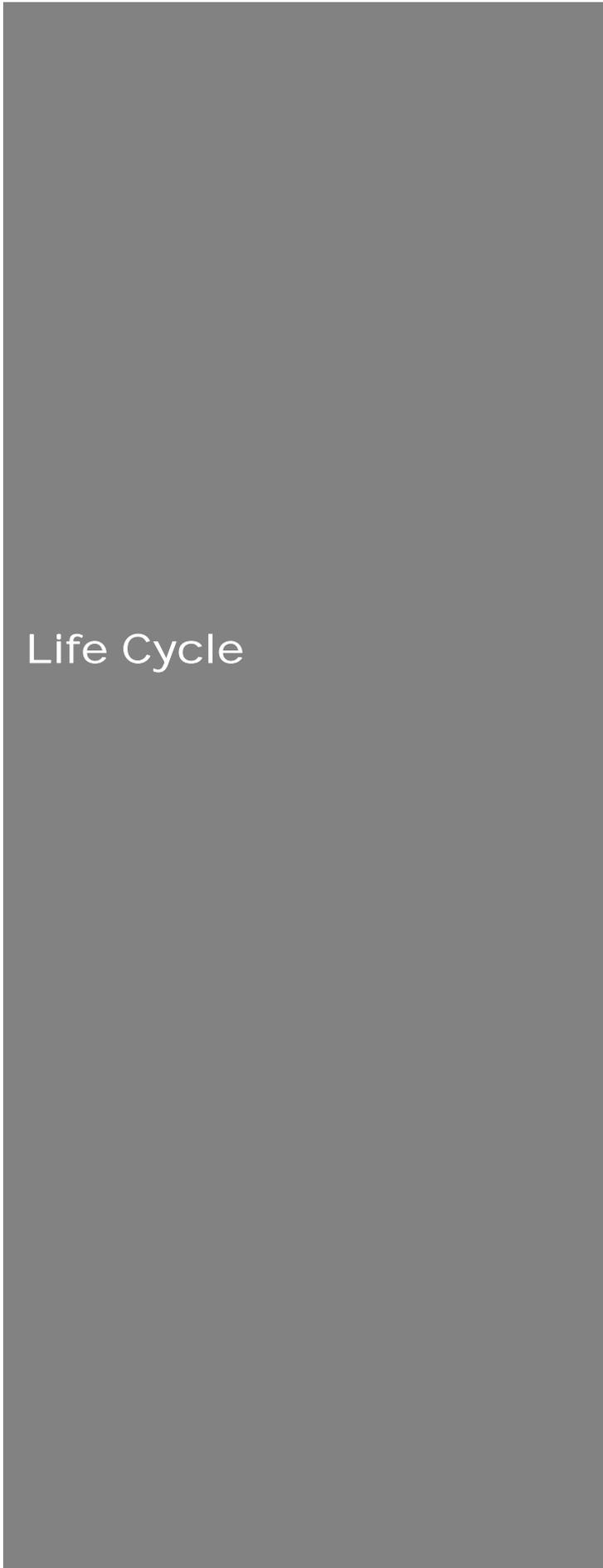


Section 3.5 Life Cycle



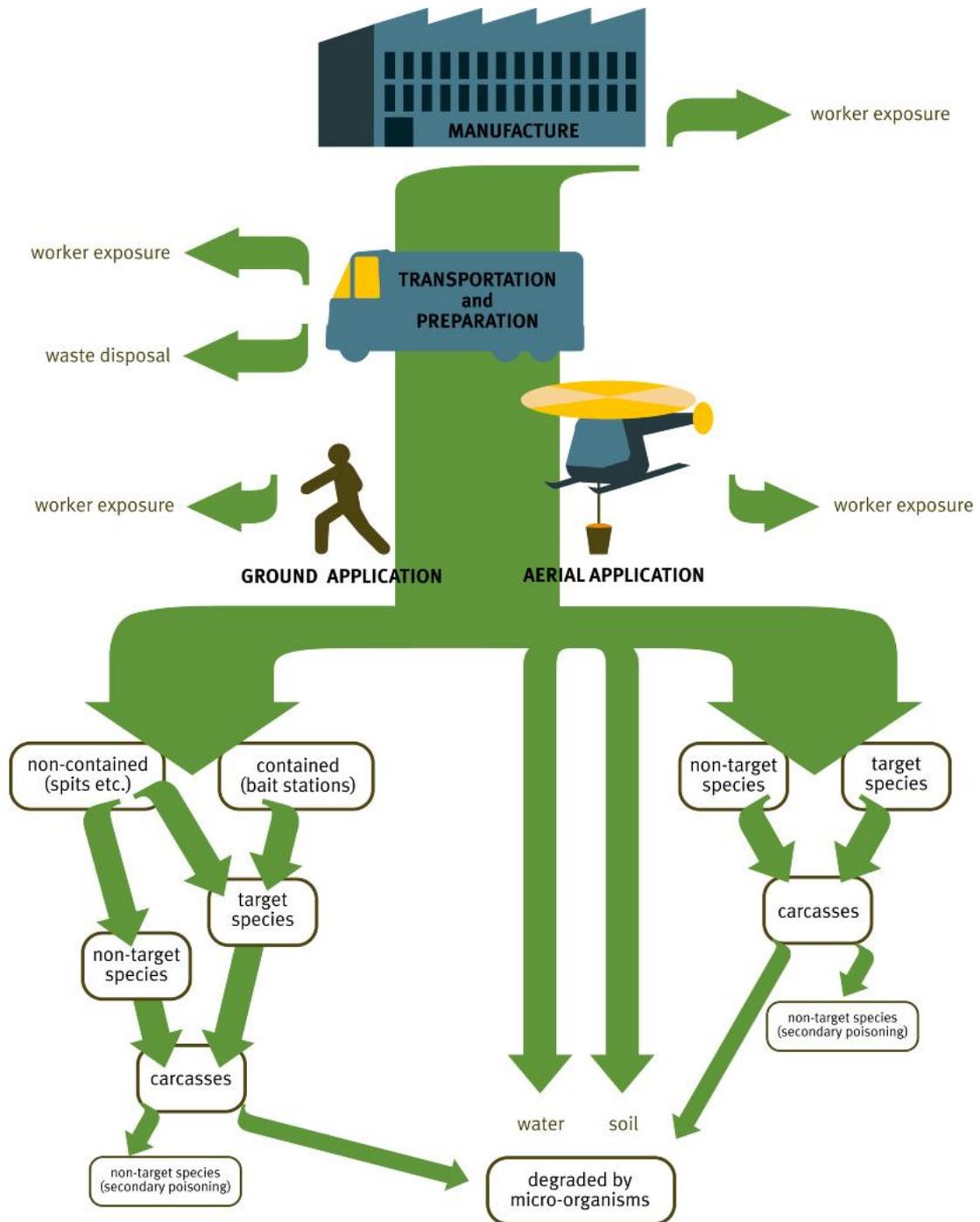


Figure 1 | The life cycle of 1080 and 1080 products

This section describes the lifecycle of 1080, illustrated in Figure 1, from its importation into New Zealand, through its uses to disposal.

1. Manufacture of 1080 Products

Animal Control Products Ltd (ACP), a Crown owned company, manufactures over 90% of the pesticide formulations containing 1080 used in New Zealand. ACP has two manufacturing sites, one in Wanganui and one in Waimate. Other pesticides (including cyanide, phosphorous and brodifacoum) are also manufactured by ACP.

1.1 Import and Delivery to Manufacturing Site

The active ingredient 1080, sodium fluoroacetate (referred to as the technical grade active) is manufactured by Tull Chemicals in the United States. The technical grade active is a fine white powder similar in consistency to damp sand. It is imported from the United States in shipments of around 500 kg to the Port of Auckland. For transport, the technical grade active is packed in 10kg plastic pails with plastic liners, in a wooden crate inside a shipping container. Transport by sea from the United States to New Zealand is subject to the IMDG (International Maritime Dangerous Goods) Code which covers packaging, labelling and placarding, stowage and documentation.

