

## Section 4.1C

## Effects on Human Health and Safety



This section contains the registers which identify effects on human health and safety.

## 1. Assessment of Benefits

The assessment of benefits to human health and safety is based on the relative benefit between future scenarios WITH 1080 and WITHOUT 1080, as described in the Pest Control Scenarios section of the application.

Each benefit was assessed by asking the following questions:

What is the relative likelihood that the benefit will occur WITH 1080 compared to WITHOUT 1080?

What is the magnitude of the benefit when the effect WITH 1080 is compared to the effect WITHOUT 1080?

## 2. Assessment of Adverse Effects

Adverse effects on human health and safety (ie. people) have been assessed using a slightly different approach to the previous sections on market economy and social/community effects, which compared the future WITH 1080 and WITHOUT 1080, and assessed the relative effect. In this section, the adverse effects on human health have been assessed separately for a future WITH 1080 and a future WITHOUT 1080, each using the same magnitude and likelihood matrices. This approach has been taken because the effects of hazardous substances on people vary throughout the lifecycle of the substance, and vary with substance formulation and type of exposure to the substance.

There are therefore two registers in this section identifying adverse effects: one, the adverse effects WITH 1080 (that is, the adverse effects of the use 1080 on human health); and the other, the adverse effects WITHOUT 1080 (that is, the adverse effects of the use of cyanide and traps on human health).

### Assessing the effects throughout the lifecycle

Each register has been divided into the different activities that result in people being exposed to the substance throughout its lifecycle. The lifecycle of 1080 is described in Section 3.5 of the application, and the register of adverse effects WITH 1080 is divided into the following major activities:

- Transport to manufacturing site
- Manufacture
- Application (aerial and ground application)
- Disposal

A similar approach has been used in the register of adverse effects WITHOUT 1080, for cyanide, as the lifecycle of cyanide is similar to that of 1080, with the exception that there is no aerial application of cyanide. The assessment of adverse effects from the use of traps has been made only for the "application" phase of the lifecycle (ie. the use of traps).

### **Assessing who and how people may be exposed to the substance**

Risk assessment considers the type of receptors, in this case people, that may be exposed to the substance throughout its lifecycle.

Occupational exposure has been considered for all steps in the lifecycle, that is, the effects of the substance on workers transporting, manufacturing or applying the substance. This assessment has been conducted separately for each type of formulation (for 1080: pellet, coated bait, paste and gel) as workers may be exposed via different exposure pathways when handling the different formulations. As stated in the Introduction to Section 4.1, the assessment assumes that the occupational controls in place for 1080 (and for cyanide and traps) continue to be applied in accordance with current practice, controls and regulations.

The potential for public exposure to 1080 (or cyanide or traps) only occurs during the application step in the lifecycle.

For **direct** exposure routes (direct exposure of a person to a bait or trap), the assessment of potential effects on the public has been conducted for each application method as this determines how a person may come into contact with the substance. Application methods for 1080 and cyanide have been divided into either contained application methods (such as bait stations and bait bags where the poison is not open to the environment), or uncontained methods (such as aerial application, or application of pastes, gels to natural features). Contained application methods require an intentional act and some level of perseverance for a person to come into contact with the contents. Uncontained application methods provide no physical barrier to contact.

The potential for 1080 to enter a water system only occurs during aerial operations. The controls on aerial applications require that Ministry of Health approval be given for operations in catchment areas from which potable water is supplied, and in practice this means that aircraft flight patterns are routed to avoid major water bodies. However pellets may fall into smaller streams or ephemeral streams. The assessment of potential human exposure to 1080 in water has therefore been assessed for aerial operations only (which may be either pellet or coated baits). During ground operations, baits are not placed in or near water.

**Indirect** (secondary) effects occur when the exposure to the substance is not direct exposure but via another medium, for example, consumption of meat from an animal that has been poisoned or has been exposed to a sub-lethal dose of the poison. These indirect pathways have therefore been assessed only once in the register; the assessment applies to all formulations and all application methods.

### **Significant Effects**

Significant effects that have been identified in these registers have been discussed further in Section 4.2. The significant effects between the WITH 1080 and WITHOUT 1080 scenarios have been compared in the Overall Evaluation (Section 4.6 of the application).

BENEFITS REGISTER					
ID	Effect	How likely?	Magnitude of effect	Level of benefit	Commentary
<b>Benefits from control or eradication of bovine Tb</b>					
H-B1	Reduced chance of contracting Tb from close contact with infected animals (herds or feral) resulting in inhalation of contaminated aerosols.	Likely	Moderate	C	<p>On average, New Zealand has about 400 cases per year of tuberculosis (Ministry of Health 2002). In 2001 63.8% of notified cases of tuberculosis in New Zealand were hospitalised and 0.5% of notified cases resulted in fatalities (Sneyd et al. 2002). Tb in humans is curable if treated early with antibiotics (MOH 2004).</p> <p>Approximately 3% of Tb in humans is caused by bovine Tb (<i>Mycobacterium bovis</i>) (Ministry of Health 2002). Inhalation of contaminated aerosols is the most common source for humans contracting bovine Tb (McGinness, 1998). Most cases of bovine Tb in humans therefore occur as a result of people handling infected animals, e.g. contact with infected herds or with infected wild animals (possums, deer, pigs and mustelids). People most at risk are therefore farmers, trappers and hunters.</p> <p>The benefit of controlling bovine Tb is significant at an individual level (avoidance of serious illness or fatality, potential for further infection) and at a community level (removal of the source of infection). A reduction in the number of infected animals would reduce the chance of a person contracting Bovine Tb.</p> <p>1080 is the most effective means of controlling bovine Tb vector reservoirs (mainly possums). A recent study which looked into the causes of persistent low levels of vector-related bovine Tb in livestock (Porphyre et al. 2005) showed that aerial control had the most pronounced effect in reducing bovine Tb incidence in cattle, whereas farm-based control alone had no significant effect. The study showed that prior to aerial control, the risk of a farm being infected decreased in association with distance from forest area, however after aerial control, no such pattern existed. Managing possum populations for bovine Tb control is heavily reliant on the ability to reduce possum numbers over a large area in a short period of time, which is important to stop new outbreaks of Tb. As ground-based operations rarely provide coverage of a large area, aerial application of 1080 can be critical in reducing the spread of bovine Tb (i.e. it is the only vertebrate poison licensed for aerial application). It is expected there would be less bovine Tb if 1080 is available to control vector reservoirs (WITH 1080) than if cyanide and trapping methods were used alone (WITHOUT 1080). The number of people exposed to the disease through handling of infected animals or carcasses is limited (farmers, trappers and hunters) and is predicted to drop by 2015 with or without the use of 1080 – though exposure risks will be lower if 1080 is available.</p> <p><i>Risk Profile</i></p> <p>The likelihood of a human benefiting from the control of bovine Tb via application of 1080 is therefore LIKELY [a good chance that it may happen under normal operating conditions]. Taking into account the number of humans coming into contact with Tb infected animals, the magnitude of the effect is MODERATE [Minor benefits to individuals or medium term benefits to</p>

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BENEFITS REGISTER					
ID	Effect	How likely?	Magnitude of effect	Level of benefit	Commentary
					surrounding community], and the benefit is therefore C [Benefits are considerable but do not justify high costs or risks].
H-B2	Reduced chance of contracting Tb from consumption of milk and dairy products from infected herds.	Likely	Minor	B	<p>The risk of contracting Tb from pasteurised milk or dairy products is nil, therefore this benefit only applies to unpasteurised milk. It is expected there would be less bovine Tb if 1080 is available to control vector reservoirs than in a scenario WITHOUT 1080. The likelihood of benefit H-B2 is therefore LIKELY [a good chance that it may happen under normal operating conditions].</p> <p>The likelihood of human exposure to Tb through ingesting unpasteurised milk is restricted to a small portion of the population, namely dairy farmers and their workers. The magnitude of the effect is therefore MINOR [mild short term health benefits to identified and isolated groups], and the benefit is therefore B [either insignificant or minor benefit].</p>
H-B3	Reduced chance of contacting Tb through consumption of meat (farmed and feral) from infected animals	Highly Improbable	Minimal	A	<p>No evidence has been found that would implicate foods other than milk in the transmission of bovine Tb (Lake et al. 2002). Viable <i>M. bovis</i> cells do not survive in meat over temperatures of 60°C. The risk of human infection from consumption of meat if properly cooked is therefore considered to be very remote.</p> <p>It is expected there would be less bovine Tb if 1080 is available to control vector reservoirs than in a scenario WITHOUT 1080. However the likelihood of a beneficial effect of a reduced chance of humans contracting bovine Tb via consumption of infected meat is HIGHLY IMPROBABLE as no evidence has been found supporting meat consumption as a source of bovine Tb infection.</p> <p>The magnitude of the effect would be limited to humans consuming meat from infected animals that had not been cooked, and is therefore MINIMAL [no effects], and the benefit is A [either insignificant or minor benefit].</p>
<b>Benefits from reduction in pest numbers</b>					
H-B4	Reduced exposure to diseases and illness carried by pest species (excluding bovine Tb)	Likely	Minor	B	<p>Fewer pests results in fewer pests carrying disease, however this effect is considered an incidental benefit from a reduction in pest species that can potentially transfer disease to humans. Examples of diseases carried by pest species include (but are not limited to): plasmosis, pneumonia, hepatitis virus, and streptococcus. A reduction in pest species is LIKELY [a good chance that it may occur under normal operating conditions], however, the magnitude of the effect is MINOR [Mild reversible short-term effects in localised area], and the benefit is therefore B [either insignificant or minor benefit].</p>

REGISTER OF ADVERSE EFFECTS WITH 1080						
ID	Formulation	Activity	Potential Receptors and Description of Exposure to 1080 and 1080 FORMULATIONS	How likely?	Magnitude of effect	Level of risk
<b>TRANSPORTATION TO MANUFACTURING SITE</b>						
For transport activities, occupational (workplace) exposure only has been assessed as there is no public access to 1080 during transport.						
H-A1	Technical grade Active (solid powder form).	Transport by road from Port of Auckland to ACP Wanganui manufacturing plant.	<p><b>Transport operators</b> may be exposed to the active 1080 ingredient only in the improbable event of an accident that causes the release of 1080 from packaged goods. The technical grade active is in solid powder form and packaged in 10 kg plastic pails, which limits the potential for distribution of the substance during an accident. Transport of stock solution between the Animal Control Products (ACP) sites is in shatterproof containers (OSH 2002).</p> <p><i>Controls</i> All road transport of any hazardous substance must comply with the relevant HSNO Regulations (see Section 3.4) as well as the Land Transport Rule: Dangerous Goods 2005 Rule 45001/1, which sets out the requirements for the safe transport of dangerous goods on land in New Zealand. These controls cover the packaging, identification and documentation of goods for transport; the segregation of incompatible goods; transport procedures and the training and responsibilities of those involved in the transport of hazardous substances.</p> <p>Transport operators have their own procedures and controls, as required of all employers under the Health and Safety in Employment Act 1992, to ensure the health and safety of their employees. 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.</p>	Improbable	Minor	B
H-A2	Stock solution (200 g/L).	Transport by road from ACP Wanganui to ACP Waimate	<p>Vehicles that transport 1080 carry equipment to deal with small spillages up to 100 kg (broom, shovel, spare container, protective clothing) and an Emergency Response Plan is required for spillage quantities greater than 100kg or litres of 1080. Refer to the Transport Standards for the safe transportation vertebrate toxic agents, available at <a href="http://www.npca.org.nz/Toxin%20Use%20Guidelines.pdf">http://www.npca.org.nz/Toxin%20Use%20Guidelines.pdf</a>.</p> <p><i>Potential Exposure Pathways and Potential Effects</i> In the improbable event of an accidental spill resulting in exposure, humans could be exposed through direct skin contact or ingestion. As neither the technical grade active nor stock solution is volatile, there is no exposure via inhalation. These pathways have not been discussed in detail in this section as the likelihood of exposure is improbable. Transport operators are trained in the transportation of dangerous goods and are informed of the precautionary steps to take in the unlikely event of a spill. If necessary, regional or emergency authorities trained in emergency response would be called to attend any serious accident.</p>	Improbable	Minor	B

