-evaluation decision regarding strychnine use, RVD2020-06, focused specifically on RGS (RVD2020-06).² This decision resulted in the cancellation of the use and sale of strychnine products for controlling RGS in Canada. The PMRA came to this conclusion based on the available scientific evidence, which demonstrated that the risks to the environment were unacceptable when using strychnine for controlling RGS. This was largely as a result of studies recording the death of various non-target species. The decision initially included a three-year phase out of these products, though a number of groups filed a notice of objection with the hopes of an immediate ban. In response, Health Canada has assembled an external science panel to reconsider the timeline.²⁴

In view of Canada’s comparatively slow-moving deliberation about limitation and restrictions on strychnine use , it is worth noting that, in 2006, the European Union

completely banned the use of strychnine as a pesticide and rodenticide. The US banned its use against predators since 1972.^{25, 26}

LABELS

Currently Alberta is registered to use strychnine products under Product #20410 for wolves, coyotes and black bears, and under Product #24510 for skunks.

For Product #20410, administration of the predacide is done by placing tablets in meat. The label stipulates that the poison is not to be administered if there are at-risk species in the area. Exposed baits must either be covered or collected. All bait sites are required to be checked every 7 days, and complete records of use are to be kept by the registrant. Disposal of carcasses and uneaten bait are to be by incineration, or burial in a pit that is at least 46cm deep which is then to be covered in order to be undetectable by scavengers. Further use limitations, as well as the whole label, are included in the appendices.⁶

Product #24510 is administered by injecting it into a raw chicken egg. Unused baits must be burned or buried at least 60cm deep. Carcasses must be burned or buried at least 46cm deep. The Label, including further use limitations, is also included in the appendices.²⁷

COMPOUND 1080

REGULATORY DECISIONS

Compound 1080, or sodium monofluoroacetate, was first registered in Canada in 1984. In 2004, the PMRA referenced a US EPA Re-evaluation Decision on Compound 1080 to develop its own Proposed Acceptability for Continuing Registration (PACR2004-20) document including a proposal for continued registration with appropriate changes to the mitigation measures.²⁸

The most recent Re-evaluation Decision for Compound 1080, **RVD2014-03**, came after a Special Review, **REV2013-04**, in which the PMRA concluded that, with amendments to address the risks of poisoning non-target species, particularly species at risk, the chemical could maintain its registration status.^{29, 30}

Amendments focused on updating the labels of tablet formulations containing Compound 1080. They also included updated administration and disposal directions, as well as directives for preventing use in areas where species at risk are present. Current labelling requires the tablets with meat baits to be buried under snow or loose soil and as well as ensuring that poisoned coyotes and wolves are buried to prevent secondary poisoning of non-target species.²⁹ It is important to note that snow can melt rapidly in Alberta, especially in the presence of chinooks thereby exposing buried tablets more quickly than the 7 day period.

LABELS

As of July 31, 2022, there is only one Compound 1080 product for use in Alberta. Product #24512 is a solution placed in bladders to be worn around the necks of farmed animals. Its use ended when its registration was allowed to expire at the end of July 2022. Product #18300 is tablet-based and designed to control wolves and coyotes. Baits are to be inspected at least every 7 days and unused or damaged tablets have to be buried at least 60cm deep or burned. Product disposal is by burning or by burying at least 60cm deep. Due to the toxicity of Compound 1080, the manufacturer and provincial regulatory agency are to be contacted in the case of spills.

ALBERTA AGRICULTURAL PESTS ACT

Under the *Alberta Agricultural Pests Act* and the *pest and Nuisance Control Regulations*, those who have permission to control coyotes and skunks with poisons must complete Form 7 or Form 8. Product #18300, Compound 1080 used for wolf and

coyote control states that, “This product is for storage, use and handling only by persons authorized under the Alberta Agricultural Pests Act and by designated Fish and Wildlife Officers of the Government of Alberta.” Under the act, one can receive a Form 8 permit to use Compound 1080 tablets on their own land, whereas Form 7 permit would allow a trained individual authorized by the Minister of Agriculture, Forestry and Rural Economic Development to use any of the registered forms of strychnine or Compound 1080 on private or public land. A trained individual with a Form 7 permit could only do so with permission from a land owner with a Form 8 permit. Form 8 explicitly refers to Compound 1080 tablets as one of the control methods. Information regarding these forms is not explicitly mentioned in either of the available sodium monofluoroacetate (Compound 1080) labels.³³ However, the labels do state: “The user of tablets must monitor and keep accurate records on the use of each poisoned bait.”(Reg. No 18300). Alberta’s strychnine label (Reg. No. 24510) for skunk poisoning refers to the *Alberta Agricultural Pests Act*, whereby only designated employees under the Department of Alberta Agriculture and Food and municipal employees under the *Agricultural Pests Act* who are trained and certified by the department can legally use the product. Conversely, Alberta’s predacidal strychnine label (Reg. No. 20410) for wolf, coyote and black bear poisoning does not refer to the Alberta Agricultural Pests Act, instead stating only that “approved Alberta Fish and Wildlife Division, Policy and Procedures and Directives relating to problem wildlife control (Prevention and Control of Wildlife Damage in Alberta: Manual for Investigating Officers.) must be adhered to.”^{12, 13}

PEST CONTROL PRODUCTS ACT

The *Pest Control Products Act* (PCPA) is a federal regulatory document that oversees the use of pesticides in Canada. It is administered by the PMRA. Under the PCPA, pesticide registrants are required to follow the label directions.⁶

ARE THE REGULATORY REQUIREMENTS BEING ENFORCED?