The crate is unloaded from the shipping container at the Port into a purpose-built steel crate for road transport to ACP's site in Wanganui. Road carriage is subject to the New Zealand Road Transport Rule for Dangerous Goods which has similar provisions to the IMDG Code. The transport operator contracted by ACP holds the appropriate licenses for transport of dangerous goods - all staff (both drivers and those loading the vehicles) have undergone training in dangerous goods handling, and hold dangerous goods endorsed licences. All material is tracked by ACP and the crate is not opened prior to receipt on site. Upon receipt, the crate is unloaded into the site's secure Dangerous Goods store.

Since December 2004, the technical grade active has no longer been handled by the Waimate site. All 1080 products manufactured in Waimate are made using the soluble concentrate (containing 200 g/litre sodium fluoroacetate) that is prepared at the Wanganui site (see Section 1.2).

On average, the total quantity of technical grade active sodium fluoroacetate imported to New Zealand is around 2,500 kg per year, and this has been typical for the last 10 years.

1.2 Manufacture of 1080 Formulations

The first step in the manufacturing process is the production of a soluble concentrate (referred to as stock solution) containing 200 g/litre (20% by weight) 1080. This is made by dissolving the technical grade active in water. The solution is packaged in 5-litre bottles, and prepared in batches of about 300 bottles. This operation takes approximately one week and is typically carried out three to four times per year. There is very little waste as the powder is dissolved directly into the water and is very soluble.

All 1080 formulations are subsequently prepared using stock solution, which is added to the other ingredients. Products are manufactured to order, and production is scheduled accordingly. The main types of formulations are:

- “Stock” solution – 20% solution (200 g/litre) for coating of apple, carrot or grain baits. This is the same as the soluble solution used for preparing other formulations, but has a black dye added. This is packaged in 5 litre containers.
- Cereal pellets – pellets manufactured by compressing a mixture containing ground cereal, sugar, 1080, green dye and flavouring such as cinnamon. The ingredients are mixed in a hopper and then extruded into pellets ranging in size from 2 to 12 grams (see Figure 2), containing 0.4 - 2.0 g/kg of 1080. The green dye is added to reduce the attractiveness of the baits to birds, and the flavouring masks any odour of 1080, as well as deterring birds. Cereal pellets have a reasonably long shelf life under suitable storage conditions and are easily handled. Pellets are bagged for sale and distribution in 25 kg bags.

Figure 2 | **Cereal 1080 pellets**



Pellet sizes L-R: 10-12 grams (20 mm diameter); about 6 grams (16 mm diameter); 2-4 grams (10 mm diameter)

- Pastes – paste made from apple pulp, invertase sugar and water, mixed with 1080, green dye and lure oil. Three pastes are made, containing 0.6, 0.8 and 1.5 g/kg 1080. These are packaged in 20 kg plastic pails.
- Gels – gels are made from polymer mixed with 1080, green dye and cinnamon oil. Gels have a similar consistency to pastes, being similar to jam, but gels are clear rather than opaque. Three gels are made, containing 1.5, 50 and 100 g/kg 1080. These are packaged in 500 gram tubes.

Cereal pellets are the most widely used formulation, and comprise close to 90% of ACP's total production.

1.3 Manufacturing Site Management

ACP has accreditation to ISO 9001:2000 for its manufacturing operations and is inspected twice a year by Bureau Veritas Qualifications International (BVQI) who review quality procedures.

Vehicle and visitor access to the sites is controlled and all facilities are kept secure. The sites have emergency procedures in place covering fire and other emergencies that could result in accidental release of 1080 (or any other hazardous substances). Manufacturing and storage areas are bunded to contain any liquid spills. All manufacturing and storage is carried out under cover, and there is no outside storage of active ingredients or finished products.

To eliminate cross-contamination, all manufacturing equipment is dismantled and thoroughly cleaned between production runs. Batches are programmed to minimise cross

contamination between 1080 and other products. For example, a typical order of production would be: non-toxic pre-feeds (which contain no toxin and no dye), brodifacoum pellets, then 1080 pellets.