REGISTER OF ADVERSE EFFECTS WITH 1080						
ID	Formulation	Activity	Potential Receptors and Description of Exposure to 1080 and 1080 FORMULATIONS	How likely?	Magnitude of effect	Level of risk
			<p><i>Risk Profile</i></p> <p>The likelihood of human exposure to 1080 occurring during transport is therefore considered to be IMPROBABLE [only occurring in very exceptional circumstances]; the magnitude of effect would be MINOR [mild reversible short-term effects in localised area], and the risk is therefore assessed as B [either insignificant or minor and not warranting further assessment].</p>			
<b>MANUFACTURE</b>						
For manufacturing activities, occupational (workplace) exposure only has been assessed as there is no public access to 1080 during this activity.						
<b>Preparation of 1080 products</b>						
H-A3	Technical grade active + stock solution 200 g/L.	Preparation of stock solution 200 g/L (in 5 L containers).	<p><b>Factory workers</b> at the manufacturing facility may be exposed to 1080 during manufacturing. Potential exposure routes are through accidental skin contact, inhalation of dust or ingestion. Receptors and the exposure pathways are similar for all formulations, and for the purpose of assessing overall risk, the formulation containing the highest concentration of 1080 has been assessed (stock solution 200 g/L).</p> <p><i>Controls</i></p> <p>The manufacture and use of hazardous substances must comply with the relevant HSNO Regulations for that substance, and the substance registration as approved by the ACVM Group, NZFSA. The HSNO controls applicable to 1080 formulations are contained in Section 3.4.</p> <p>In addition, the manufacturers (ACP) have their own procedures and controls to ensure the health and safety of their employees, as required of all employers under the Health and Safety in Employment Act 1992. These include strict operating procedures, monitoring of the workplace, and use of appropriate Personal Protective Equipment (PPE) including gloves, coveralls and respirators. ACP follow <i>Guidelines for the Safe Use of Monosodium Fluoroacetate (1080)</i> (OSH 2002) and health surveillance of their employees is conducted routinely in accordance with these guidelines. Staff who process the stock solution (by mixing the 1080 powder with water) wear fully-waterproof suits, protective gloves, boots, and full-face respirators. Staff who process the 1080 products (pellets, pastes, and gels) wear overalls, protective gloves, boots and filter masks.</p> <p><i>Potential Exposure Pathways</i></p> <p><i>Ingestion of Technical grade Active, Stock solution, Pellets, Pastes, Gels.</i></p> <p>If inadvertent ingestion was to occur, the LD<sub>50</sub> value used for HSNO classification for humans is 2.0 mg/kgbw (Section 3.3). A person weighing 60 kg would need to eat about thirteen 6-gram baits or seven 12-gram baits (containing 0.15% 1080) to receive the LD<sub>50</sub> dose of 1080. The stock solution is the most concentrated 1080 formulation, and a person weighing 60 kg would need to swallow 0.6 mL to receive the LD<sub>50</sub> dose, hence strict use of PPE is enforced (see above).</p>	Unlikely	Minor	D
H-A4	Pellets (all concentrations) + stock solution 200 g/L.	Preparation of pellets 0.4-0.8, 1.0, 1.5-2.0 g/kg (in 25 kg bags).				
H-A5	Paste (all concentrations) + stock solution 200 g/L.	Preparation of pastes 1.5, 50, 100 g/kg (in 20 kg plastic pails).				
H-A6	Gels (all concentrations) + stock solution 200g/L.	Preparation of gels 1.5, 50, 100 g/kg (in 20 kg plastic pails).				

REGISTER OF ADVERSE EFFECTS WITH 1080						
ID	Formulation	Activity	Potential Receptors and Description of Exposure to 1080 and 1080 FORMULATIONS	How likely?	Magnitude of effect	Level of risk
			<p><i>Inhalation</i> There is potential for exposure to dust generated during the manufacture of 1080 pellets. There is no published information on the LC<sub>50</sub> for 1080 in dust or mist, however dust masks are worn to prevent any potential exposure via this route.</p> <p><i>Dermal</i> Dermal (skin) exposure is a less significant exposure route. Research on skin sensitisation, and skin and eye irritation concluded that 1080 is poorly absorbed through the skin (Fagerstone et al. 1994). The dermal LD<sub>50</sub> at 300 mg/kg. Exposure guidelines (Threshold Limit Values, TLV) for 1080 have been set in USA, with a Time-weighted average (TLV-TWA) of 0.05 mg/m<sup>3</sup> for skin exposure.</p> <p><i>Potential Effects</i> Relatively few cases of human poisoning (accidental or deliberate) have been reported in the literature (22 cases, 16 of which were fatal) (Harrison et al. 1952; Brockman et al. 1955; Trabes et al. 1983; Ellenhorn &amp; Barceloux 1988; Anon. 1992). Cases of acute human poisoning have been reported outside New Zealand and have generally resulted from accidental ingestion of a pest control product by children or deliberate ingestion by adults (AHB 2003). In humans, death from 1080 ingestion would result from cardiac or respiratory failure. There is a delay of at least half an hour and often several hours before the onset of symptoms following swallowing.</p> <p>For manufacturing workers, the BEI (Biological Exposure Index) is the key indicator of occupational exposure to 1080, which is measured by urine testing of employees who may potentially be exposed during the manufacture or handling of 1080. A BEI of 15 µg/L (0.015 ppm) for 1080 has been set by OSH New Zealand (OSH 2002). This level includes a large precautionary safety factor and health risks at this exposure level will be extremely low. If urine levels are found to exceed the BEI for the first time, controls and individual work practices are evaluated and corrected. If the BEI is exceeded, workers are temporarily suspended from work and given a medical assessment, and work control measures are reviewed (OSH 2002). A study which monitored occupational exposure (from the two manufacturing sites) during manufacture of 1080 baits in 2002 indicated that 10 workers (out of 53 tested) had instances where levels were above the BEI (Fisher et al. 2002). The exact source or route of exposure could not be identified, but was assumed to be failure to wear PPE correctly. Continuation of worker monitoring against the BEI does provide a means to ensure that 1080 handling practices and protective equipment minimise worker exposure to acceptable levels (Fisher et al. 2002). Research conducted in New Zealand that relates specifically to occupational exposure concluded that 74% of the workers monitored were protected from most exposure during the majority of procedures (Eason et al. 2000).</p>			

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REGISTER OF ADVERSE EFFECTS WITH 1080						
ID	Formulation	Activity	Potential Receptors and Description of Exposure to 1080 and 1080 FORMULATIONS	How likely?	Magnitude of effect	Level of risk
			<p><i>Risk Profile</i></p> <p>The likelihood of exposure to 1080 occurring during manufacture is therefore considered to be UNLIKELY [could occur but is not expected to occur under normal operating conditions], the magnitude of any effects is MINOR [mild reversible short-term effects in localised area] and the risk is therefore assessed as D [risks within the ALARP band and broadly classed as tolerable subject to ongoing monitoring and control].</p>			
<b>Disposal / off-site discharges (normal manufacturing process)</b>						
H-A7	Active and traces of all formulations may be present on disposable items, packaging etc.	Solid Waste disposed to landfill, including packaging etc.	<p><b>Transport operators and waste disposal contractors</b> may be exposed to 1080 in solid waste products. The potential exposure pathways resulting from human exposure during the transportation and disposal of 1080 packaging to the landfill are inadvertent ingestion, dermal contact and inhalation of dust.</p> <p>1080 packaging is disposed of to a landfill in Wanganui. Appropriate approvals are held for this activity. The controls and potential effects for this activity are similar to those for manufacture and transport (H-A1 through A6).</p> <p>The likelihood of exposure to 1080 occurring during transportation and disposal of 1080 packaging to the landfill is therefore considered to be VERY UNLIKELY [considered only to occur in very unusual circumstances]; the magnitude of effect would be MINOR [mild reversible short-term effects in localised area], and the risk is therefore assessed as C [risks within the ALARP band and broadly classed as tolerable subject to ongoing monitoring and control].</p>	Very unlikely	Minor	C
H-A8	Active, stock solution 200 g/L (in solution, diluted with washwater).	Wastewater collected in waste tank and disposed of to the local sewage system.	<p><b>Transport operators and waste disposal contractors</b> may be exposed to 1080 in wastewater products. All liquid discharge (which includes small remnants of pellets, pastes and gels) from inside the manufacturing plant drains into an underground storage tank, which is routinely emptied and collected by waste contractors using large trucks. The liquid waste is then transported to the local sewage plant and processed through the sewage system.</p> <p>Potential exposure to 1080 would only occur in the event of an accident. Pathways resulting from human exposure during the collection, transportation and disposal of 1080 stock solution to the local sewage plant are inadvertent ingestion and dermal contact. The controls and potential effects for this activity are similar to those for manufacture and transport (H-A1 through A6).</p> <p>The likelihood of exposure to 1080 occurring during collection, transportation and disposal of 1080 waste water to the local sewage plant is therefore considered to be VERY UNLIKELY [considered only to occur in very unusual circumstances]; the magnitude of effect would be MINOR [mild reversible short-term effects in localised area], and the risk is therefore assessed as C [risks within the ALARP band and broadly classed as tolerable subject to ongoing monitoring and control].</p>	Very unlikely	Minor	C

REGISTER OF ADVERSE EFFECTS WITH 1080						
ID	Formulation	Activity	Potential Receptors and Description of Exposure to 1080 and 1080 FORMULATIONS	How likely?	Magnitude of effect	Level of risk
<b>Site spills (abnormal event)</b>						
H-A9	Active, stock solution 200 g/L, and solid formulations (pellets, gels, pastes).	Accidental spill at the ACP Manufacturing site.	<p><b>Factory workers</b> may be exposed to 1080 in the event of an accidental spill within the manufacturing plant. Spills are not expected to occur during the normal manufacturing process. However, if a spill does occur on-site, the stock solution is drained and collected in the underground storage tank (as detailed above), and any solid form of 1080 is either recycled, or if it has been exposed to water, will drain to the underground storage tank.</p> <p>The potential exposure pathways resulting from human exposure in the unlikely event of a spill occurring at the manufacturing site are inadvertent ingestion, inhalation and dermal contact. Staff are trained and educated in the handling of toxic substances, and depending on the formulation (whether in solid or liquid form), potential exposure in the event of a spill is prevented with the use of PPE. The controls and potential effects are similar to those for manufacture (H-A3 through A6).</p> <p>The likelihood of exposure to 1080 occurring in the event of a spill is therefore considered to be VERY UNLIKELY [considered only to occur in very unusual circumstances], the magnitude of effect would be MINOR [mild reversible short-term effects in localised area] and the risk is therefore assessed as C [risks within the ALARP band (As Low As Reasonably Practicable) and broadly classed as tolerable subject to ongoing monitoring and control].</p>	Very unlikely	Minor	C
<b>TRANSPORTATION FROM FACTORY SITE TO APPLICATION SITE</b>						
Occupational (workplace) exposure only has been assessed as there is no public access to 1080 during this activity						
H-A10	Pellets (all concentrations); Paste (all concentrations); Gels (all concentrations); stock solution 200 g/L.	Transportation of packaged goods by road from the manufacturing site to the application site.	<p>1080 formulations are transported throughout the country via road and ferry. <b>Transport operators</b> may be exposed to the active 1080 ingredient only in the event of an accident resulting in the release of and from packaged goods. The potential exposure pathways resulting in human exposure in the event of a spill are inadvertent ingestion and dermal contact. The controls and potential effects for this activity are the same as for H-A1 and H-A2.</p> <p>The likelihood of exposure to 1080 occurring for this activity is therefore considered to be IMPROBABLE [only occurring in very exceptional circumstances]; the magnitude of effect would be MINOR [mild reversible short-term effects in localised area], and the risk is therefore assessed as B [either insignificant or minor and not warranting further assessment].</p>	Improbable	Minor	B
<b>APPLICATION OF 1080 - AERIAL</b>						
			<b>OCCUPATIONAL EXPOSURE</b>			
H-A11	Pellet formulations (0.4-0.8, 1.5-2.0 g/kg).	Emptying of 1080 pellets from bags at	<b>Pest control workers</b> may be exposed to 1080 pellets when transferring the baits to the aircraft or loader bucket, particularly through inhalation of airborne dust generated when loading the bags of dry pellets. The action of emptying bags of dry pellets, often at face level, into the aircraft or loader bucket and the proximity of the hopper to the aircraft propeller or helicopter rotor blade can	Unlikely	Minor	D

REGISTER OF ADVERSE EFFECTS WITH 1080						
ID	Formulation	Activity	Potential Receptors and Description of Exposure to 1080 and 1080 FORMULATIONS	How likely?	Magnitude of effect	Level of risk
		operation site. Pellets arrive at site pre-prepared. Bags of pellets are loaded directly into hopper.	<p>increase the dispersion of dust or contaminated soil particles, due to induced air currents (OSH 2002). There may also be the possibility of inadvertent dermal exposure and ingestion either directly from contaminated hands or indirectly from clothing.</p> <p><i>Controls</i> The use of hazardous substances must comply with the relevant HSNO Regulations for that substance, and the substance registration as approved by the ACVM Group, NZFSA. The HSNO controls applicable to 1080 formulations are contained in Section 3.4. In particular, 1080 can only be used by licensed operators holding an Approved Handlers Certificate <i>and</i> Controlled Substance Licence.</p> <p>The pest control agencies and pest control contractors have their own procedures and controls, as required of all employers under the Health and Safety in Employment Act 1992, to ensure the health and safety of their employees. These include strict operating procedures, the use of appropriate PPE (including respirators, overalls, gloves, gumboots, eye protection and hearing protection when preparing pellets for aerial application) and monitoring of exposure.</p> <p><i>Potential Effects</i> The potential effects are the same as for H-A3 through A6. A study which analysed occupational exposure to 1080 revealed that during two aerial cereal pellet operations none of the 29 urine samples were above the BEI (Eason et al. 2002a). In a study by O'Connor et al. (2000), 6 out of 10 workers exposed to aerial pellet operations had a level 2 exposure (1080 blood concentrations below the limit of detection (0.006 µg/mL) and urine levels below 0.02 µg/mL) and the other 4 people had no measurable 1080 (Level 1 Exposure). Both levels of exposure remain well below the BEI of 15 µg/mL adopted by OSH as the safe level of exposure.</p> <p><i>Risk Profile</i> Based on the above, the likelihood of exposure occurring during aerial application is UNLIKELY [could occur, but is not expected to occur under normal operating conditions], as aerial operations occur infrequently - pest control workers are only exposed to 1080 for approximately two-three months during the year. The magnitude of effect for occupational exposure occurring during application is MINOR [mild reversible short-term effects in localised area]. The risk is therefore assessed as D [risks ALARP and broadly classed as tolerable subject to ongoing monitoring and control].</p>			
H-A12	<b>Stock solution (200 g/L) and coated baits</b>	Stock solution diluted from 200 g/L to 100 g/L (at	The spraying of baits with stock solution takes place in an enclosed system, however the workers may be exposed to stock solution when transferring coated baits to the aircraft or loader bucket, particularly as the stock solution can drip off the baits. The freshly cut carrot surfaces may be moist and not completely absorb all the 1080 solution (OSH 2002). There may also be the	Unlikely	Minor	D