FREEDOM OF INFORMATION REQUEST- FOI E17-G-0418

In 2017, AAC submitted a Freedom of Information and Protection of Privacy Act Requisition to Alberta's Ministry of Environment and Parks for records pertaining to the use of Strychnine and Compound 1080. In 2018, the Alliance received a package of FOIP documents that included a number of occurrence and intelligence reports. Also provided were data showing the number of wolves and coyotes killed from aerial and toxicant programs in the Little Smoky Caribou Range and A La Peche Winter range, between 2010/11 to 2016/17. The number of wolves killed per year ranged from 0 to 34, and number of coyotes killed per year ranged from 1 to 6. Some occurrence reports demonstrated a level of enforcement, such as disposal report citing a CN, "...who said all the poison was eaten and the carcass was cleaned up as well". However, many others included no such information. For example, although one report mentioned that all residents were notified within a two-mile radius of the bait sets, it said nothing of the effect of the dispersal of the poison, nor how any resulting carcasses were disposed of.

Also included in this package was a briefing note to the minister where the Fish and Wildlife Division admit that it cannot comply with the requirement of the Compound 1080 Label and indicates that "it is very difficult to monitor its effectiveness as it is slow acting; animals can travel long distances before succumbing to toxicity. Retrieval of carcasses is typically impossible and secondary poisoning of other wildlife species feeding on the carcass is a potential concern."

Initiatives purportedly intended to facilitate the recovery of caribou populations involve killing wolves both by aerial shooting and strychnine poisoning. The report indicates that aircrafts are used to identify and radio-collar one member in a wolf pack and then shoot non-collar members located by following the collared individual to its pack. According to the report, this is not feasible for removing wolves not associated with packs and in "areas of dense timber and rugged topography" and it is for these reasons that

strychnine is also used. (pg 61) Between 2005/2006 and 2011/2012, 733 wolves were killed using toxicants in the Little Smoky Caribou range.

FREEDOM OF INFORMATION REQUEST- FOI E19-G-0389 AND FOI E19-G-1774

FOI E19-G-0389 included information provided by the Provincial Caribou Management Coordinator in Alberta as part of a request from the Health Canada Pesticide Compliance Program. It included a spread sheet of toxicants used at a number of bait sites from January to March 2018. As well, FOI E19-G-1774 provided a spreadsheet of information on bait sites for the Caribou Recovery Program in February/March 2017.

According to the spreadsheets, the times between site checks were as long as two weeks – a full week longer than the maximum time prescribed on the predacide tablet labels. This spreadsheet provided information on toxicant kills, with non-target deaths that included ravens, a red fox and a fisher. Over these two periods, 31% (15/48) of the sites had wolf or coyote deaths. 25% (5/20) of sites with wildlife kills had non-target species deaths only, and 33% (5/15) of the sites with wolf or coyote kills included the death of a non-target animal. The proportion of non-target wildlife kills in this sample is alarming. Additionally, the spreadsheet provided no information on toxicant and carcass disposal.

FREEDOM OF INFORMATION REQUEST- # 2021-G-25, 2021-G-26 and E21-G-0095

More recently, the AAC submitted requests for summary data on the use of Compound 1080 (2021-G-26), strychnine (E21-G-0095) and sodium cyanide (2021-G-25) from December 2019 to April 2021 to the Ministry of Agriculture, Forestry and Rural Economic Development and the Ministry of Environment and Parks. The response came in the form of a spreadsheet listing the use of these poisons throughout the province. According to the spreadsheet, there were 18 tablets of Compound 1080 used by landowners in 2019. Then, in 2020, 1014 landowners used tablets and 6 were used by inspectors.

With respect to strychnine use to kill skunks, the Alberta government reported that no tablets were used in 2019 and there were no data for 2020.

As regards strychnine use, data from January to March 2020 revealed how much use was made in the Little Smoky and A La Peche Woodland Caribou ranges. Eight hundred and sixty drop-baits were known to have killed seven wolves, along with two coyotes, nine ravens, one lynx, one mink and one golden eagle. Again, this statistic reveals a remarkably high number of non-target animals killed as compared to target species.

FREEDOM OF INFORMATION REQUEST- 2021-G-48 AND 2021-G-117

In order to examine enforcement of Compound 1080 specifically, AAC submitted Freedom of Information and Protection of Privacy requests to Alberta's Ministry of Agriculture, Forestry and Rural Economic Development and the Ministry of Justice and Solicitor General of Alberta. The aim of the requests was to determine whether records were kept in 2019 and 2020 regarding use of Compound 1080 by designated persons under the *Alberta Agricultural Pests Act*, and whether these records showed that those who had administered this substance had followed instructions on its use as written on the Label and that they had taken steps to reduce the risk of death of non-target species.

Despite reporting that they had used 1080 tablets in 2019 and 1020 tablets in 2020, the Ministry of Agriculture, Forestry and Rural Economic Development provided no records whatsoever to indicate whether or not the instructions on the labels were followed.

The Ministry of Justice and Solicitor General of Alberta provided what appeared to be one occurrence report of Compound 1080 being used to control wolves who had attacked a steer. For this occurrence, it appeared from a completed investigator's report that a trained individual had taken this action. However, we were not provided evidence

of a Form 7 and/or a Form 8 being completed in this particular situation. It has been impossible to find out whether these forms are used. No Forms 7 or 8 were provided to AAC despite repeated Freedom of Information requests which calls into question whether Alberta Ministry staff are complying with their own Act and Regulations .

Additionally, there was no evidence of adherence to requirements listed on the labels - such as inspecting poisoned bait every 7 days and removing poisoned bait within 15 days of placement. Moreover, because the spreadsheet data clearly showed at least 1038 Compound 1080 tablets used in 2019 and 2020 combined, it is obvious that there were far more occurrences than the single instance that appeared in the data we received.

GROUND INVESTIGATIONS REVEALED LACK OF COMPLIANCE

The aforementioned open letter reveals additional evidence for lack of compliance: A ground investigation in 2018 demonstrated that an active strychnine poison site in Alberta's Little Smoky Caribou range was not marked - even though this requirement would likely be the easiest to follow. Nor were bait stations checked as often as required (every 8 days on average as opposed to at least every 7 days, with several instances of bait sites remaining unchecked for more than two weeks at a time due to inclement weather).⁴² As noted during a compliance inspection by the PMRA in 2018, they were violations of the pesticide Label #20410. Lastly, AAC FOIP records received from the registrant indicate that wildlife came, consumed many of the baits and then dispersed without the carcasses ever being found, collected or disposed of. This means that the number of target and non-target animals killed by the poison is not known but is essential to evaluate the risk quotients.