The site is also subject to regular inspections by Occupational Safety and Health (OSH) staff from the Department of Labour. Health and safety procedures are applied to and by all employees, consistent with the *Guidelines for the Safe Use of Sodium Fluoroacetate (1080)* (Department of Labour, 2002). Strict occupational health and safety controls are in place for all processing operations involving handling of 1080. Workers are fully suited and wear respiratory protection when handling 1080 powder and preparing solution. They shower before removing the suits that are then disposed of (refer to Section 1.4 for disposal).

OSH has set a Biological Exposure Index (BEI) for 1080 of 15 µg/L of 1080 in urine, and a workplace exposure standard (WES) of 0.05 mg/m³ (concentration of 1080 in air). The BEI is the level of the determinant (in this case 1080) that would be expected to be present if the employee was exposed to concentrations equal to the WES. Employee monitoring is carried out by quarterly urine sampling and annual blood testing, and results confirm compliance with the New Zealand standards.

1.4 Disposal of Waste from Manufacturing

Waste disposal processes are the same for both the Waimate and Wanganui sites. Solid wastes from manufacturing which contain 1080 are recovered and reused in the process so waste is minimised. Washdown water cannot be recycled within this process, and is collected in an underground waste tank. The tank is emptied monthly by a waste contractor and volumes are recorded. The contractor disposes of the liquid waste by spraying to landfill, where the 1080 is biodegraded by microbial action. Appropriate consents are held for this activity.

Plastic pails are washed and punctured, so they cannot be reused, and are then disposed of to landfill. The plastic liners in the pails are removed, washed and disposed of along with other solid waste (such as packaging, disposable gloves and overalls etc) to landfill.

2. Transport and Distribution

ACP supplies 1080 primarily to professional pest control contractors, although in some cases supplies are provided directly to DOC and regional councils. 1080 products are dispatched by road to purchasers at a known destination. As described in Section 1.1, ACP uses a transport operator licensed for the carriage of dangerous goods in accordance with the HSNO controls.

3. Application

1080 products may be applied aerially or using ground-based application methods. Table 1 summarises the main target pests, methods of application and pesticide formulations available. By far the most commonly used formulations are the cereal pellets, and the use of stock solution for coated baits. Pastes and gels make up only a small proportion (5% or less) of total 1080 used.

Table 1 | Target Pest and 1080 Application Methods and Bait Types

| Pest | Method of application | | Bait type | Concentration of 1080 in bait g/kg | | |
|-------------|------------------------------|----------------|---------------------------------|---|----------------|----------|
| Possums | Aerial | | Carrot | 0.8, 1, 1.5 | | |
| | | | Cereal pellets | 0.6, 0.8, 1.5 | | |
| | Ground | Bait stations | Apple | 0.8, 1.5 | | |
| | | | Gel | 1.5 | | |
| | | | Carrot | 0.8, 1, 1.5 | | |
| | | | Cereal pellets | 0.6, 0.8, 1.5 | | |
| | | | Paste | 1.5 | | |
| | | | Hand-laying | | Apple | 0.8, 1.5 |
| | | | Carrot | 0.8, 1, 1.5 | | |
| | | | Cereal pellets | 0.6, 0.8, 1.5 | | |
| | | | Paste | 0.6, 0.8, 1.5 | | |
| | Bait bags | | Paste | 1.5 | | |
| | | Cereal pellets | 0.8, 1.5 | | | |
| Rodents | Aerial | | Cereal pellets | 0.8, 1.5 | | |
| | Ground | Bait stations | Cereal pellets | 0.8, 1.5 | | |
| | | Hand-laying | Cereal pellets | 0.8, 1.5 | | |
| Feral cats | Ground | Bait stations | Pellets | 1 | | |
| | | Hand-laying | Pellets | 1 | | |
| Rabbits | Aerial | | Carrot | 0.2 | | |
| | | | Cereal pellets | 0.4, 0.6 | | |
| | | | Grain | 0.4 | | |
| | Ground | Bait stations | Cereal pellets | 0.4, 0.6 | | |
| | | | Hand-laying/mechanical spreader | | Carrot | 0.2 |
| | | | | | Cereal pellets | 0.4, 0.6 |
| | | | | | Grain | 0.4 |
| | | Paste | 0.6 | | | |
| Wallabies | Aerial | | Carrot | 1.5 | | |
| | | | Cereal pellets | 2.0 | | |
| | Ground | Bait stations | Carrot | 1.5 | | |
| | | | Cereal pellets | 2.0 | | |
| | | Hand-laying | | Carrot | 1.5 | |
| | | | | Cereal pellets | 2.0 | |
| | | | | Gel | 50, 100 | |
| Deer | Aerial | | Carrot | 1.5 | | |
| | Ground | Hand-laying | Carrot | 1.5 | | |
| | | | Gel | 100 | | |
| Goats | Ground | Hand-laying | Gel | 100 | | |
| Wasps | Ground | Bait stations | Paste | 10 | | |