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ID	Formulation	Activity	Potential Receptors and Description of Exposure to 1080 and 1080 FORMULATIONS	How likely?	Magnitude of effect	Level of risk
		<p>application site). Uncoated baits (mostly carrots but grain also used) are diced and coated with diluted stock solution. Coated Baits are loaded into hopper.</p>	<p>possibility of inadvertent ingestion either directly from contaminated hands or indirectly from clothing.</p> <p><i>Controls</i> The use of hazardous substances must comply with the relevant HSNO Regulations for that substance, and the substance registration as approved by the ACVM Group, NZFSA. The HSNO controls applicable to 1080 formulations are contained in Section 3.4. In particular, 1080 can only be used by licensed operators holding an Approved Handlers Certificate and Controlled Substance Licence.</p> <p>In addition, the pest control agencies and pest control contractors have their own procedures and controls, as required of all employers under the Health and Safety in Employment Act 1992, to ensure the health and safety of their employees. These include strict operating procedures, the use of appropriate PPE (including respirators, overalls, gloves, gumboots, eye protection and hearing protection when preparing coated baits for aerial application) and monitoring of exposure.</p> <p><i>Potential Effects</i> The potential effects are the same as for as for H-A3 through A6. Research by Fisher et al. (2002) looked at occupational exposure during both preparation of 1080 cereal pellets and coated baits, and found that although urine samples of workers exposed to 1080-cereal pellets did not exceed the BEI, some urine samples of workers handling 1080-coated baits did exceed the exposure standards. The possibility of sample contamination in the field could not be ruled out in this study, and negligence by some workers to wear the appropriate PPE was noted; therefore, BEI results may not necessarily represent typical exposure levels under normal operations when all appropriate PPE is worn. One other study that assessed occupational exposure to 1080 revealed that during two aerial carrot bait operations, 5 out of 9 aerial carrot operation field workers sampled had a Level 2 Exposure (blood concentrations of 1080 were below the limit of detection and urine levels &lt;0.02 µg/mL), and the other 4 people had a Level 3 exposure (blood concentrations of 1080 of 0.006 µg/mL and urine levels ≥ 0.02 µg/mL), however these levels were well below the BEI of 15 µg/mL (O'Connor et al, 2000).</p> <p><i>Risk Profile</i> Based on the above, the likelihood of exposure occurring during aerial application is UNLIKELY [could occur, but is not expected to occur under normal operating conditions], particularly as aerial operations occur infrequently and pest control workers are only exposed to 1080 intermittently – approximately two to three months in the year. The magnitude of effect for occupational exposure occurring during application is MINOR [mild reversible short-term effects in localised area], and the risk is therefore assessed as D [risks ALARP and broadly classed as tolerable subject to ongoing monitoring and control].</p>			

REGISTER OF ADVERSE EFFECTS WITH 1080						
ID	Formulation	Activity	Potential Receptors and Description of Exposure to 1080 and 1080 FORMULATIONS	How likely?	Magnitude of effect	Level of risk
			<b>PUBLIC EXPOSURE</b>			
H-A13	Pellet formulations (0.4-0.8, 1.5-2.0 g/kg) and 1080-coated baits	Aerial Application	<p><b>Direct Contact with 1080 Baits</b></p> <p><b>The public</b> (hunters, farmers and the general public) may be exposed to 1080 baits if they enter the treatment area before clearance is given by the operator, or in the unlikely event that baits remain intact in the environment for a long period of time (for which time the 1080 baits remain toxic). 1080 does not accumulate in soil as microbial activity either within the bait or in the soil degrades the substance into harmless by-products relatively quickly (Green 2004; Parfitt et al 1994; Eason 1993). This usually takes about 1-4 weeks (Parfitt et al. 1994), however in colder dryer weather degradation is slower (Green 2004; Parfitt et al. 1994). If 1080 is not removed from soil by microbial activity it is likely to be removed from soil by leaching (Parfitt et al. 1994). A study has calculated that most of the 1080 content of large cereal baits is removed following 150 – 200 mm of natural rainfall (Thomas et al. 2004). Other work with similar conclusions on the relatively quick breakdown of cereal pellets exposed to favourable conditions has been undertaken by Booth et al. (1999), Bowen et al. (1995), Ogilvie et al (2004), Eason et al (1991a and b) and Wright (2004).</p> <p>To further confirm the minimal impact of pellets applied aerially studies have shown that residues of 1080 are small. Residues from one field trial (1.5g/kg 1080 carrot coated baits) and after 3 aerial applications (1.5g/kg 1080 pellets) were between 0.0-0.6 mg/kg on the day of application. Concentrations of 1080 were highest 5 or more days later (0 - 0.16 mg/kg for the carrot bait field trial and as high as 0.19 mg/kg for the cereal pellet studies) and decreased thereafter (Spurr et al. 2002; Wright et al. 2002).</p> <p>Public access is likely to be prohibited to trampers, hunters, recreational walkers, farmers and trappers. There is potential for public exposure via inadvertent ingestion and dermal exposure of baits in the application area; risk of public exposure via inhalation is negligible.</p> <p><i>Controls</i> The use of hazardous substances must comply with the relevant HSNO Regulations for that substance, and the substance registration as approved by the ACVM Group, NZFSA. The HSNO controls applicable to 1080 formulations are contained in Section 3.4</p> <p>Existing controls on aerial 1080 operations include distance restrictions from stocked paddocks, residential dwellings, and any other restricted fly zones specified by consent providers. Permission is required from DOC (on DOC-controlled land), who has the authority to impose additional controls. Permission must also be obtained from all landowners, and letters are sent to people nearby.</p> <p>Permission is required from the Medical Officer of Health (MoH) where there is a risk to public</p>	Very unlikely	Moderate	D

REGISTER OF ADVERSE EFFECTS WITH 1080						
ID	Formulation	Activity	Potential Receptors and Description of Exposure to 1080 and 1080 FORMULATIONS	How likely?	Magnitude of effect	Level of risk
			<p>health i.e. where the public might normally have access. Certain times of the year such as public holidays are avoided, and controls to avoid public exposure are particularly stringent in peri-urban areas. Application to the MoH requires the pest control operator to identify and assess risks relating to access areas, tramping huts, tracks and roads, exclusion areas, nearby schools, the completion of an Assessment of Environmental Effects, and details of actions taken on notification as well as community and Maori consultation. A model application form can be viewed at <a href="http://www.ermanz.govt.nz/resources/publications/word/MoH-VTA.doc">http://www.ermanz.govt.nz/resources/publications/word/MoH-VTA.doc</a>.</p> <p>During aerial operations, the aerial contractor receives a digital copy of the treatment boundary and exclusion zones, which are uploaded to the aircraft's GPS system prior to applying the substance. Prior to aerial application, the operation controller informs the aerial contractor on the treatment area, sensitive boundaries, and provides copies of relevant resource consents, permissions, and a hard copy of the base map. Maps showing the intended area poisoning are also required for the notification process, and confirmed with adjoining landowners.</p> <p>Warning signs must be placed at all entrances to areas where baits will be used. As 1080 can only be sold to and/or used by a person holding a controlled substances licence, further requirements set by the ACVM are that signs must be posted in prominent places around the perimeter of the treated area, not just access points. Sign information must be in simple language and readable from 10 metres. All warning signs must show the name of the person or body who is applying the substance, skull and crossbones, the name and nature of bait, colour, the word "POISON", and the intended date of application and rules to reduce risk. The warning signs shall remain until such time that the substance is no longer toxic or when baits have been retrieved from the place; unless legal obligation requires the signs to remain in place for a longer period of time.</p> <p><i>Potential Effects</i> Relatively few cases of human poisoning (accidental or deliberate) have been reported on an international scale (22 cases, 16 of which were fatal) (Harrison et al. 1952; Brockman et al. 1955; Trabes et al. 1983; Ellenhorn &amp; Barceloux 1988; Anon. 1992). Cases of acute human poisoning reported outside New Zealand have generally resulted either from accidental ingestion of a pest control product by children or deliberate ingestion by adults (AHB 2003); however no New Zealand cases have been reported.</p> <p>In humans, death from 1080 ingestion would result from cardiac or respiratory failure. There is a delay of at least half an hour and often several hours before the onset of symptoms following swallowing. If inadvertent ingestion was to occur, the LD<sub>50</sub> value used for HSNO classification for humans is 2.0 mg/kgbw (see Section 3.3). A person weighing 60 kg would need to eat about thirteen 6-gram baits or seven 12-gram baits (containing 0.15% 1080) to receive the LD<sub>50</sub> dose of 1080. A child weighing 20 kg would need to eat about four 6-gram baits or two 12-gram baits</p>			

## Section 4.1C Effects on Human Health and Safety

REGISTER OF ADVERSE EFFECTS WITH 1080						
ID	Formulation	Activity	Potential Receptors and Description of Exposure to 1080 and 1080 FORMULATIONS	How likely?	Magnitude of effect	Level of risk
			<p>(containing 0.15% 1080) to receive the LD<sub>50</sub> dose. If a person was to ingest a sub-lethal dose, 1080 will be metabolised and excreted in urine in the same manner as in target pests (NZFSA, 2005).</p> <p><i>Risk Profile</i> The likelihood of public exposure to 1080 is less likely than occupational exposure. Based on the above, the likelihood of exposure to the wider community under standard 1080 operations is VERY UNLIKELY [considered only to occur in very unusual circumstances]; the effect could be MODERATE [minor irreversible effects to individuals, or reversible medium term effects in surrounding community], and the risk is therefore assessed as D [risks ALARP and broadly classed as tolerable subject to ongoing monitoring and control].</p>			
H-A14	Pellet formulations (0.4-0.8, 1.5-2.0 g/kg) and 1080-coated baits	Aerial Application	<p><b>Ingestion of 1080-contaminated water</b> <b>The public</b> may be indirectly exposed to 1080 through ingestion of water into which 1080 baits fall. Contamination of surface water in water supply catchments during aerial operations is the most significant potential exposure route for the general public (Eason et al. 1999). Other potential sources of contamination include carcasses of poisoned animals being carried into water bodies, and accidental spillage of baits into water during transport of 1080.</p> <p><i>Risk Profile</i> The likelihood of adverse health effects from the consumption of 1080-contaminated water is IMPROBABLE [only occurring in very exceptional circumstances]. The level of adverse effect from contaminated water at the concentrations observed is therefore considered to be MINIMAL [no effects], and the risk is therefore assessed as A [either insignificant or minor and not warranting further assessment]. However, as the matter is considered to be publicly contentious, a more detailed discussion is included in Section 4.2C.</p>	Improbable	Minimal	A
<b>APPLICATION OF 1080 – GROUND</b>						
			<p><b>OCCUPATIONAL EXPOSURE</b> The assessment of occupational exposure to 1080 formulations has been conducted on a formulation-by-formulation basis as they relate to specific activities (application methods) and associated exposure pathways.</p>			
H-A15	Ground Application of pellets (0.4-0.8, 1.0, 1.5-2.0 g/kg)	Hand-laying – sown directly onto the ground or with a mechanical spreader. Contained –	<p><b>Pest Control Workers</b> may be exposed to 1080 pellets during ground application through inadvertent inhalation, ingestion or dermal exposure either directly from contaminated hands or indirectly from clothing. Baits are loaded from larger bags into smaller carry bags to take out in the field.</p> <p><i>Controls</i> The use of hazardous substances must comply with the relevant HSNO Regulations for that substance, and the substance registration as approved by the ACVM Group, NZFSA. The HSNO</p>	Very unlikely	Minor	C