The Alberta report from the 2017 Freedom of Information request (FOI E17-G-0418- pg 65) states that the strychnine program, "...causes minimal damage to non-target wildlife..." and that, "...department personnel are highly trained in the use of toxicants

and follow a number of federal and provincial regulations.” (77). However, the records we have obtained from the registrant clearly demonstrates this as being false.

WHAT THE SCIENCE SAYS: ENVIRONMENTAL RISK

Below we summarize science and data that the PMRA has used to justify their decisions (acquired through an Access to Information (A-2019-001232) request), and present additional studies that shed light on the environmental risks associated with using strychnine and Compound 1080.

STRYCHNINE

EPA RED DOCUMENT

One paper used by the PMRA for their most recent re-evaluation decision is the US Reregistration Eligibility Decision (RED) document for Strychnine from 1996, 24 years before the most recent re-evaluation decision. ²⁶

Another study that the EPA cited looked at the environmental effects of controlling pocket gophers with strychnine. A burrow builder was used to apply strychnine, which creates an artificial burrow, places the strychnine bait in the burrow and seals it. Three non-target species were found dead, a horned lark, a Brewer's blackbird and a striped skunk. Hazards to non-target avian species were attributed to, "...spillage of the poisoned baits...". ²⁶ Additionally, it was indicated that, "residues of strychnine in the gastrointestinal tract of pocket gophers exceed the Agency's unacceptable risk criteria for non-target organisms. Residues at those levels could kill secondary consumers". Thus, the proposed use could harm endangered species.

However, the EPA concluded that there would not be an unacceptable risk to non-target species on the grounds that instructions specify that the operators of the burrow builder

must collect spilled bait.²⁶ Canadian records show that strychnine baits are being consumed regularly from baits sites where carcasses are never recovered.

It is therefore critical that the PMRA acknowledge the gap when it comes to the non-target impacts of strychnine and Compound 1080. It is misleading to the public and other stakeholders to not do so. In view of records showing these impacts on non-target animals, including species at risk along with the lack of records for most uses of predacides in response to livestock losses, and the detailed notes from the Alberta government showing that strychnine baits placed at sites in caribou range are repeatedly consumed without carcasses being found, the environmental risk of predacides is clearly unacceptable.

Furthermore, strychnine may yield significant environmental risks through its water solubility with potential for dispersal into water bodies during runoff. That, in addition to the aforementioned failure of those administering strychnine to recover poisoned carcasses and the evidence that strychnine bait sites and poisoned carcasses are not adequately recovered in at least some instances. Because of the presence of the endangered Athabasca Rainbow Trout in streams where strychnine is used, the risks of poisoning freshwater fish are a real possibility.

ADDITIONAL STUDIES

A 2015 study examined the impact of strychnine-containing rodenticides (used to control pocket gophers) on Great Basin Gophersnakes in North America. Modelling indicated that “in a low density (0.1/ha) population scenario, a diet of one pocket gopher per year wherein 10 % of them carried enough strychnine to kill an adult snake could cause the loss of 2 females annually from the population and this would reduce the population by 35.3 % in 25 years. Under the same dietary exposure, up to 35 females could die per year in a high density (0.4/ha) population which would result in a loss of 50 % of adults in 25 years.”⁴⁶ This demonstrates that using these chemicals as a means for pest control can threaten other species’ populations significantly.

In 2015, Brook and others led a study to examine previous research by Hervieux et al. (2014) which had looked at the humane implications of killing wolves to protect the caribou population in the Little Smoky woodlands. This study included both the aforementioned aerial killing methods and strychnine poisoning, neither of which guaranteed avoidance of pain and distress. The paper determined that CCAC guidelines apply to these activities because Alberta's 2005 Alberta Animal Protection Act committed the province to adopting CCAC standards and guidelines. These standards and guidelines include compliance with CCAC document, as well as ensuring oversight by an institutional animal care committee.

The paper by Brook and others called for independent audits and concluded that "based on an apparent lack of compliance with CCAC's guidelines, we believe that this controversial study should never have taken place and should not have been published by the Canadian Journal of Zoology".⁴⁷

COMPOUND 1080

EPA RED DOCUMENT

Through the Access to Information request, the AAC also acquired a US EPA's RED document from 1995 regarding use of Compound 1080/ sodium monofluoroacetate used in collars. According to ecological toxicity data, Compound 1080 is highly toxic to mammalian and avian species. Non-target species can be exposed through contaminated sheep or goat carcasses or through a punctured collar. There is also risk of secondary exposure through the carcasses and vomitus of target animals, such as coyotes.³⁶

The EPA data suggests that the amount of a carcass required to kill a scavenger is "ordinarily not substantial" enough to create a "secondary hazard to animals that may feed on a contaminated coyote carcass..." Subsequently, however, the paper concludes "it is likely that carcasses will occasionally contain enough sodium fluoroacetate to kill a scavenger".³⁶

In terms of environmental fate, the limited data in the document suggests that ungraded fluoroacetate may leach into the ground although this may be dependent on the porosity or other features of the surrounding soils. The EPA RED study found that, "...ungraded fluoroacetate is considered mobile and consequently has a high potential to move downward in the soil and reach groundwater." Nevertheless, the document specified that, "...no acceptable guideline studies for hydrolysis or other fate properties have been submitted." ³⁶

Further to livestock collars, the EPA study found that when the collar is punctured by a target predator, approximately 33% of the poison spills on the ground and is not recovered. The EPA does not believe that this creates a significant hazard to non-target species based on the available information – even though the agency concedes that inadequate studies limit the amount of valid information. ⁴⁸ The fact that the EPA document dates from 1995 constitutes a significant problem as does the lack of data. Such concerns serve to further highlight problems that accrue from making crucial regulatory decision on the basis of incomplete data.