All operations undertaken for AHB are carried out either by professional pest control contractors or by regional council pest control staff, under contract to AHB. Regional council staff may also undertake 1080 pest control operations on council land for conservation purposes. Operations undertaken by DOC may be undertaken either by DOC staff or by professional pest control contractors.

Controls on the use of 1080 formulations are applied under the HSNO regulations, and are listed in Default Controls (Section 3.4 of the Application). In addition, under the Agricultural Compounds and Veterinary Medicines (ACVM) Act 1997, the ACVM Group of the New Zealand Food Safety Authority also impose controls. These primarily relate to trade name registration and labelling requirements of all vertebrate toxic agents, including 1080 (see Default Controls, Annex 1).

The detailed controls have not been repeated here, but there are two key controls that relate to the use of 1080:

- Permission is required to use 1080 on land owned by the Department of Conservation, or in a catchment area from which water is drawn for human consumption, or where a risk to public health may be created. This control has been set by ERMA as an Additional Control (Clause 3) (see Section 3.4 of the Application). ERMA has delegated the authority for giving such permissions to DOC and to the Ministry of Health respectively. (Use of 1080 on private land requires the permission of the land-owner; this is not set as a specific control in the regulations).
- Persons involved in the application and use of 1080 must hold an Approved Handler Test Certificate (satisfying requirements for fit and proper persons) and a Controlled Substance Licence.

3.1 Aerial Application

1080 is the only toxin that is able to be applied aurally throughout mainland New Zealand. In general, aerial application is used for difficult and/or inaccessible country or large areas. Distribution is typically done using custom-designed bait applicators incorporated into fixed wing aircraft (modified topdressers) or suspended from helicopters. Global positioning systems (GPS) are used by the pest control agency and contractor to plan the operations, and by the aircraft operator to ensure complete coverage and accurate targeting of areas to be treated.

Generally, prior to the application of toxic baits, a non-toxic "pre-feed" is applied to the treatment area. This is a non-toxic feed (such as non-coated carrots or pellets that contain no 1080) in the same formulation that will be used in the poison operation. Pre-feeds are used to attract and familiarise the pests with the bait.

1080 formulations that are applied aurally are cereal pellets (0.4-0.8 or 1.5-2.0 g/kg 1080), or "coated baits" (carrot or grain baits coated with 1080 stock solution). The most common formulations to be applied aurally are the 0.8 or 1.5 g/kg cereal pellet, or carrot baits. Over the past 30 years, there has been a significant reduction in the amount of 1080 distributed per hectare (sowing rate) as application methods have increased in accuracy, and bait quality has improved. Sowing rates are now typically 2 – 5 kg of baits per hectare, the average being 2 -3 kg/ha.

For baits weighing 6 grams, this results in the distribution of about 330 - 830 baits per hectare (at 2-5 kg baits per hectare). Alternatively, for baits weighing 12 grams, this results in the distribution of about 170 - 420 baits per hectare.