## Section 4.1C Effects on Human Health and Safety

REGISTER OF ADVERSE EFFECTS WITH 1080						
ID	Formulation	Activity	Potential Receptors and Description of Exposure to 1080 and 1080 FORMULATIONS	How likely?	Magnitude of effect	Level of risk
		<p>Bait Station</p> <p>All pellets may be used in ground operations. There is no specific preparation required for pellets prior to application</p>	<p>controls applicable to 1080 formulations are contained in Section 3.4. In particular, 1080 can only be used by licensed operators holding an Approved Handlers Certificate and Controlled Substance Licence.</p> <p>The pest control agencies and pest control contractors have their own procedures and controls, as required of all employers under the Health and Safety in Employment Act 1992, to ensure the health and safety of their employees. These include strict operating procedures, the use of appropriate PPE (including long sleeves, gloves, boots) and monitoring of exposure. All 1080 packages must have the label intact except pre-bagged bait, which must be clearly marked to identify contents, and be carried in a backpack with the VTA label securely attached to the outside of the backpack and Safety Data Sheet (SDS) readily available. When sacks or backpacks are used, a plastic liner is placed inside them. All equipment used to handle, dispense or carry (e.g., bait station, back packs etc) must be fit for purpose and be free of defects (e.g. no rips, tears, holes or cracks).</p> <p><i>Potential Exposure Pathways and Effects</i> The potential effects are the same as for manufacturing activities, however there is no published information relating directly to occupational exposure during ground application of 1080 pellets. Research which assesses occupational exposure during the preparation of pellets at the loading site during aerial operations is not representative of ground operations as ground operations do not include the risk of exposure via dust inhalation generated by the aircraft, and much smaller quantities are dealt with in the field (compared with H-A11).</p> <p><i>Risk Profile</i> Based on the above, the likelihood of exposure occurring during ground application of 1080 pellets is VERY UNLIKELY [considered only to occur in very unusual circumstances]; the magnitude of effect for occupational exposure is MINOR [mild reversible short-term effects in localised area], and the risk is therefore assessed as C [risks within the ALARP band and broadly classed as tolerable subject to ongoing monitoring and control].</p>			
H-A16	Ground Application of coated baits (coated with stock solution)	<p>Hand-laying – sown directly onto the ground or with a mechanical spreader.</p> <p>Contained – Bait Station</p>	<p><b>Pest Control Workers</b> may be exposed to 1080-coated baits during ground application through inadvertent inhalation, ingestion or dermal exposure either directly from contaminated hands or indirectly from clothing.</p> <p><i>Controls</i> Refer to H-A15 for controls relating specifically to ground application of 1080 formulations. The use of hazardous substances must comply with the relevant HSNO Regulations for that substance, and the substance registration as approved by the ACVM Group, NZFSA. The HSNO controls applicable to 1080 formulations are contained in Section 3.4. In particular, 1080 can only be used by licensed operators holding an Approved Handlers Certificate and Controlled</p>	Very unlikely	Minor	C

REGISTER OF ADVERSE EFFECTS WITH 1080						
ID	Formulation	Activity	Potential Receptors and Description of Exposure to 1080 and 1080 FORMULATIONS	How likely?	Magnitude of effect	Level of risk
			<p>Substance Licence</p> <p><i>Potential Exposure Pathways and Effects</i> The potential exposure pathways are the same as for manufacturing. There is no published information relating directly to occupational exposure during ground application of 1080-coated baits. Research which assesses occupational exposure during the preparation of coated baits at the loading site during aerial operations is not representative of ground operations as workers carrying out ground application are handling much smaller quantities in the field.</p> <p><i>Risk Profile</i> Based on the above, the likelihood of exposure occurring during ground application of 1080-coated baits is VERY UNLIKELY [considered only to occur in very unusual circumstances]; the magnitude of effect for occupational exposure is MINOR [mild reversible short-term effects in localised area], and the risk is therefore assessed as C [risks ALARP and broadly classed as tolerable subject to ongoing monitoring and control].</p>			
H-A17	Ground Application of Paste (0.6-0.8, 1.5, 10 g/kg 1080).	<p>Hand-laying – on tin lids, cardboard squares, and spits.</p> <p>Contained – bait bags.</p>	<p><b>Pest Control Workers</b> may be exposed to 1080 paste during ground application through inadvertent ingestion or dermal exposure either directly from contaminated hands or indirectly from clothing. Paste is pressure-squirted (pumped) directly into bait bags and hand-laying in the field is carried out using a “jam gun” which minimises occupational exposure.</p> <p><i>Controls</i> Refer to H-A15 for controls relating specifically to ground application of 1080 formulations. The use of hazardous substances must comply with the relevant HSNO Regulations for that substance, and the substance registration as approved by the ACVM Group, NZFSA. The HSNO controls applicable to 1080 formulations are contained in Section 3.4. In particular, 1080 can only be used by licensed operators holding an Approved Handlers Certificate and Controlled Substance Licence.</p> <p><i>Potential Exposure Pathways and Effects</i> The potential effects are the same as for manufacturing activities. A study carried out by O’Connor et al. (2001) assessed the degree of worker exposure to 1080 during the distribution of paste bait and found that all workers in the study had a minimal level exposure - urine concentrations were detected at below 0.02 µg/mL, a level well below the BEI of 15 µg/mL (OSH 2002).</p> <p><i>Risk Profile</i> Based on the above, the likelihood of exposure occurring during application of paste is VERY UNLIKELY [considered only to occur in very unusual circumstances]; the magnitude of effect for occupational exposure is MINOR [mild reversible short-term effects in localised area], and the risk is therefore assessed as C [risks ALARP and broadly classed as tolerable subject to ongoing</p>	Very unlikely	Minor	C

## Section 4.1C Effects on Human Health and Safety

REGISTER OF ADVERSE EFFECTS WITH 1080						
ID	Formulation	Activity	Potential Receptors and Description of Exposure to 1080 and 1080 FORMULATIONS	How likely?	Magnitude of effect	Level of risk
			monitoring and control].			
H-A18	Ground Application of Gel (1.5, 50, 100 g/kg 1080).  1.5 g/kg formula is used solely in the bait station.  The 50 g/kg and 100 g/kg formulations are applied on vegetation.	Hand-laying – on vegetation.  Contained – bait station.	<p><b>Pest Control Workers</b> may be exposed to 1080 gel during ground application through inadvertent inhalation, ingestion or dermal exposure either directly from contaminated hands or indirectly from clothing. Gel is hand-laid on vegetation in small pea-sized pieces (approximately 0.4 grams).</p> <p><i>Controls</i> The use of hazardous substances must comply with the relevant HSNO Regulations for that substance, and the substance registration as approved by the ACVM Group, NZFSA. The HSNO controls applicable to 1080 formulations are contained in Section 3.4. In particular, 1080 can only be used by licensed operators holding an Approved Handlers Certificate and Controlled Substance Licence. Refer to H-A15 for further controls relating specifically to ground application of 1080 formulations.</p> <p>The pest control agencies and pest control contractors have their own procedures and controls, as required of all employers under the Health and Safety in Employment Act 1992, to ensure the health and safety of their employees. These include strict operating procedures, the use of appropriate PPE (including long sleeves, gloves, boots) and monitoring of exposure.</p> <p><i>Potential Exposure Pathways and Effects</i> The potential effects are the same as for manufacturing activities. There is no published information relating directly to occupational exposure during application of 1080 gel formulations.</p> <p><i>Risk Profile</i> Based on the above, the likelihood of exposure occurring during ground application of 1080 gels is VERY UNLIKELY [considered only to occur in very unusual circumstances]. The magnitude of effect for occupational exposure occurring is MINOR [mild reversible short-term effects in localised area]. The risk is therefore assessed as C [risks ALARP and broadly classed as tolerable subject to ongoing monitoring and control].</p>	Very unlikely	Minor	C
			<p><b>PUBLIC EXPOSURE</b></p> <p>The assessment of public exposure to 1080 formulations applied via ground control has been conducted on an application basis, as the activity (application method) will ultimately determine the likelihood of public exposure to the poison.</p>			
H-A19	All formulations	All contained application methods	<p><b>Direct Contact with 1080 Baits</b></p> <p><b>The public</b> (hunters, farmers and the general public) may be exposed to 1080 baits if they enter the treatment area before clearance is given by the operator, or in the unlikely event that baits</p>	Improbable	Moderate	C

REGISTER OF ADVERSE EFFECTS WITH 1080						
ID	Formulation	Activity	Potential Receptors and Description of Exposure to 1080 and 1080 FORMULATIONS	How likely?	Magnitude of effect	Level of risk
			<p>remain intact in the environment for a long period of time (for which time the 1080 baits remains toxic). Public access is likely to be prohibited to trappers, hunters, recreational walkers, farmers and trappers. There is potential for public exposure via inadvertent ingestion and dermal exposure of baits in the application area; public exposure via inhalation is negligible as the formulations are solid and not volatile.</p> <p>Numerous studies indicate that 1080 degrades rapidly in the environment (Booth et al. 1999; Bowen et al. 1995; Ogilvie et al 2004; Eason et al 1991(a and b); Wright 2004). 1080 does not accumulate in soil as microbial activity either within the bait or in the soil degrades the substance into harmless by-products relatively quickly (Green 2004; Parfitt et al. 1994; Eason 1993). This usually takes about 1-4 weeks (Parfitt et al. 1994), however in colder dryer weather degradation is slower (Green 2004; Parfitt et al. 1994). If 1080 is not removed from soil by microbial activity it is likely to be removed from soil by leaching (Parfitt et al. 1994).</p> <p><i>Controls</i></p> <p>The use of hazardous substances must comply with the relevant HSNO Regulations for that substance, and the substance registration as approved by the ACVM Group, NZFSA. The HSNO controls applicable to 1080 formulations are contained in Section 3.4</p> <p>Prior to ground operations, the operator receives a copy of the base map, and is informed of specific sensitive boundaries and exclusion areas.</p> <p>Permission is required from DOC (on DOC-controlled land), who has the authority to impose additional controls. Permission must also be obtained from all landowners.</p> <p>Permission is required from the Medical Officer of Health (MoH) where there is a risk to public health i.e. where the public might normally have access. Certain times of the year such as public holidays are avoided, and controls to avoid public exposure are particularly stringent in peri-urban areas. Application to the MoH requires the pest control operator to identify and assess risks relating to access areas, tramping huts, tracks and roads, exclusion areas, nearby schools, the completion of an Assessment of Environmental Effects, and details of actions taken on notification as well as community and Maori consultation. A model application form can be viewed at <a href="http://www.ermanz.govt.nz/resources/publications/word/MoH-VTA.doc">http://www.ermanz.govt.nz/resources/publications/word/MoH-VTA.doc</a>.</p> <p>Warning signs must be placed at all entrances to areas where baits will be used. As 1080 can only be sold to and/or used by a person holding a controlled substances licence then further requirements set by the ACVM are that signs must be posted in prominent places around the perimeter of the treated area, not just access points. Sign information must be in simple language and readable from 10 metres. All warning signs must show the name of the person or body who is applying the substance, skull and crossbones, the name and nature of bait, colour, the word "POISON", the intended date of application and actions to reduce risk. The warning signs shall</p>			

## Section 4.1C Effects on Human Health and Safety

REGISTER OF ADVERSE EFFECTS WITH 1080						
ID	Formulation	Activity	Potential Receptors and Description of Exposure to 1080 and 1080 FORMULATIONS	How likely?	Magnitude of effect	Level of risk
			<p>remain until such time that the substance is no longer toxic, or when baits have been retrieved from the place; unless legal obligation requires the signs to remain in place for a longer period of time.</p> <p><i>Potential Effects</i> Relatively few cases of human poisoning (accidental or deliberate) have been reported on an international scale (22 cases, 16 of which were fatal) (Harrison et al. 1952; Brockman et al. 1955; Trabes et al. 1983; Ellenhorn &amp; Barceloux 1988; Anon. 1992). Cases of acute human poisoning reported outside New Zealand have generally been either accidental ingestion of a pest control product by children or deliberate ingestion by adults, however no New Zealand cases have been reported.</p> <p>In humans, death from 1080 ingestion would result from cardiac or respiratory failure. There is a delay of at least half an hour and often several hours before the onset of symptoms following swallowing. If inadvertent ingestion was to occur, the LD<sub>50</sub> value used for HSNO classification for humans is 2.0 mg/kgbw (see Section 3.3). A person weighing 60 kg would need to eat about thirteen 6-gram baits or seven 12-gram baits (containing 0.15% 1080) to receive the LD<sub>50</sub> dose of 1080. A child weighing 20 kg would need to eat about four 6-gram baits or two 12-gram baits (containing 0.15% 1080) to receive the LD<sub>50</sub> dose. If a person was to ingest a sub-lethal dose, 1080 will be metabolised and excreted in urine in the same manner as in target pests (NZFSA, 2005).</p> <p><i>Risk Profile</i> The likelihood of public exposure to 1080 is less likely than occupational exposure. Based on the above, the likelihood of exposure to the wider community under standard 1080 operations is IMPROBABLE [only occurring in very exceptional circumstances]; the effect would be MODERATE [minor irreversible effects to individuals, or reversible medium term effects in surrounding community], and the risk is therefore assessed as C [risks within the ALARP band (As Low as Reasonably Practicable) and broadly classed as tolerable subject to ongoing monitoring and control].</p>			
H-A20	All formulations	All uncontained application methods	<p><b>Direct Contact with 1080 Baits</b></p> <p><b>The public</b> (hunters, farmers and the general public) may be exposed to 1080 baits if they enter the treatment area before clearance is given by the operator, or in the unlikely event that baits remain intact in the environment for a long period of time (for which time the 1080 baits remains toxic). Public access is likely to be prohibited to trappers, hunters, recreational walkers, farmers and trappers. There is potential for public exposure via inadvertent ingestion and dermal exposure of baits in the application area; public exposure via inhalation is negligible.</p>	Very Unlikely	Moderate	D