A final important point: This EPA RED document underscores the inefficiency of using collars. During a three year period in Wyoming, Montana, Texas and New Mexico, 13% of collars were punctured (294/2257) and only 36.7% of those were punctured by targeted animals (coyotes), with the other punctures having been by vegetation or an unknown cause. In spite of those findings, the RED document concluded that there were no unacceptable risks if label instructions were followed. Hence the registration and use of Compound 1080 continued. ³⁶

It is important to note that the PMRA used this document to inform its decisions on Compound 1080 use even though the RED document only referred to Compound 1080 use in collars. The PMRA used the RED document to permit the use of all Compound 1080 products even though the findings in the RED document were not relevant to all products used in Canada (Proposed Acceptability for Continuing Registration

(PACR2004-20) document ²⁸). Thus, both the outdatedness of the document and its lack of relevance are a cause for concern.

The difference between Compound 1080 collars and tablets, and the absence of US EPA assessment of tablets, are both acknowledged in a 2004 PMRA memorandum to Virgine Bergeron, Section Head, regarding the use of Compound 1080. ⁴⁹ The memorandum goes on to specify that tablets are only to be used by trained personnel and under exceptional circumstances where there are no practical alternatives available. The document specifies a number of safety measures that are required, such as posting warning signs and inspecting and removing baits at regular intervals. The memorandum also adds that human exposure is limited based on label restrictions.

The information above cannot alone be a justification for allowing the use of Compound 1080 tablets. The PMRA has also not adequately referenced research that has focused on Compound 1080 tablets specifically, nor have they calculated risk quotients for tablet form, meaning that there is limited evidence to assume that labelling restrictions are sufficient for mitigating any risks to non-target species. It is also reasonable to assume that tablets may be of greater risk to non-target species than collars; while the poison could remain isolated to collars and may only be present in the case of a puncture, the tablets may be accessible to non-target species for the entire duration that they are set out. Even so, collars are also a hazard to non-target animals because of potential exposure between when a collar is punctured and when the carcass is retrieved, as indicated in PMRA's special review in 2013. ³⁰ This is further exacerbated by the lack of records made or kept by registrants regarding the use of collars and tablets, which should indicate how often carcasses are retrieved, how often baits are consumed without collecting any carcasses, and how often bait sites are checked to retrieve carcasses. Without this information, PMRA cannot conclude that the environmental risk is acceptable.

ADDITIONAL STUDIES

Additional research from British Columbia demonstrates that a significant portion of Compound 1080 wolf bait (20-28%) was taken by other species,³⁸ and that Compound 1080 may be partly responsible for a decline of populations of non-target species due to the poison being administered in areas where at-risk species reside, according to the Committee on Endangered Wildlife in Canada.^{39, 40, 10}

Another study looking at the historical impact of gray wolf poisoning programs from 1956-1964, some of which included strychnine and Compound 1080, showed that while 119 wolves were killed across various studies evaluated, 265 non-target organisms were killed among 19 different species.⁴¹ This finding validates the concern that the detrimental ecological impact of strychnine use and poison control in general is likely not exclusive to controlling RGS. Furthermore, per a previous ATIP request, these programs were not considered in the 1992 re-evaluation of strychnine despite the fact they took place long before.

MISSING VALUE ASSESSMENT

As previously stated to the PMRA, we remain concerned that the agency has failed to conduct value assessments for both predacidal strychnine and Compound 1080. Value assessments are mandatory components of registration decisions as per the PCPA.

There is substantial doubt whether lethal strategies, such as use of poisons, even work as intended to resolve conflicts between native carnivores and livestock. Treves et al. (2016) conducted a meta-analysis of twelve tests to examine the effectiveness of predator control methods and concluded that “non-lethal methods were more effective than lethal methods in preventing carnivore predation on livestock generally; at least two lethal methods (government culling or regulated public hunting) were followed by increases in predation on livestock; zero tests of non-lethal methods had counterproductive effects”.⁴²

The 2017 FOIP request to Alberta Environment and Parks (E17-G-0418) included a 2012 Briefing Note from 2012 to the Minister acknowledging that the, "...accidental kill of some non-target animals [is] unavoidable..." when using toxicants; nevertheless, "...it is minimized by strict adherence to the specific procedures." (56). If adverse impacts are unavoidable, and likely under reported given general lack of record-keeping, surely alternative options should be further explored.

REASONS WHY ALL USES OF STRYCHNINE AND COMPOUND 1080 SHOULD BE DISCONTINUED

1. THERE ARE ALTERNATIVE CONTROL MEASURES

- a. **Protection of caribou - Registration #20410:** The label registration #20410 states that strychnine is "For use when there is no other practical alternative control measures." Boreal caribou are listed as threatened under the federal *Species at Risk Act* and under provincial legislation in Ontario, British Columbia, Alberta, Manitoba, Northwest Territories, Labrador and Quebec. Yet, Alberta is the only province of the other five provinces and territory to poison wolves in order to protect its "at risk" caribou populations. The strychnine label requires the Alberta Government to demonstrate that the management approach (i.e. alternative control measures used by the other provinces to protect caribou) is deficient, hence requiring the use of strychnine. Our review of documents provided by the PMRA showed no such information had been provided. We urge the PMRA to deny the re-registration and require the Government of Alberta to comply with the label and implement a protection programme that does not use strychnine, similar to the other provinces and territory.

- b. **Rabid skunk control - Registration #25410:** Strychnine has not been used to poison skunks in Alberta for approximately a decade, which begs the question, why is its ongoing registration required? In addition, there are alternative control

measures should a rabies outbreak occur in skunks in Alberta. Ontario, which was once the rabies capital of North America, instituted a rabies control programme that did not involve the use of strychnine. In fact, Ontario research showed that the removal of large numbers of animals in targeted areas did not reduce the incident of rabies. The Ontario government's Point Infection Control programme which originally involved the killing of thousands of target animals at the epicentre of the outbreak was largely ineffective and even counter-productive. It showed that the removal of large numbers of animals resulted in others moving in to fill the void, thereby exposing more animals to the virus. In addition, tests that were done on the animals trapped and killed showed that less than one percent actually carried the rabies virus. The Ontario government asserts that baiting an area with an oral rabies vaccine is significantly more effective in preventing and limiting an outbreak than killing the target species. Strychnine has not been used for skunk/rabies control in Alberta in close to a decade and there is a non-lethal alternative to the use of strychnine. Therefore, its re-registration should be denied.