For baits with a concentration of 1.5 g/kg 1080, these sowing rates mean that the total amount of 1080 distributed per hectare is 4.5 grams (at a sowing rate of 3 kg baits per hectare).

For pellet baits, bulk bags of pellets are loaded directly into the hopper of the helicopter or aircraft.

Coated baits are prepared at the application site, with the carrot or grain being chopped and the stock solution applied directly before loading into the aircraft or hopper. The stock solution is usually diluted with water to achieve the required final concentration of 1080 in the coated baits which, for possum control, is typically around 1.0-1.5 g/kg 1080. Lower 1080 concentrations are typically used for rabbit or rodent control, as shown in Table 1.

In addition to the approvals that may be required from DOC or the Ministry of Health, a resource consent under the RMA or a certificate of compliance for aerial operation is often required from the relevant regional council, unitary authority or other local authorities, depending on the local rules for the application area. In most cases, where resource consent is required, it is usually publicly notified. More detail on the controls applied to aerial operations is contained in Section 3.4, Default Controls (particularly the Additional Controls (Clauses 5 and 6)).

Baits sown by air are not removed at the completion of the operation, but are left in-situ to break down naturally. However, where an application is in areas with public access, operators will clear any baits from roads and walkways, to comply with the conditions of Ministry of Health permissions.

3.2 Ground Application

In ground operations, 1080 is used in bait stations or applied directly to the ground or vegetation. All 1080 formulations (with the exception of stock solution) may be used in ground operations. Stock solution is applied to carrots, apple or grain, to make coated baits.

Bait stations are commonly used where it is important to avoid exposing livestock, people, pets or native animals to the toxin. Bait stations are generally covered, to keep baits dry, and designed and positioned to exclude non-target species. Commonly used bait stations include the Philproof, KK and Romark models.

Large bait stations may hold up to approximately 1 kg of pellets, enabling pests to feed over a period of days or weeks. If protected from rain, pellets can remain as an active poison for several months. Baits are removed from stations at the end of operations to prevent bait shyness and sublethal poisoning of target pests. The timing of bait removal is dependent on bait type and rain protection. Waste baits are either buried or returned to the depot where they are disposed of via a locally approved landfill or disposal company.

Pastes are commonly applied using an applicator gun. Application of pastes is into bait stations, onto upturned earth spits, retrievable cardboard squares or tin lids, or directly onto vegetation. Gels may be placed in bait stations but are usually applied directly to vegetation so that the target pest ingests the gel along with its natural food. Paste bait may be replaced over several days before the spits are turned back to bury the residual paste, the bait

stations emptied or the cardboard squares or lids retrieved. Pastes are removed from stations, and their contents buried or returned to the depot where they are disposed of via a locally approved landfill or disposal company. However, the tin lids used at these stations are washed and reused.

Pellet or coated baits may also be sown directly into the ground by hand, or using a mechanical sower in more open country. To date, mechanical spreaders have only been used for the control of rabbits.

3.3 Operating Procedures and Standards

All personnel involved in the application of 1080 (and other pesticides) must be registered as Approved Handlers and hold Controlled Substance Licence, and comply with HSNO controls (described in Section 3.4, Default Controls). In addition, the applicant agencies, AHB and DOC, have specific internal requirements, described below.

DOC has a comprehensive set of standard operating procedures (SOPs) for Safe Handling of Pesticides as part of its Quality Conservation Management System. These procedures meet all the legal obligations under the Health and Safety in Employment Act 1992, HSNO Act and other applicable legislation. Procedures set out practices to be followed for all phases of the operation including planning, transport, preparation of coated baits, using pellet baits, ground and aerial application methods, post-operational cleanup, waste disposal and accidents and emergency procedures. The procedures are mandatory for all staff, contractors or sub-contractors working on lands managed by DOC. Some parts of the SOPs are also mandatory for contractors undertaking external operations on land managed by DOC.