## Section 4.1C Effects on Human Health and Safety

REGISTER OF ADVERSE EFFECTS WITH 1080						
ID	Formulation	Activity	Potential Receptors and Description of Exposure to 1080 and 1080 FORMULATIONS	How likely?	Magnitude of effect	Level of risk
			<p>Numerous studies indicate that 1080 degrades rapidly in the environment (Booth et al. 1999; Bowen et al. 1995; Ogilvie et al 2004; Eason et al 1991a and b; Wright 2004). 1080 does not accumulate in soil as microbial activity either within the bait or in the soil degrades the substance into harmless by-products relatively quickly (Green 2004; Parfitt et al 1994; Eason 1993). This usually takes about 1-4 weeks (Parfitt et al. 1994), however in colder dryer weather degradation is slower (Green 2004; Parfitt et al. 1994). If 1080 is not removed from soil by microbial activity it is likely to be removed from soil by leaching (Parfitt et al. 1994).</p> <p><i>Controls</i> Refer to H-A19 for a description of the controls.</p> <p><i>Potential Effects</i> Refer to H-A19 for a description of the effects.</p> <p><i>Risk Profile</i> The likelihood of public exposure to uncontained 1080 baits is greater than exposure to contained baits. Based on the above, the likelihood of exposure from uncontained 1080 baits to the wider community under standard 1080 operations is VERY UNLIKELY [Considered only to occur in very unusual circumstances]; the effect would be MODERATE [minor irreversible effects to individuals, or reversible medium term effects in surrounding community], and the risk is therefore assessed as D [risks within the ALARP band and broadly classed as tolerable subject to ongoing monitoring and control].</p>			
			<p><b>INDIRECT (SECONDARY) EXPOSURE</b></p> <p>Secondary poisoning occurs when the exposure to the poison is not direct but via another medium, for example, meat from an animal that has been poisoned or has been exposed to a sub-lethal dose of the poison. The potential exposure pathways are described below. The pathways apply to all formulations and all application methods.</p>			
H-A21	All formulations	All application methods	<p><b>Farmed meat</b></p> <p><b>The public</b> (farmers and the general public) may be exposed to 1080-contamination if they consume meat from domestic stock (cattle, deer, sheep, goats) that have received sub-lethal doses of 1080. 1080 is metabolised within several days and therefore human exposure could only occur if animals ingest baits directly and are then immediately slaughtered for human consumption. Contamination of animals via consumption of stock water is considered very unlikely due to the low concentrations and rapid degradation of 1080 in waterways, and therefore has not been assessed further.</p> <p><i>Controls</i> 1080 is toxic for livestock, therefore farm animals are kept out of treated areas. If any poisoning of</p>	Improbable	Minor	B

## Section 4.1C Effects on Human Health and Safety

REGISTER OF ADVERSE EFFECTS WITH 1080						
ID	Formulation	Activity	Potential Receptors and Description of Exposure to 1080 and 1080 FORMULATIONS	How likely?	Magnitude of effect	Level of risk
			<p>livestock is suspected, a safety period of 5 days is followed before humans should consume the meat. If some animals die after eating baits, it is standard practice to extend this period to 10 days and move the surviving stock to 1080-free pasture (Rammel 1993; Eason et al. 1994). When recommended practices are followed in possum control operations, 1080 is unlikely to be present in meat for consumption (Green 2004).</p> <p>If exposure of stock to 1080 was to occur, absorption, metabolism and excretion studies in laboratory animals since the 1950s have shown that sub-lethal amounts of 1080 are excreted both unchanged and as a range of non-toxic metabolites. Defluorination (i.e. detoxification or breakdown) of 1080 and fluorocitrate has been demonstrated in animals and other living organisms (Rammel 1993; Eason et al. 1994; Gal et al. 1961; Schaefer &amp; Machleidt 1971; Kirk &amp; Goldman 1970; Smith et al. 1977; Soifer &amp; Kostyniak 1983; Twig et al. 1986). The mean 1080 concentrations declined to less than 0.003 mg/kg in all tissues sampled 96 hours after dosing (Eason et al. 1994). In a study using mice, 1080 concentrations in plasma, muscle and liver decreased by half in less than two hours. The highest concentrations are found in blood, with moderate levels in muscle and kidneys and the lowest concentrations in liver. Prolonged persistence of 1080 in animals after sub-lethal exposure is unlikely, and this has been confirmed for larger animals such as rabbits, goats, possums and sheep (Eason et al. 1994; Eason et al. 1993). 1080 was rapidly absorbed and excreted, and is highly unlikely to bioaccumulate in the food chain. In sheep, the highest concentration occurred at 2.5 hours whilst negligible amounts were found in the muscle tissue and plasma (Broome et al. 2004).</p> <p>Residue monitoring is the responsibility of the New Zealand Food Safety Authority. The NZFSA Animal Products Group administers a chemical residue monitoring programme under which samples from farmed and feral animals submitted for slaughter and registered premises are randomly tested for a variety of chemicals and agricultural compounds (NZFSA, 2005).</p> <p><i>Potential Effects</i> It would not be possible for a person to ingest sufficient quantities of 1080-contaminated meat to receive a fatal dose of 1080. If humans ingest a sub-lethal dose, 1080 will be metabolised and excreted in urine in the same manner as in target pests (NZFSA, 2005).</p> <p><i>Risk Profile</i> Based on the above, the likelihood of a person being poisoned by 1080 via consumption of meat is IMPROBABLE [only occurring in very exceptional circumstances]; the level of adverse effect would be MINOR [no effects], and the overall risk is therefore assessed as B [insignificant or minor and not warranting further assessment].</p>			
H-A22	All formulations	All application methods	<p><b>Vegetation</b> <b>The public</b> may be exposed to 1080-contaminated vegetation through ingestion of contaminated</p>	Highly Improbable	Minimal	A

## Section 4.1C Effects on Human Health and Safety

REGISTER OF ADVERSE EFFECTS WITH 1080						
ID	Formulation	Activity	Potential Receptors and Description of Exposure to 1080 and 1080 FORMULATIONS	How likely?	Magnitude of effect	Level of risk
			<p>crops. The mechanisms through which 1080 contamination may affect food crops are plant uptake of 1080 from soil contaminated by baits and irrigation of crops with contaminated water.</p> <p><i>Controls</i> Refer to H-A13 <i>Controls</i>.</p> <p><i>Potential Effects</i> While plants may take up 1080, it is in very small quantities (Broome et al. 2004; Ogilvie 2004). Studies indicate that plants are capable of degrading 1080 (Atzert 1971; Meyer &amp; Grobbelaar 1991; Rammel &amp; Fleming; Preuss &amp; Weinstein 1969; Ogilvie et al. 1998; Ward &amp; Huskisson 1969). Some soil micro-organisms, such as <i>Pseudomonas</i> species, can also breakdown and defluorinate 1080. Under favourable conditions, 1080 will be significantly defluorinated in 1-2 weeks. In extreme cold 1080 residues may persist in baits or in the soil for several months (King et al. 1994).</p> <p>Uptake concentrations in plant species are not expected to cause poisoning (Eason et al. 2001). Concentrations of 1080 persistence in broadleaf and perennial ryegrass indicate that residues persist less than 38 days, and poisoning via consumption of plants would be most unlikely to cause adverse human health effects (Ogilvie et al. 2004).</p> <p><i>Risk Profile</i> Given that relatively high concentrations of 1080 are required to cause detectable levels in plants, and the very low historical levels of 1080 contamination observed, human exposure to 1080 residues in contaminated plant material is HIGHLY IMPROBABLE [almost certainly not occurring but cannot be totally ruled out]; the effect would be MINIMAL [no effects] and the overall risk is therefore assessed as A [insignificant or minor and not warranting further assessment].</p>			
H-A23	All formulations	All application methods	<p><b>Wild harvested plants</b></p> <p><b>The public</b> may be exposed to 1080-contaminated wild harvested plants through ingestion of aquatic and land plants, and herbs.</p> <p><i>Controls</i> Refer to H-A13 <i>Controls</i>.</p> <p><i>Potential Effects</i> A study by Ogilvie (2004) concluded that the uptake of 1080 by plants of cultural importance poses a negligible risk to humans who consume contaminated plants that have taken up 1080 from baits during an aerial control operation (Ogilvie et al. 2004). Potential contamination of the fern pikopiko (<i>asplenium bulbiferum</i>, a plant used for food) and karamuramu (<i>coprosma robusta</i>, a</p>	Highly improbable	Minimal	A

REGISTER OF ADVERSE EFFECTS WITH 1080						
ID	Formulation	Activity	Potential Receptors and Description of Exposure to 1080 and 1080 FORMULATIONS	How likely?	Magnitude of effect	Level of risk
			<p>medicinal plant) from aerial application of 1080 was assessed by placing toxic baits at the base of wild growing plants and sampling plant parts for 1080 residues over time. No detectable residue was found in pikopiko, and very low levels of 1080 were detected for a short time in karamuramu – up to 5 ppb, falling to below detectable limits after 25 days. At the highest measured 1080 concentration, a 70 kg adult would need to consume 28 tonnes of karamuramu to receive a lethal dose and an equally improbable quantity to have any sub-lethal effects.</p> <p><i>Risk Profile</i> 1080 is not expected to cause human health effects via consumption of contaminated wild harvested plants. The likelihood of human exposure via ingestion is HIGHLY IMPROBABLE [almost certainly not occurring but cannot be totally ruled out]; the magnitude of effect is considered to be MINIMAL [no effects], and the overall risk is therefore assessed as A [insignificant or minor and not warranting further assessment].</p>			
H-A24	All formulations	All application methods	<p><b>Honey</b></p> <p><b>The public</b> may be exposed to 1080-contaminated honey via ingestion. 1080 is toxic to honey bees, however there is no research indicating the potential for sub-lethal exposure. Baits used in pest control are generally not attractive to bees (Broome et al. 2004), however this may not always be the case if bees are particularly hungry, and beekeepers should always be notified of operations. There have been recorded instances of bees being killed after feeding on 1080 paste baits, however the risk is very much reduced when alternative baits are used e.g. carrot, apple (Thomas et al., 2003).</p> <p><i>Controls</i> Specific controls in place to reduce exposure of honey bee are contained in the HSNO controls (see Section 3.4). 1080 use is prohibited in an area where bees are foraging and the substance is in a form in which bees are likely to be exposed to it. 1080 use is also prohibited on specific plants likely to be visited by bees if the plant is in open flower or part bloom, or is likely to flower within a specified period of time following application of the substance (not longer than 10 days). Honey bees were known to be attracted to 1080 paste baits used in pest control prior to 1995. Changes in formulation of 'Pestoff Professional' possum paste since then have been found to be unattractive to bees (Morgan 2000).</p> <p><i>Potential Effects</i> There is no evidence to indicate that bees exposed to 1080 have contaminated honey supplies and no record of adverse effects resulting from human consumption of honey. In general, the persistence of 1080 in food is short and is degraded into non-toxic metabolites. If humans ingest a sub-lethal dose, 1080 will be metabolised and excreted in urine in the same manner as in target pests (NZFSA, 2005).</p>	Highly improbable	Minimal	A