2. LACK OF STUDIES REGARDING THE IMPACT OF THE ONGOING REMOVAL OF WOLVES IN ALBERTA'S CARIBOU MANAGEMENT PROGRAMME:

The Alberta government's goal is to remove all wolves annually within the caribou range prior to and within caribou calving season through aerial shooting and poisoning. This programme has been in place for seventeen years.

Label 20410 states the strychnine is to be used "For control of problem wolf, coyotes or black bears when predation has been shown to be one of the primary mortality factors which is limiting a specific wildlife population density and where the wildlife population is threatened with extirpation or where the wildlife population is economically or ecologically important. Such a program must be approved by the Minister responsible for wildlife." The label does not allow those who administer strychnine as part of the caribou management programme to remove all wolves in the caribou area, but only problem wolves.

The Hervieux study ⁵ used to justify Alberta's approach to management of "at risk" caribou does not address the broader ecological impacts caused by the ongoing removal of a top predator from the environment. As far as we could tell from available studies, little to no information was gathered about the wolf populations, their behaviour, movements and hunting patterns in the area as they pertained to caribou. Nor could we find studies done by the Alberta government that would assess the impact of the persistent removal of a top ecosystem predator and its impact on bordering wolf populations drawn to the area where wolves are being removed.

Contrary to the directions on the label, the goal of the Alberta government was is to remove as many wolves as possible prior to calving season and beyond.

The PMRA argues in its proposed re-evaluation decision that, "Based on a review of the available scientific information, risks to the environment are acceptable at a population level when strychnine and sodium monofluoroacetate are used according to the proposed label directions, including new mitigation measures (improved label directions, updated reporting requirements and a registrant-implemented product stewardship program)..." The PMRA has not considered the years of combined effect of aerial shooting and poisoning of the wolf population as a result of Alberta's caribou management programme. The PMRA cannot consider the use of predacides in isolation of other aggressive wolf management approaches and other environmental pressures on wolves.

3. ONGOING VIOLATIONS OF THE LABEL INSTRUCTIONS GOVERNING THE USE OF STRYCHNINE AND COMPOUND 1080 – REVIEW OF PMRA DOCUMENTS #3249560 AND #3249569:

Alberta remains the sole province to use Compound 1080 and strychnine. The PMRA's Re-evaluation Committee has examined a decade of available data provided to the PMRA by Alberta over a ten year period.

Of note, registration #24512, Sodium Monofluoroacetate Restricted Toxic Collar Solution registration has not been renewed. Our examination of the data provided in PMRA documents #3249560 and #3249569 will focus on the remaining three labels: label #20410: Strychnine wolf, coyote and bear control predacide, #24510: strychnine predacide for skunk control, and label #18300: sodium monofluoroacetate predacide for coyote and wolf control.

The evidence shows repeated non-compliance with the PMRA label directions and with the Alberta's legislation governing the use of these two predacides. This calls into question the PMRA's recommendation to allow the continued use of the predacides based on changes to and clarification of the labels. There appears to be an underlying assumption that changes to the labels will somehow result in compliant action on the part of the Alberta government and if not, the use of the predacides is limited enough that non-compliance will not impact non-target populations. Even with limited and missing data, including the number of target and non-target species killed and even when more non-target animals died than did target animals, the PMRA is assuming that there is no impact on wildlife populations. After a decade of ongoing non-compliance, the PMRA should deny the re-registration of these two predacides.

ADDITIONAL DOCUMENTS PROVIDED BY PMRA

When the public comment period started at the end of August 2022, APPC requested access to the documents that PMRA relied upon for its re-evaluation of strychnine and Compound 1080 and proposed support for continued use. We were provided with three of the many documents used. Below is a summary of the two documents provided.

SUMMARY OF PMRA DOCUMENT #3249560 – COMPOUND 1080 – 2010-2021**1. Question: Were the tablets recovered or consumed and if not what happened to them?**

The records show that the PMRA could not tell what happened to nearly half of the tablets used. Approximately 51% of the tablets were either consumed or recovered while 49% were “unknown/don’t know/blank/ don’t know on the second baiting”.

2. Question: Were the Compound 1080 tablets disposed of according to the label?

Only 4% of the records show that poisons were disposed properly. In 96% of the records, the PMRA could not tell if they were disposed properly because the tablets were not recovered, it was not reported, it was marked as unknown or it was left blank. Target species, 5 wolves, were identified in only 4 records. The remaining 127 records showed no target species. Non-target species were identified in 3 of the reports. Leghold traps and snares were used in 20 reports that resulted in the deaths of 6 wolves and 1 coyote.

3. Question: Was the amount of Compound 1080 used consistent with the label directions?

The records show that 52% used 1080 consistent with the labels while 48% did not. One record provided no information. It is important to note that 7 of the 62 (or 12%) were allowed to rebait sites despite not using Compound 1080 in a manner consistent with label directions.

4. Question: Were the baits disposed of properly?

The records show that 55% of the baits were disposed of in accordance with the label. However, some of those records said that they were mostly compliant. It is unclear what “mostly” means. Approximately 40% were not compliant, either

because there was a clear “no” or there was nothing reported. Five percent were compliant on the initial baiting but not on the rebaiting.

5. Question: Were the poisons placed properly according to the label:

According to the records only 26% placed the tablets according to the label.

Seventy four percent reported no or did not report how the poisons were placed.

6. Question: Do the municipalities using Compound 1080 include data regarding the number of coyotes killed and the number of non-targets killed?