The DOC Safe Handling of Pesticides Standard Operating Procedure specifies the type of protective clothing that must be worn during different parts of the operation and for bait types (i.e. different parts of the lifecycle). The personal protective equipment (PPE) worn depends on the risk of and type of exposure the worker will be subject to. For example, PPE required when handling stock solution provides a greater level of protection for the worker than that required for putting 1080 pellets in a bait station. As a minimum, protective equipment such as gloves and overalls are required to be worn whenever handling any 1080 formulations, and respirators and eye protection are required when handling large quantities such as those required for aerial operations.

For operations by the AHB, users of 1080 must have standard operating procedures in place that have been approved by AHB's regional vector managers. Tb operations are governed by Vector Control Contracting Procedures, which is an Animal Health Board initiative. Where AHB operations occur on land administered by DOC, they are also subject to DOC's approval processes.

3.4 Disposal of Waste from Application

Small quantities of surplus or spoilt bait is either buried or disposed of down an offal hole.

Because 1080 is water soluble, all equipment is washed at the completion of an operation. Washing may occur in the field or at the contractor/agency depot. Waste water must be disposed of to ground rather than direct to a water course. Spillages are cleaned up using water and the waste water is disposed of to ground.

DOC's SOP for the Safe Handling of Pesticides requires that all PPE must be cleaned before and after use. Clothing is washed weekly by a commercial cleaner who washes them separately from other clothing.

All cardboard packaging (eg. the boxes etc that 1080 is delivered in) is burnt on the contractor's premises or disposed of to a locally approved landfill.

4. 1080 in the Environment

4.1 Post-application

In the majority of control applications, 1080 baits are not retrieved at the completion of the control operation. Rather, access to the control area is either closed or controlled (through use of warning signs, withholding periods for stock on treated land etc), for the duration of the time that the 1080 will remain active as a toxin. Typically this is several weeks, although this is dependent on climate and location, and level of rainfall. On the occasions when baits are retrieved, this is done to prevent bait shyness from developing in the target species, or in particularly high risk areas in respect to human contact.

Baits that are not eaten are left to degrade in the environment. 1080 is not persistent and breaks down relatively quickly through microbial action in the environment when in contact with water or soil. A period of rain after a control operation will accelerate the degradation rate, and reduce the period of time that the baits remain toxic.

While all pest control operations are designed to kill "target" pest species, it is inevitable that some non-target species may also be killed. Non-target species may include birds, domestic animals (livestock or pets) and other game animals (wild deer, pigs, goats). The effects of 1080 operations on these animals, and on other native species (including native mammals (bats), insects, freshwater species and reptiles) have been intensively studied and are discussed in detail in the risk assessment in Section 4 of the Application.

Carcasses, either of target or non-target species, are also naturally degraded over time. Secondary poisoning (where consumption of 1080 is via a secondary medium) can occur, and is an important benefit of many 1080 operations, particularly the poisoning of mustelids if they prey on poisoned possums, rodents or rabbits.

Secondary poisoning as the result of eating live animals that have been exposed to 1080 is rare. 1080 is rapidly metabolised and excreted from live animals and, prior to excretion, 1080 is likely to be concentrated in the gut rather than in the flesh. Therefore, secondary poisoning of predators from consumption of the flesh of animals that have received a sub-lethal dose is considered unlikely.

The most common cause of secondary poisoning occurs when scavenging animals and predators feed on the carcasses of poisoned animals. 1080 degrades more slowly in carcasses and may persist for some months. This poses a particular risk to dogs. There have been documented cases of poisoned carcasses being washed into rivers and carried well beyond the treatment area, with resulting poisoning of dogs.

The fate of 1080 in the environment, the risks posed to water, soil and non-target species, as well as the benefits of 1080 use is discussed in detail in the risk assessment in Section 4 of the Application.

4.2 Landfill Disposal

As noted previously, waste from manufacturing, packaging and spoiled or surplus baits are generally disposed of to landfills. The landfills must be notified of the type of baits/product for disposal. The landfill will generally identify and record a specific area for disposal of the material prior to arrival. Whether a landfill will accept 1080 or not is dependent on their resource consent conditions.