REGISTER OF ADVERSE EFFECTS WITH 1080						
ID	Formulation	Activity	Potential Receptors and Description of Exposure to 1080 and 1080 FORMULATIONS	How likely?	Magnitude of effect	Level of risk
			<p><i>Risk Profile</i> 1080 is not expected to cause human health effects via consumption of honey. The likelihood of human exposure via ingestion is HIGHLY IMPROBABLE [almost certainly not occurring but cannot be totally ruled out]; the magnitude of effect is considered to be MINIMAL [no effects] and the overall risk is therefore assessed A [insignificant or minor and not warranting further assessment].</p>			
H-A25	All formulations	All application methods	<p><b>Meat from wild animals</b></p> <p><b>The public</b> may be exposed to 1080-contaminated meat through consumption of meat sourced from wild animals that have received sub-lethal doses of 1080.</p> <p><i>Controls</i> Refer to H-A13 and H-A14 <i>Controls</i>.</p> <p><i>Terrestrial Wild Animals (eg, Deer, Goats, Pigs)</i> Warning signs must be placed at all entrances to areas where baits will be used, and posted in prominent places around the perimeter of the treated area, not just access points. Sign information must be in simple language and readable from 10 metres. All warning signs must show the name of the person or body who is applying the substance, skull and crossbones, the name and nature of bait, colour, the word "POISON", the intended date of application and rules to reduce risk. Some warning signs will require the caution "DO NOT take ANIMALS for eating." The warning signs shall remain until such time that the substance is no longer toxic, or when baits have been retrieved from the place; unless legal obligation requires the signs to remain in place for a longer period of time.</p> <p>Humans could only be exposed to 1080 residues from wild animals if they harvest and consume an animal that had recently ingested the toxin. The existing restrictions on harvesting from areas where such agents are in use manage the risk from this source (NZFSA, 2005). The NZFSA recommends that wild or game estate animals should not be taken from any area where 1080 has been laid for up to four months after the operation has ended or two months after the operation has ended <i>and</i> 100mm of rain has fallen (<a href="http://www.nzfsa.govt.nz/animalproducts/subject/hunting-wild-animals/hunting-poison-free.htm">www.nzfsa.govt.nz/animalproducts/subject/hunting-wild-animals/hunting-poison-free.htm</a>, viewed 12 July 2006). The requirement (as of November 2004) for commercial hunters to be a "Certified Supplier" or "Certified Game Estate Supplier" when supplying processors with wild and game estate meat enforces prosecution and disciplinary action if hunters are caught hunting in areas treated with poisons.</p> <p>The NZFSA Animal Products Group administers a chemical residue monitoring programme under which samples from farmed and feral animals submitted for slaughter and registered premises are randomly tested for a variety of chemicals and agricultural compounds (NZFSA, 2005). Muscle samples from feral deer, feral goat, feral pigs, possums, mallard ducks, and rabbits were tested</p>	Improbable	Minimal	A

REGISTER OF ADVERSE EFFECTS WITH 1080						
ID	Formulation	Activity	Potential Receptors and Description of Exposure to 1080 and 1080 FORMULATIONS	How likely?	Magnitude of effect	Level of risk
			<p>for 1080 residues under the NZFSA chemical residue monitoring programme between 1999 and 2004. There is no research on 1080 residues in sub-lethally exposed deer, however it is likely to be low and short-term (NZFSA, 2005). Muscle samples from feral pigs and possums tested for 1080 residues under the same NZFSA monitoring programme revealed no 1080 residues. No research was found on the levels of 1080 residues present in poisoned goats. Sub-lethally dose rabbits had no detectable sodium fluoroacetate in their blood plasma after 6 hours, and none in their tissues after 9 hours (NZFSA, 2005; Gooneratne et al. 1995). Adult mallard ducks were dosed with sub-lethal concentrations of 1080 and the elimination of the toxin was observed within 24 hours (NZFSA, 2005; Ataria et al. 2000).</p> <p><i>Aquatic wild animals</i></p> <p>On a weight of evidence basis, 1080 is not considered to have potential for bioaccumulation in natural water. Landcare Research studies have investigated the potential for contamination of koura from 1080 falling into a stream bed (Suren &amp; Bonnett, 2004), and from eels consuming contaminated meat in a stream (Lyver et al. 2004). These studies found small quantities of 1080 residues in muscle tissue. Captive eels were fed sausage meat of poisoned possum carcasses and after three days, the highest concentration of 1080 in muscle tissues was 38 ppb. Based on an estimated LD<sub>50</sub> for humans of 3.5 mg/kg body weight, a person weighing 60 kg would need to eat approximately 5.5 tonnes of eel flesh to receive a lethal dose.</p> <p>Fish are relatively resistant to 1080 (Green 2004). New Zealand, fingerling and adult trout were subjected to 1080 concentrations of 500 mg/L and 1000 mg/L by force-feeding cereal pellets, without any visible effect (Rammel &amp; Fleming 1978). No information relating to bait intake (oral LD<sub>50</sub> values) could be found. One study undertaken by NIWA that assessed the effect of 1080 on invertebrate communities and three species of native fish in four West Coast streams (at a dose representing a 10-fold increase of the number of baits previously found within streams) revealed no demonstrable biological effects on the fish (AHB 2005). Since the concentrations of 1080 described above are many times higher than the residue concentrations only very rarely found in water after 1080 use (Eason et al. 1999), adverse effects on aquatic animals are very unlikely (Eason 2002); hence, the potential for human poisoning via consumption of fish is considered to be remote.</p> <p>If exposure was to occur, absorption, metabolism and excretion studies in laboratory animals since the 1950s have shown that sub-lethal amounts of 1080 are excreted both unchanged and as a range of non-toxic metabolites. Defluorination (i.e. detoxification or breakdown) of 1080 and fluorocitrate has been demonstrated in animals and other living organisms (Rammel 1993; Eason et al. 1994; Gal et al. 1961; Schaefer &amp; Machleidt 1971; Kirk &amp; Goldman 1970; Smith et al. 1977; Soifer &amp; Kostyniak 1983; Twig et al. 1986). Prolonged persistence of 1080 in animals after sub-lethal exposure is unlikely, and this has been confirmed for larger animals such as rabbits, goats, possums and sheep (Eason et al. 1994; Eason et al. 1993a).</p>			

REGISTER OF ADVERSE EFFECTS WITH 1080						
ID	Formulation	Activity	Potential Receptors and Description of Exposure to 1080 and 1080 FORMULATIONS	How likely?	Magnitude of effect	Level of risk
			<p><i>Risk Profile</i></p> <p>The likelihood of adverse effects resulting from consumption of fish and game is considered to be IMPROBABLE [only occurring in very exceptional circumstances]. The level of adverse effect would be MINIMAL [no effects] due to the quantity that would need to be consumed, and the risk is therefore assessed as A [insignificant or minor and not warranting further assessment].</p>			
H-A26	All formulations	All application methods	<p><b>Milk Products</b></p> <p><b>The public</b> may be exposed to 1080-contaminated milk products through ingestion of contaminated milk products, where sub-lethal dose has occurred in animals.</p> <p><i>Controls</i></p> <p>Specific controls in place to reduce exposure of milking herds (stock) are contained in the HSNO controls (see Section 3.4). Should death occur as a result of 1080 poisoning within a herd of dairy cows, the withholding period for the entire flock or herd should be 10 days (Eason et al. 1994; Rammel 1993). If dairy cattle become exposed to 1080 baits the dairy supply company must be notified immediately.</p> <p>Two incidents of suspected milk contamination have occurred in New Zealand. In once instance, 4 dairy cows that had already been milked died after ingesting 1080. The farmer notified the dairy company immediately and the milk was disposed of, even though 1080 concentrations in the milk were sampled and calculated as negligible (in parts per billion). In the second instance, the location of the water supply was incorrectly marked on the map during an aerial operation, and 5 pellets were accidentally dropped near a waterway supplying dairy cows. The milk from cows that may have been exposed to this water was disposed of immediately, and water supply to the dairy cows was cut until such time that it was deemed clear of 1080, following sufficient rainfall and monitoring of the waterway (Goldschmidt, 2002).</p> <p><i>Potential Effects</i></p> <p>Research conducted by Landcare Research (Eason et al. 2002b) analysed the effect of 1080 pellets on lactating ewes as a model for assessing the potential for contamination of cows' milk. Residues of 1080 were detected in the milk of high-dose ewes only at the limit of detection (0.0005 µg/ml) 72 hours after exposure, and were completely absent at 96 hours. Four of the eight low-dose ewes had no detectable 1080 residues in their milk 48 hours after exposure, and all were free of 1080 residues at 72 hours. A person would have to drink 120 times their body weight of milk over a short period of time to receive enough 1080 to receive the LD<sub>50</sub> dose (Landcare Research 2001).</p> <p>Based on the above, the likelihood of this exposure to contaminated milk via ingestion is HIGHLY IMPROBABLE [almost certainly not occurring but can not be ruled out]; the effect would be</p>	Highly improbable	Minimal	A

## Section 4.1C Effects on Human Health and Safety

REGISTER OF ADVERSE EFFECTS WITH 1080						
ID	Formulation	Activity	Potential Receptors and Description of Exposure to 1080 and 1080 FORMULATIONS	How likely?	Magnitude of effect	Level of risk
			MINIMAL [no effects], and the risk is therefore assessed as A [insignificant or minor and not warranting further assessment].			
DISPOSAL OF 1080 WASTE						
H-A27	All formulations	Wash down of application equipment and PPE; disposal of 1080 waste at the application site and to the landfill.	<p><b>Occupational Exposure</b></p> <p><b>Pest Control Workers</b> may be exposed to 1080-contaminated waste when washing down their equipment and PPE, and disposing of 1080 waste at the operation site (for aerial operations) or in the field.</p> <p><i>Controls</i> The use of hazardous substances must comply with the relevant HSNO Regulations for that substance, and the substance registration as approved by the ACVM Group, NZFSA. The HSNO controls applicable to 1080 formulations are contained in Section 3.4. In particular, 1080 can only be used by licensed operators holding an Approved Handlers Certificate and Controlled Substance Licence. As disposal of 1080 may constitute a discharge to land and/or water, activities relating to the disposal of containers, equipment and carcasses must comply with the requirements of the respective local authority.</p> <p>The pest control agencies and pest control contractors have their own procedures and controls to ensure the health and safety of their employees as required of all employers under the Health and Safety in Employment Act 1992. These include strict operating procedures, monitoring of exposure, use of appropriate PPE including respirators, overalls, gloves, gumboots, and eye protection when washing. Disposal techniques and potential hazards are discussed with staff before commencing the work and PPE is worn per label requirements. Any contaminated equipment to be refilled must be triple rinsed. Protective clothing and equipment is removed and skin thoroughly washed before eating, drinking, smoking or using the toilet.</p> <p>Surplus baits may be treated by burial, incineration or alternatively, a sewage oxidation facility or chemical treatment facility is also an acceptable means of disposing of unwanted bait material with the approval of the local authority. Stock solution may be incinerated after being applied to an absorbent flammable material such as woodchips. When disposing of 1080 via burial, the bait is placed with other organic material on the active tip face of the landfill or buried within the biologically active layer of soil else within a secure area. 1080 is degraded through microbial activity and will decompose at high temperatures.</p> <p>Where transport to a landfill/disposal facility is practical and safe, redundant 1080 scheduled for disposal must be:</p> <ul style="list-style-type: none"> <li>- securely contained with the manufacturers label and Safety Data Sheet;</li> <li>- taken to a disposal facility approved by a local authority; and</li> </ul>	Very unlikely	Minor	C

REGISTER OF ADVERSE EFFECTS WITH 1080						
ID	Formulation	Activity	Potential Receptors and Description of Exposure to 1080 and 1080 FORMULATIONS	How likely?	Magnitude of effect	Level of risk
			<ul style="list-style-type: none"> <li>- delivered to disposal personnel who are Approved Handlers.</li> </ul> <p>Contaminated bags, redundant packaging or equipment e.g., securely contained paper bags must be:</p> <ul style="list-style-type: none"> <li>- securely contained with the manufacturers label and Safety Data Sheet;</li> <li>- taken to a disposal facility approved by a local authority; and delivered to disposal personnel who are Approved Handlers.</li> </ul> <p>Where transport to disposal facility is unpractical/unsafe, the label regarding disposal of VTA packaging is followed. The process for storage and disposal of unwanted baits and empty containers at the operation site is required to ensure that the risk of occupational and public exposure is minimised (OSH 2002). Empty bags are holed to prevent re-use, then burned or buried in a suitable location at a depth of approximately 60 cm. Empty containers of 1080 are rinsed thoroughly and must not be used for any other purpose. A waste disposal contractor is engaged to dispose of rinse water or it is otherwise channelled into a hole dug especially for this purpose (i.e. soak away) and is to be located at least 50 m away from any water body.</p> <p><i>Potential Exposure Pathways and Effects</i> Potential exposure pathways include inadvertent ingestion, inhalation and dermal exposure either directly from contaminated hands or indirectly from clothing, similar to the pathways and effects associated with application of 1080.</p> <p><i>Risk Profile</i> Based on the above, the likelihood of exposure occurring during disposal of 1080 is VERY UNLIKELY [considered only to occur in very unusual circumstances]; the magnitude of effect would be MINOR [mild reversible short-term effects in localised area], and the risk is therefore assessed as C [risks ALARP and broadly classed as tolerable subject to ongoing monitoring and control].</p>			