Over a period of 11 years, the vast majority of Alberta municipalities using Compound 1080 did not collect the data on the number of target animals (coyotes) killed by the poison and the number of non-target animals who died.

Responses: #1:Yes-0 No-68; #2:Yes-3 No-62; #3:Yes 24 No 44; #4:Yes-54 No-10; #5:Yes-0 No-64; #6:Yes-0 No-66; #7:yes-0 No-57; #8:Yes-0 No-47 N/A4; #9:Yes-0 No-9 ?-3; #10:Yes-0 No-59; #11:Yes-0 No-61.

This is a label requirement and yet the rate of non-compliance is very high. More troubling is the failure to recover bodies, to determine who is consuming the baits and whether there are significant impacts on non-target species.

7. Question: Was the amount of strychnine used consistent with directions?

The data revealed that 52% of the municipalities were in compliance while 48% were unclear, did not report or were not compliant.

SUMMARY OF PMRA DOCUMENT #3249569:

1. Question: Were the cubes disposed of in accordance with the label?

The data show that the PMRA could not tell whether the strychnine cubes were disposed of according to the label instructions. The data indicate that most of the

information is unknown or not available. It is unclear from the documents what is meant by “unknown but consumed”. Given that most municipalities are in non-compliance with the label because they do not track the killing of either target or non-target species, the PMRA would not know who ate the poisons and who was killed by the poisons. Also, if disposal of these cubes is so unclear, it would be difficult for the PMRA to determine that there was no environmental risk, including non-target animals and species at risk.

2. Question: Which animals were killed – target or non-target?

Fifteen records showed that a total of 67 wolves (target animals) were killed, 26 in one record or 39% of all the wolves killed. Twenty-one records show that a total of 66+ non-target species died from the poison including ravens, magpies, coyote, crow, Golden Eagle and a weasel.

Review of: Environmental Assessment Directorate Monograph: Re-evaluation of the Predicide Cluster: Strychnine and Sodium Monofluoroacetate: PMRA #3249390; and Proposed Re-evaluation Decision: PRVD2022-18: Predicide Uses of Strychnine and Sodium Monofluoroacetate and their Associated End-use Products

Summary of 10 years of non-compliant use of strychnine and Compound 1080:

The information below is a summary of the data provided in PMRA’s monograph and re-evaluation document.

Information provided by AEP was insufficient to verify claims: Although the Alberta government sets out its argument for the need to use strychnine in order to protect “at risk” caribou, the authors of PMRA#3249390 clearly state that “the use records provided by Alberta Environment and Parks (AEP) (reviewed in Section 2.2.2) do not provide enough details to verify the above information.”

Removal of wolves as a target species: The document provides a summary of the non-compliance with label directions for the use of strychnine to control wolves for

protection of livestock. The records show numerous instances of potential non-compliance with the label directions and provide adequate evidence to discontinue the use of strychnine to control wolves who predate on farmed animals. They include:

- Use in general population reduction programs, or when predation has not been confirmed.
- Over-baiting and/or not applying the strychnine in a manner consistent with the directions.
- Not maintaining complete records of target and non-target organisms killed.
- Not disposing of all carcasses and bait according to label directions (Yes 21, No/Unclear/Not Reported 22).
- Not checking on the bait sites at least every 7 days (19 yes and mostly, 24 no and unknown); and,
 - Leaving strychnine baits in place for longer than permitted.

Failure to comply with label direction in two winter wolf control programs: The document states that records for two winter wolf control programs were provided. These programs do not appear to have followed the label directions. They used as a pre-emptive measure to reduce wolf populations instead of responding to predation. They include:

- Record #11-29175, initiated March 25, 2012: A total of 45 cubes of strychnine were applied as drop baits as part of an on-going winter wolf control program. This is not consistent with the directions to use one to three tablets in a maximum of 12 drop baits. The records do not indicate that the site was checked at least every seven days, nor do the records report target/non-target kills (beyond one wolf) or that the site was closed with the poisoned baits properly disposed of.
- Record 13-18840, December 2013: A total of 88 cubes of strychnine were placed on site between December 9, 2013 and January 8, 2014. A total of 26 wolves, one golden eagle, along with an unknown number of coyotes and ravens were killed as a result of this strychnine baiting program.
- The occurrence report for this record (PMRA #3248739) indicates that on January 7, 2014: "Near the bait site numerous wolves were found, along with an

unknown number of coyotes and ravens. 12 wolves were collected from the area and brought to the gate for retrieval”.

- Further, the document reads, “It is unclear how the number of dead coyotes and ravens found at the site could be unknown. It may be that the number could not be determined because the remains were in pieces, and the carcasses were not retrievable. However, it is also possible that that the FWO did not attempt to retrieve the carcasses for disposal, as required, particularly given that 12 wolf carcasses were retrieved from the site. The presence of poisoned carcasses at the site increases the risk of further non-target poisonings. This site appears not to have followed a number of the Use Limitations and Directions for Use of this product: (1) The site was not checked at least every 7 days. (2) Strychnine was not applied in a manner that is consistent with the label directions: (a) on December 9, 2013, more than 12 drop baits were used (and were used in conjunction with a large, poisoned carcass), (b) on January 7, 2014, four tablets were used per drop bait, which exceeds the label directions of one to three tablets per drop bait. (3) A complete record of non-targets killed was not maintained. It is unknown how many coyotes and raven carcasses were left at the site; Given that the state of the numerous coyote and raven carcasses is unknown, it is possible that all carcasses were not disposed of appropriately by incineration or by burial in a pit no less than 46 cm deep; and, (4) The poisoned bait was in the field from December 9, 2013 to March 18, 2014, which exceeds the 90-day limit in winter permitted by nine days.