REGISTER OF ADVERSE EFFECTS WITHOUT 1080						
ID	Formulation	Activity/Risk	Potential Receptors and Description of Exposure to CYANIDE and CYANIDE FORMULATIONS	How likely?	Magnitude of effect	Level of risk
<p><b>BACKGROUND INFORMATION:</b> In its pure form cyanide is a colourless solid and is soluble in water. Cyanide is hydrolysed and decomposed by carbon dioxide and water or acids, generating the gas hydrogen cyanide, which has a characteristic odour of bitter almonds. Inhalation of hydrogen cyanide can be lethal. Oil in the paste normally protects the cyanide from exposure to air and minimises the release of hydrogen cyanide. Cyanide rapidly hydrolyses and dissipates with water or damp soil, and does not leave a residue. Cyanide is lethal to humans, and extreme care must be taken during the manufacture and handling of all formulations.</p> <p>Pure cyanide is imported from the United States of America, and its major uses are in the electroplating and mining industries. In the pest control industry, there are three formulations of cyanide in use in New Zealand: pellets (trade name Feratox®), and encapsulated paste (trade name Cyanara Ferapaste®) and a non-encapsulated paste (sodium cyanide paste). The active cyanide in both Feratox pellets and Cyanara Ferapaste is “encapsulated” with a non-toxic moisture and air barrier. This barrier reduces the amount of hydrogen cyanide gas (HCN) liberated from the active ingredient. The barrier benefits both health and safety (for workers handling the baits) and efficacy as the odour of the gas can deter pests from ingesting the baits, (referred to as “bait-shyness”).</p> <p>MAF requires cyanide handlers to hold an Approved Handlers Certificate and Controlled Substance Licence which is issued by the ACVM Group, NZFSA. ERMA require handlers to hold an Approved Handler Test Certificate (satisfying requirements for fit and proper persons). The MOH issues licences to sell or pack cyanide (MOH 2003). A seller of cyanide must comply with HSNO requirements, which include requirements to securely store the cyanide under lock and key and record details of purchasers (MOH 2003). The sale of cyanide is restricted to “commercial users”, such as manufacturing jewellers, the mining industry, research laboratories, persons authorised under the Toxic Substances Regulations (1983), and employees acting on behalf of the Crown. Anyone using cyanide requires an Approved Operators Licence, which is issued by the ACVM Group, NZFSA.</p>						
<p><b>TRANSPORTATION TO MANUFACTURING SITE</b></p> <p>Occupational (workplace) exposure only has been assessed as there is no public access to cyanide during this activity.</p>						
H-CN-A1	Active Cyanide Ingredient in granular form, in 50 kg steel drums.	Transport by road from Port of Auckland to manufacturing sites at Animal Control Products (Wanganui), and Connovation (Auckland).	<p><b>Transport operators</b> may be exposed to the active cyanide ingredient only in the event of an accident that causes the release of packaged goods and the release of the packaged contents. The amount of cyanide being transported for the pest control industry in New Zealand is minimal compared to the amount of cyanide being transported for the electroplating and mining industries.</p> <p><i>Controls</i> All road transport of any hazardous substance must comply with the relevant HSNO Regulations (see Section 3.4) as well as the Land Transport Rule: Dangerous Goods 2005 Rule 45001/1, which sets out the requirements for the safe transport of dangerous goods on land in New Zealand. These controls cover the packaging, identification and documentation of goods for transport; the segregation of incompatible goods; transport procedures and the training and responsibilities of those involved in the transport of hazardous substances.</p> <p>Transport operators have their own procedures and controls to ensure the health and safety of their employees, as required of all employers under the Health and Safety in Employment Act 1992. Vehicles transporting cyanide carry equipment to deal with small spillages up to 100 kg (broom, shovel, spare container, protective</p>	Improbable	Moderate	C

## Section 4.1C Effects on Human Health and Safety

REGISTER OF ADVERSE EFFECTS WITHOUT 1080						
ID	Formulation	Activity/Risk	Potential Receptors and Description of Exposure to CYANIDE and CYANIDE FORMULATIONS	How likely?	Magnitude of effect	Level of risk
			<p>clothing).</p> <p><i>Potential Exposure Pathways and Potential Effects</i> In the unlikely event of an accidental spill resulting in release of and from packaged goods, transport operators could be exposed through inadvertent inhalation, ingestion, or dermal contact. These pathways have not been discussed in detail in this section as the likelihood of exposure is improbable. Cyanide is clearly labelled and securely packaged. Transport operators are trained in the transportation of dangerous goods and are informed of the precautionary steps to take in the unlikely event of a spill. If necessary, regional or emergency authorities trained in emergency response would be called to attend any serious accident.</p> <p><i>Risk Profile</i> The likelihood of human exposure to cyanide occurring during transport is therefore considered to be IMPROBABLE [only occurring in very exceptional circumstances]; the magnitude of effect has been assessed as MODERATE [minor irreversible effects to individuals], and the risk is therefore assessed as C [within the ALARP range, and broadly classed as tolerable subject to ongoing monitoring and control]. The magnitude has not been assessed as “extreme” as even if the cyanide was released and came into contact with water, resulting in the emission of hydrogen cyanide gas, the gas would be dispersed and diluted into open air.</p>			
<b>MANUFACTURE</b>						
For manufacturing activities, occupational (workplace) exposure only has been assessed as there is no public access to cyanide during this activity.						
<b>Preparation of CN products</b>						
H-CN-A2	Feratox Pellets (475 g/kg) – manufactured at Connovations (Auckland).	Preparation of Feratox pellets, either as individual pellets or prepared in a sealed polyethylene-lined paper bag	<p><b>Factory workers</b> at the manufacturing facility may be exposed to cyanide during manufacturing. Potential exposure routes are through inadvertent inhalation, dermal exposure, and ingestion. The most common route of exposure is via inhalation (Fisher &amp; Fairweather 2004), followed by oral ingestion. The active ingredient is encapsulated in a hard inert coating then packed into specifically designed airtight shipping container. The substance is stored in a cool, dry well-ventilated area, out of direct sunlight and is stored away from incompatible materials such as oxidising agents, acids, water and products containing water. Storage containers are frequently inspected for damage and leakage.</p> <p><i>Controls</i> The manufacture and use of hazardous substances must comply with the relevant HSNO Regulations for that substance, and the substance registration as approved</p>	<p><b>Ingestion</b> Highly Improbable</p> <p><b>Inhalation</b> Unlikely</p>	<p>Extreme</p> <p>Minor</p>	<p>D</p> <p>D</p>
H-CN-A3	Encapsulated Paste (500 g/kg) – Connovations (Auckland).	In Cyanara Ferapaste, potassium cyanide is micro-encapsulated.				

REGISTER OF ADVERSE EFFECTS WITHOUT 1080						
ID	Formulation	Activity/Risk	Potential Receptors and Description of Exposure to CYANIDE and CYANIDE FORMULATIONS	How likely?	Magnitude of effect	Level of risk
H-CN-A4	Sodium Cyanide Paste (600 g/kg) – ACP Wanganui.	The sodium cyanide paste contains oil, which protects the cyanide from exposure to air and hence slows down the release of hydrogen cyanide gas.	<p>by the ACVM Group, NZFSA.</p> <p>Controls applicable to the three cyanide formulations can be viewed at the following ERMA web links:</p> <p>Feratox pellets 500 g/kg &lt;<a href="http://www.ermanz.govt.nz/search/registers.html?id=12417">http://www.ermanz.govt.nz/search/registers.html?id=12417</a>&gt;;</p> <p>Encapsulated paste 500 g/kg &lt;<a href="http://www.ermanz.govt.nz/search/registers.html?id=12050">http://www.ermanz.govt.nz/search/registers.html?id=12050</a>&gt;;</p> <p>Sodium cyanide paste 500-600 g/kg &lt;<a href="http://www.ermanz.govt.nz/search/registers.html?id=12049">http://www.ermanz.govt.nz/search/registers.html?id=12049</a>&gt;.</p> <p>The manufacturers have their own procedures and controls to ensure the health and safety of their employees, as required of all employers under the Health and Safety in Employment Act 1992. These include strict operating procedures, monitoring of the workplace, use of appropriate PPE including gloves, and coveralls and respirators.</p> <p>The only possible way a person could accidentally ingest cyanide during the manufacturing process is at the drying and compressing stage. During these procedures, the operators (two) wear protective clothing, face masks and breathing apparatus. The face or mouth is not exposed in any way; therefore, to ingest the cyanide would require the deliberate and planned action by an operator to remove this personal protective equipment before placing it inside the mouth.</p> <p><i>Potential Exposure Pathways</i></p> <p><i>Ingestion</i> Cyanide is highly toxic to humans. If inadvertent ingestion was to occur, the LD<sub>50</sub> value for humans is 0.5 – 3.5 mg/kgbw (Eisler 1991). In the unlikely event of accidental ingestion of a cyanide pellet, a 60 kg person would need to ingest between 30 and 210 grams of cyanide bait to receive the LD<sub>50</sub> dose. For the purposes of this assessment, an estimate of 100 grams of cyanide has been used, as a mid-point value between 30 and 210 grams, as this is a relatively wide-ranging set of LD<sub>50</sub> values. 100 mg equates to the amount of pure cyanide present in one Feratox pellet; therefore a 60 kg person would need to eat the equivalent of one Feratox pellet to receive the LD<sub>50</sub> dose. This is consistent with the study by Yu (2001), which estimated the LD<sub>50</sub> range to be 40 – 100 mg in a 70-kg adult.</p> <p><i>Inhalation</i> Hydrogen cyanide gas has a STEL (Short-Term Exposure Limit) of 10 ppm and the peak is 8 ppm for an eight hour shift; however exposure to this gas during</p>			

REGISTER OF ADVERSE EFFECTS WITHOUT 1080						
ID	Formulation	Activity/Risk	Potential Receptors and Description of Exposure to CYANIDE and CYANIDE FORMULATIONS	How likely?	Magnitude of effect	Level of risk
			<p>manufacture is very unlikely, as the gas is only emitted if it comes into contact with water. The manufacturers of cyanide have controls in place to ensure there is no potential exposure to water and dehumidifiers are located in every room of the factory.</p> <p>The calculated LC<sub>50</sub> values for inhalation of HCN gas are 4400 µg/mL for 1 minute, 200 µg/mL for 30 minutes, and 140 µg/mL for 60 minutes (Eisler 1991). Yu (2001) reported that inhalation of air containing around 100 mg/L of cyanide can be fatal in 30-60 minutes, and at a concentration of around 300 mg/L, death can occur within minutes. A literature search failed to find published or verified unpublished data on an LC<sub>50</sub> for dust and mist.</p> <p>Sodium cyanide pastes (non-encapsulated) emit hydrogen gas. In standard laboratory trials, emission rates of gas have been recorded at 25.5 (±4.3 HCN/hr) for Cyanide Paste for Possum Destruction and 23.0 (±0.3 µg HCN/hr) for Trappers Cyanide Paste (Wright 1999). Cyanara Ferapaste and Feratop pellets contain cyanide in an encapsulated form and have low emissions of HCN (3.7 µg HCN/hr) for Cyanara Ferapaste and 0.2-0.3 µg HCN/hr for Feratop during laboratory trials (Wright 2000; Morriss et al. 2003), reducing the risk of operator exposure to cyanide gas (Eason &amp; Wickstrom 2001).</p> <p><i>Dermal</i> Dermal (skin) exposure is a significant pathway for occupational exposure. The estimated average LD<sub>50</sub> value for humans is 100 mg/kg HCN (Eisler 1991) and absorption can be significant if the skin is cut or grazed (Eason &amp; Wickstrom 2001). OSH WES (Workplace Exposure Standards) for cyanide have been set with a Time-weighted average of 5mg/m<sup>3</sup> for dermal exposure.</p> <p><i>Potential Effects</i> Hydrogen cyanide gas and cyanide salts (the active ingredient) are among the most rapidly acting of all known poisons and even small concentrations are extremely hazardous.</p> <p>Fatality will typically result from ingestion of bait or cyanide salts. If sodium or potassium cyanide (as in possum paste and pellets) is swallowed, it is converted by the acids in the stomach into hydrocyanic acid, which is absorbed through the blood stream. Due to the toxicity of hydrogen cyanide gas, people involved in the manufacture and handling of cyanide must be aware when working with the substance in enclosed spaces, such as a storeroom or in a vehicle. Signs of acute poisoning are hyperventilation, headache, nausea and vomiting, generalised weakness and coma, followed by respiratory depression and death (Fisher and Fairweather 2004). The risk of death is minimal in such circumstances</p>			

## Section 4.1C Effects on Human Health and Safety

REGISTER OF ADVERSE EFFECTS WITHOUT 1080						
ID	Formulation	Activity/Risk	Potential Receptors and Description of Exposure to CYANIDE and CYANIDE FORMULATIONS	How likely?	Magnitude of effect	Level of risk
			<p>but precautions must be taken seriously as prompt treatment is crucial if any of the above symptoms are observed (Fisher and Fairweather 2004). Should a person escape to clean air following accidental inhalation of the gas, the possibility of delayed adverse health effects are unlikely (Peden et al. 1986).</p> <p>Unless as a deliberate attempt of suicide, the act of swallowing cyanide is unlikely for an adult; however it could happen to a small child who finds a tube of possum paste or of bait left within reach (ACVM, 2002). Contact with skin will result in a burning sensation and possible discolouration (MOH 2003). Very high exposures to cyanide vapour may damage the retina and the nerves of the eye (MOH 2003).</p> <p>Effective antidotes are amyl nitrite and methaemoglobin-forming compounds (Fisher and Fairweather 2004). Some antidotes can only be administered by medical professionals and their efficacy depends on how quickly they can be administered after poisoning (Eason &amp; Wickstrom 2001).</p> <p><i>Risk Profile</i> As the risks vary significantly depending on the exposure pathway, two risks have been assigned.</p> <p><b>For the ingestion pathway</b>, the likelihood of exposure to cyanide occurring during manufacture is considered to be HIGHLY IMPROBABLE [only occurring in exceptional circumstances]; however the magnitude of any effects could potentially be EXTREME [fatality and/or significant irreversible effects reaching beyond the immediate community], and the risk is therefore assessed as D [within the ALARP band and broadly classed as tolerable subject to ongoing monitoring and control].</p> <p><b>For the inhalation pathway</b>, the likelihood of exposure to cyanide occurring during manufacture is considered to be UNLIKELY [could occur but not expected to occur under normal operating conditions]; the magnitude of any effects have been assessed as MINOR [mild reversible short term effects], and the risk is therefore assessed as D [risks ALARP, tolerable subject to ongoing monitoring and control].</p>			
<b>Disposal / off-site discharges (normal manufacturing process)</b>						
H-CN-A5	Active formula, all formulations (Feratox pellets, sodium cyanide paste, encapsulated	Human exposure through solid waste disposal by specialist waste contractor.	The <b>transport operator</b> or <b>waste disposal contractor</b> may be exposed to cyanide while collecting and transporting wastes from the factory. Liquid waste is neutralised with sodium hydrochloride, taken offsite by a waste disposal company and disposed of via a treatment plant. Solid wastes are disposed of to landfill. The controls and potential effects for this activity are as for H-CN-A1 through A4.	Very Unlikely	Moderate	D