Use of strychnine to control wolf predation on livestock: “FWO use records from 2010 to 2016 show extensive non-compliance with the label directions. Health Canada’s Regulatory Operations and Enforcement Branch (ROEB) conducted a review of the use of Strychnine Wolf, Coyote and Black Bear Predacide (PMRA #3292175) in the livestock protection program conducted by AEP between 2010 and 2021. ROEB identified a total of 53 instances of non-compliance in the 43 use records from 2010 to 2016, including a failure to check the bait site every seven days, using too many poisoned drop baits and/or poisoned carcasses, using too many strychnine tablets, the

baiting program exceeding the permitted length, baiting when there was no record of wolf predation, and a failure to maintain proper records, including a record of target/non-target animals killed. ROEB indicated that a failure to follow the record keeping requirements of the label likely contributed to the number of non-compliant situations. Lack of compliance with the label directions increases risk to non-target organisms. Furthermore, the FWOs frequently did not follow AEP's Use, Storage and Handling of Vertebrate Toxicants for Problem Wildlife Control and Wildlife Management Procedure when using strychnine."

Use of Compound 1080 to Control Wolf Preying on Livestock by AEP: "The records show that the FWOs frequently did not apply an amount of sodium monofluoroacetate that is consistent with label directions (62 out of 132 records either applied too many sodium monofluoroacetate tablets and/or too many drop baits), rarely returned to the site after applying the poisoned bait (40 out of 132 records indicate that the FWO returned to the site within seven days), frequently left the landowners to monitor the site (at least 40/132 records), and rarely found the carcasses of target or non-target organisms. A total of three wolf, two coyote and one raven carcasses were reported between 2010 and 2021. The use of Sodium Monofluoroacetate Predacide in a manner that is consistent with label directions increased in 2017 to 2021, when the FWO use of sodium monofluoroacetate significantly decreased."

RECOMMENDATION

The Animal Protection Party of Canada, Animal Alliance of Canada, the Humane Society International/Canada and Zoocheck strongly recommend that the PMRA discontinue all uses of Compound 1080 and strychnine. Our recommendation is based on the Alberta government's failure over 10 years to comply with the requirements of the labels, and without testing other available options for wildlife management as is the requirement for licensing. Amending the labels to tighten and clarify requirements will not ensure compliance.

REFERENCES

1. Xie B. *Memorandum To: Virgine Bergeron, Head Program 1 Re-Evaluation Section. Subject: Strychnine (STR) Re-Evaluation Review- Human Health (DRAFT)*. Health Canada; 2004.
2. Health Canada. Re-evaluation Decision RVD2020-06, Strychnine and Its Associated End-use Products (Richardson's Ground Squirrels). Published January 19, 2022. Accessed February 24, 2022. <https://www.canada.ca/en/health-canada/services/consumer-product-safety/reports-publications/pesticides-pest-management/decisions-updates/reevaluation-decision/2020/strychnine.html>
3. Mech LD, American Museum of Natural History. *The Wolf: The Ecology and Behavior of an Endangered Species*,. Published for the American Museum of Natural History by the Natural History Press; 1970.
4. Government of Canada HC. Pesticide Label Search - Health Canada. Published February 23, 2010. Accessed February 24, 2022. <https://pr-rp.hc-sc.gc.ca/ls-re/index-eng.php>
5. Hervieux D, Hebblewhite M, Stepnisky D, Bacon M, Boutin S. Managing wolves (*Canis lupus*) to recover threatened woodland caribou (*Rangifer tarandus caribou*) in Alberta. *Canadian Journal of Zoology*. 2014;92. doi:10.1139/cjz-2014-0142
6. Health Canada. Label Registration Number 20410. Accessed February 24, 2022. <https://pr-rp.hc-sc.gc.ca/ls-re/index-eng.php>
7. Proulx, Brook, Cattet, and Paquet. 2015. Poisoning wolves with strychnine is unacceptable in experimental studies and conservation programmes. *Environmental Conservation* 43:1-2

8. Khan SA. Overview of Strychnine Poisoning - Toxicology. *Merck Veterinary Manual*. Accessed February 24, 2022. <https://www.merckvetmanual.com/toxicology/strychnine-poisoning/overview-of-strychnine-poisoning>
9. Eason C, Wickstrom M. Vertebrate Pesticide Toxicology Manual (Poisons). *DEPARTMENT OF CONSERVATION TECHNICAL SERIES 23 Wellington, New Zealand: Department of Conservation*. Published online January 1, 2001.
10. Addendum to: An open letter to Minister Petitpas Taylor and Canada's Pest Management Regulatory Agency regarding the use of strychnine, sodium monofluoroacetate (Compound 1080), and sodium cyanide to kill wildlife in Canada. Published online September 27, 2018. Accessed February 24, 2022. https://www.animalprotectionparty.ca/wp-content/uploads/2018/09/Sept-27-ADDENDUM_Open-letter-to-Petitpas-Taylor-and-PMRA_strychnine-1080-cyanide-.pdf
11. An open letter to the Minister of Health and Canada's Pest Management Regulatory Agency regarding the use of strychnine, sodium monofluoroacetate (Compound 1080), and sodium cyanide to kill wildlife in Canada. Published online September 27, 2018. Accessed February 24, 2022. https://www.animalprotectionparty.ca/wp-content/uploads/2018/09/Sept.-27-Open-letter-to-Petitpas-Taylor-and-PMRA_2018.pdf
12. Health Canada. Label Registration Number 18300. Accessed February 24, 2022. <https://pr-rp.hc-sc.gc.ca/ls-re/index-eng.php>
13. Health Canada. Label Registration Number 24512. Accessed February 24, 2022. <https://pr-rp.hc-sc.gc.ca/ls-re/index-eng.php>
14. Health Canada. Label Registration Number 18300. Accessed February 24, 2022. <https://pr-rp.hc-sc.gc.ca/ls-re/index-eng.php>

15. CVMA. CVMA | Documents | Pest Control – Position Statement. Published July 16, 2014. Accessed February 24, 2022.

<https://www.canadianveterinarians.net/documents/pest-control>

16. Health Canada. Consultation: Humane Vertebrate Pest Control. Published January 6, 2020. Accessed February 24, 2022. [https://www.canada.ca/en/health-](https://www.canada.ca/en/health-canada/services/consumer-product-safety/pesticides-pest-management/public/consultations/humane-vertebrate-pest-control/document.html)

[canada/services/consumer-product-safety/pesticides-pest-management/public/consultations/humane-vertebrate-pest-control/document.html](https://www.canada.ca/en/health-canada/services/consumer-product-safety/pesticides-pest-management/public/consultations/humane-vertebrate-pest-control/document.html)

17. The Canadian Press Staff. Health Canada says it won't consider animal suffering in strychnine review. CTVNews. Published February 2, 2021. Accessed February 24, 2022. [https://www.ctvnews.ca/health/health-canada-says-it-won-t-consider-animal-](https://www.ctvnews.ca/health/health-canada-says-it-won-t-consider-animal-suffering-in-strychnine-review-1.5292573)

[suffering-in-strychnine-review-1.5292573](https://www.ctvnews.ca/health/health-canada-says-it-won-t-consider-animal-suffering-in-strychnine-review-1.5292573)

18. Dubois S, Fenwick N, Ryan EA, et al. International consensus principles for ethical wildlife control. *Conservation Biology*. 2017;31(4):753-760. doi:10.1111/cobi.12896

19. Mckinnon D, Wilk C, Mineau P. *Potential for Primary Poisoning of Non-Target Species from the Use of Strychnine-Treated Wheat Bait to Control Richardson's Ground Squirrels.*; 2001.

20. Mckinnon DT, Mineau P. *Effectiveness and Non-Target Impact of Zinc Phosphide and Various Concentrations of Strychnine in Controlling Richardson's Ground Squirrels in Saskatchewan.*; 2004.

21. Health Canada. *Re-Evaluation of Strychnine.*; Submission Number 2003-1376. Updated August 2016.

22. Health Canada Pest Management Regulatory Agency. *Proposed Acceptability for Continuing Registration PACR2005-08, Re-Evaluation of Strychnine.*

23. Health Canada. *Re-Evaluation Note REV2007-03, Update on the Re-Evaluation of Strychnine.*
24. Health Canada. Information Note. Outcome following External Advisory Review Panel from Notices of Objections for RVD 2020-06: Strychnine and Its End Use Products (Richardson Ground Squirrels)
25. Parker AJ, Lee JB, Redman J, Jolliffe L. Strychnine poisoning: gone but not forgotten. *Emerg Med J.* 2011;28(1):84. doi:10.1136/emj.2009.080879
26. US EPA. Reregistration Eligibility Decision (RED): Strychnine. Published online July 1996. Accessed February 24, 2022.
<https://archive.epa.gov/pesticides/reregistration/web/pdf/3133.pdf>
27. Health Canada. Label Registration Number 24510. Accessed February 24, 2022.
<https://pr-rp.hc-sc.gc.ca/lr-re/index-eng.php>
28. Health Canada Pest Management Regulatory Agency. *Proposed Acceptability for Continuing Registration (PACR2004-20): Re-Evaluation of Sodium Monofluoroacetate.*; 2004.
29. Health Canada Pest Management Regulatory Agency. *Re-Evaluation Decision RVD2014-03, Special Review Decision for Compound 1080.*; 2014.
30. Health Canada Pest Management Regulatory Agency. *Re-Evaluation Note REV2013-04, Special Review of Compound 1080.*; 2013.
31. APPC. Request for Special Reviews of Pest Control Products Containing Strychnine, Compound 1080, and Sodium Cyanide. December 9, 2020.

32. Government of Alberta. Agricultural Pests Act: Pest and Nuisance Control Regulation. June 1, 2020. Accessed February 24, 2022.
https://www.qp.alberta.ca/1266.cfm?page=2001_184.cfm&leg_type=Regs&isbncln=9780779817504
33. Proulx G. Field evidence of non-target and secondary poisoning by strychnine and chlorophacinone used to control Richardson's ground squirrels in southwest Saskatchewan. In: ; 2011.
34. Bishop CA, Williams KE, Kirk DA, Nantel P, Reed E, Elliott JE. A population model of the impact of a rodenticide containing strychnine on Great Basin Gophersnakes (*Pituophis catenifer deserticola*). *Ecotoxicology*. 2016;25(7):1390-1405.
doi:10.1007/s10646-016-1690-2
35. Brook R, Cattet M, Darimont C, Paquet P, Proulx G. Maintaining ethical standards during conservation crises. *Canadian Wildlife Biology & Management*. 2015;4:70-79.
36. US EPA. Reregistration Eligibility Decision (RED) Sodium Fluoroacetate. Published online September 1995. Accessed February 24, 2022.
<https://www3.epa.gov/pesticides/endanger/litstatus/effects/2011/sodium-fluo/so-fluoro-red.pdf>
37. Wepruk S. *Memorandum To: Virgine Bergeron, Head Program 1 Re-Evaluation Section. Subject: Sodium Monofluoroacetate.*
38. BCMOELP. (British Columbia Ministry of Environment, Lands and Parks). 1999. Final Pesticide Use Report for Permit #139-061-96/98.
39. Ginsberg and MacDonald. 1990. Canid Action Plan with updated references from Foxes, Wolves, Jackals, and Dogs, an action plan for the conservation of canids the

IUCN/SSC Canid Specialist Group's 1990 Action Plan IUNC/SSC Canid Specialist Group IUCN Wolf Specialist Group (L.D. Mech, Chair)

40. Defenders of Wildlife. 1982. 1080, the case against poisoning our wildlife. Special report. Washington, DC, USA

41. Harris AG, Armstrong T (Edward) R. An overview of experimental Gray Wolf (*Canis lupus*) poisoning programs in northern Ontario, 1956 to 1964. *The Canadian Field-Naturalist*. 2021;135(2):142-152. doi:10.22621/cfn.v135i2.2293

42. Treves A, Krofel M, McManus J. Predator control should not be a shot in the dark. *Frontiers in Ecology and the Environment*. 2016;14(7):380-388. doi:10.1002/fee.1312