Section 4.1C Effects on Human Health and Safety

REGISTER OF ADVERSE EFFECTS WITHOUT 1080						
ID	Formulation	Activity/Risk	Potential Receptors and Description of Exposure to CYANIDE and CYANIDE FORMULATIONS	How likely?	Magnitude of effect	Level of risk
	paste)		The likelihood of exposure to cyanide occurring during transportation and disposal of cyanide wastes to either a treatment facility or landfill is therefore considered to be VERY UNLIKELY [considered only to occur in very unusual circumstances], the magnitude of effect has been assessed MODERATE [minor irreversible effects to individuals] and the risk is therefore assessed as D [risks ALARP, tolerable subject to ongoing monitoring and control]. The magnitude has not been assessed as extreme due to the fact that solid wastes do not contain cyanide products in bulk quantities.			
<b>Site Spills (abnormal event)</b>						
H-CN-A6	Active formula, all formulations (Feratox pellets, sodium cyanide paste, encapsulated paste)	Human exposure through accidental spill at the manufacturing site.	<p><b>Factory workers</b> may be exposed to cyanide in the event of an accidental spill within the manufacturing plant. Spills are not expected to occur during the normal manufacturing process, particularly as the substance is contained within sealed steel drums; however, if a spill does occur on-site, the potential for contact with moisture (which would result in the release of hydrogen cyanide gas) is eliminated by the presence of dehumidifiers in each manufacturing room. Staff are trained and educated in the handling of toxic substances, and potential exposure is prevented with the use of relevant PPE. The controls and potential effects are the same as for H-CN-A1 through A4. In the event of large spills, local authorities would be notified and the area is flushed with water containing an alkaline (which prevents gas being emitted), once the solid material has been cleared.</p> <p><i>Risk Profile</i> As the risks vary significantly depending on the exposure pathway, two risks have been assigned.</p> <p><b>For the ingestion pathway</b>, the likelihood of exposure to CN as a result of a spill is considered to be HIGHLY IMPROBABLE [only occurring in exceptional circumstances], however the magnitude of any effects could potentially be EXTREME [fatality and/or significant irreversible effects reaching beyond the immediate community] and the risk is therefore assessed as D [risks ALARP, tolerable subject to ongoing monitoring and control].</p> <p><b>For the inhalation pathway</b>, the likelihood of exposure to cyanide as a result of a spill is considered to be UNLIKELY [could occur but not expected to occur under normal operating conditions], and the magnitude of any effects have been assessed as MINOR [mild reversible short term effects] and the risk is therefore assessed as D [Risks ALARP, tolerable subject to ongoing monitoring and control].</p>	<p><b>Ingestion</b> Highly Improbable</p> <p><b>Inhalation</b> Unlikely</p>	<p>Extreme</p> <p>Minor</p>	<p>D</p> <p>D</p>

REGISTER OF ADVERSE EFFECTS WITHOUT 1080						
ID	Formulation	Activity/Risk	Potential Receptors and Description of Exposure to CYANIDE and CYANIDE FORMULATIONS	How likely?	Magnitude of effect	Level of risk
<b>TRANSPORTATION FROM FACTORY SITE TO APPLICATION SITE</b>						
Occupational (workplace) exposure only has been assessed as there is no public access to cyanide during this activity						
H-CN-A7	All formulations: Feratox pellets, sodium cyanide paste, encapsulated paste.	Transportation of packaged goods by road from the manufacturing site to the application site.	<p><b>Transport operators</b> may be exposed to the active cyanide ingredient only in the event of an accident that causes the release of packaged goods and the release of the packaged contents. The controls and potential effects for this activity are the same as for H-CN-A1. Vehicles transporting cyanide carry equipment to deal with small spillages up to 100 kg (broom, shovel, spare container, protective clothing) and an Emergency Response Plan is required for quantities greater than 100 kg or litres of cyanide paste or micro-encapsulated paste.</p> <p><i>Risk Profile</i> The likelihood of exposure to cyanide occurring for this activity is therefore considered to be IMPROBABLE [only occurring in very exceptional circumstances], the magnitude of effect would be MODERATE [minor irreversible effects to individuals] and the risk is therefore assessed as C [within the ALARP range, and broadly classed as tolerable subject to ongoing monitoring and control]. The magnitude has not been assessed as extreme as, even if the cyanide was released and came into contact with water, resulting in the emission of hydrogen cyanide gas, the gas would be dispersed and diluted in the open air.</p>	Improbable	Moderate	C
<b>APPLICATION OF CYANIDE – GROUND</b>						
<p>BACKGROUND INFORMATION: All cyanide formulations are applied from the ground (there is no aerial application). Pellets may not be placed “uncontained” on the ground (e.g. distributing by hand). They must be placed in pellet feeders or bait stations. Pellets are used in biodegradable bait bags (effectively a form of bait station). Bait bags containing the pellets are supplied ready-made by the manufacturer, and pest control workers attach them by stapling to trees or posts. Pests will force or tear open the bag to access the cyanide pellets or pastes. Pastes are also applied in either bait stations or in bait bags, but may also be applied “uncontained” on to natural features such as leaves, twigs and spits (small earth mounds).</p> <p>The optimum height for bait placement is 17 cm above ground, however baits may be set as low as 10 cm where livestock have no access; where livestock have access, baits are to be placed two metres above ground (ACVM 2002). Workers must ensure the owner/occupier of the land has given permission, and that people who are allowed into the area are warned that poison has been laid. How long cyanide baits will remain poisonous in the environment depends greatly on rainfall and on how well they are protected from rain, however they must be regarded as toxic for as long as they remain identifiable as baits (ACVM 2002).</p> <p>The application of cyanide paste is often preceded with a pre-feed non-toxic paste. The non-toxic paste is applied as a pea-sized drop from the tube and sprinkled with flour as a lure, and after two to three days the toxic cyanide paste is applied.</p>						
			<b>OCCUPATIONAL EXPOSURE</b>			
			The assessment of occupational exposure to cyanide formulations has been conducted on a formulation-by-formulation basis, as each formulation has specific activities and exposure pathways associated.			

REGISTER OF ADVERSE EFFECTS WITHOUT 1080						
ID	Formulation	Activity/Risk	Potential Receptors and Description of Exposure to CYANIDE and CYANIDE FORMULATIONS	How likely?	Magnitude of effect	Level of risk
H-CN-A8	<b>Feratox Pellets - Potassium Cyanide (475 g/kg).</b>	<p>Placement of ready-made paper bait bags containing pellets.</p> <p>Placement of pellets in bait stations.</p> <p>When placing in bait stations, pellets are mixed with non-toxic cereal feed pellets or placed into peanut based feed paste by the pest control worker.</p>	<p><b>Pest control workers</b> may be exposed to cyanide pellets during application through ingestion or dermal exposure either directly from the baits, from contaminated hands or indirectly from clothing. The coated pellet is relatively inert and is insoluble in water, but will dissolve when in contact with common solvents such as alcohol, petrol and oils. The coated pellet is considered safe to handle provided it is unbroken. Exposure via inadvertent inhalation is highly improbable as exposure could only occur if the pellet had been immersed in water for 24 hours, after which time the gas would have to be contained and inhaled directly by a factory worker. It is very unlikely that dangerous concentrations of the gas could occur from cyanide paste in the outdoors (ACVM 2002).</p> <p><i>Controls</i> The use of Feratox pellets must comply with the relevant HSNO Regulations for that substance, and the substance registration as approved by the ACVM Group, NZFSA. The HSNO controls for Feratox pellets can be viewed at: <a href="http://www.ermanz.govt.nz/search/registers.html?id=12417">http://www.ermanz.govt.nz/search/registers.html?id=12417</a>.</p> <p>Cyanide is a controlled substance and can only be used by those holding an Approved Handler Test Certificate (satisfying requirements for fit and proper persons) and a Controlled Substance Licence. In addition, the pest control agencies and pest control contractors have their own procedures and controls, as required of all employers under the Health and Safety in Employment Act 1992, to ensure the health and safety of their employees. These include strict operating procedures, the use of appropriate PPE including overalls, gloves (rubber or plastic) and dust masks.</p> <p><i>Potential Effects</i> In the unlikely event of accidental ingestion of a cyanide pellet, a 60 kg person would need to ingest one Feratox pellet to receive the LD<sub>50</sub> dose (Fisher and Fairweather 2004) (see H-CN-A2 through A4). The potential effects are the same as for effects H-CN-2 through H-CN-A4, however published information relating directly to occupational exposure during ground application of cyanide pellets could not be found.</p> <p><i>Risk Profile</i> As the risks vary significantly depending on the exposure pathway, two risks have been assigned.</p> <p><b>For the ingestion pathway</b>, the likelihood of exposure to cyanide during application is considered to be HIGHLY IMPROBABLE [Almost certainly not occurring but cannot be totally ruled out], however the magnitude of effects could be EXTREME [mild reversible short-term effects in localised area] and the risk is</p>	<p><b>Ingestion</b> Highly improbable</p> <p><b>Inhalation</b> Very Unlikely</p>	<p>Extreme</p> <p>Minor</p>	<p>D</p> <p>C</p>

REGISTER OF ADVERSE EFFECTS WITHOUT 1080						
ID	Formulation	Activity/Risk	Potential Receptors and Description of Exposure to CYANIDE and CYANIDE FORMULATIONS	How likely?	Magnitude of effect	Level of risk
			<p>therefore assessed as D [Risks ALARP, tolerable subject to ongoing monitoring and control].</p> <p><b>For the inhalation pathway</b>, the likelihood of exposure to cyanide during application is considered to be VERY UNLIKELY [occurring only in unusual circumstances], and the magnitude of any effects have been assessed as MINOR [mild reversible short term effects] and the risk is therefore assessed as C [Risks ALARP, tolerable subject to ongoing monitoring and control].</p>			
H-CN-A9	<b>Cyanara Ferapaste-</b> encapsulated Potassium Cyanide (500 g/kg).	<p>Placement of ready-made paper bait bags containing paste.</p> <p>Placement of paste in bait stations</p> <p>Placement of paste on natural features.</p>	<p><b>Pest control workers</b> may be exposed to encapsulated cyanide paste during application through inadvertent inhalation (of gas) or dermal exposure either directly from the paste, from contaminated hands or indirectly from clothing. Where the work is carried out outside it is less likely that dangerous concentrations of gas could accumulate, compared with inside activities. Cyanara Ferapaste is contained in 500g tubes that contain approximately 1230 "baits" (of 0.4g each) and is more stable than sodium cyanide paste due to the encapsulation, which reduces the release of hydrogen cyanide gas. However, the physical nature of this formulation and its application means that there are likely to be greater risks from dermal absorption than with dry pellets. Similarly, there is likely to be a slightly increased risk of accidental ingestion of a paste formulation, compared with pellets.</p> <p><i>Controls</i> The use of Cyanara Ferapaste must comply with the relevant HSNO Regulations for that substance, and the substance registration as approved by the ACVM Group, NZFSA. The HSNO controls for encapsulated paste can be viewed at <a href="http://www.ermanz.govt.nz/search/registers.html?id=12050">http://www.ermanz.govt.nz/search/registers.html?id=12050</a>.</p> <p>Cyanide is a controlled substance and can only be used by those holding an Approved Handler Test Certificate and a Controlled Substance Licence. In addition, the pest control agencies and pest control contractors have their own procedures and controls to ensure the health and safety of their employees as required of all employers under the Health and Safety in Employment Act 1992. These include strict operating procedures, the use of appropriate PPE including overalls, gloves (rubber or plastic) and dust masks.</p> <p><i>Potential Effects</i> The effects of exposure to cyanide in encapsulated paste are the same as for H-CN-A8. Published information relating directly to occupational exposure during ground application of encapsulated paste could not be found.</p>	<p><b>Ingestion</b> Improbable</p> <p><b>Inhalation</b> Unlikely</p>	<p>Major</p> <p>Minor</p>	<p>D</p> <p>D</p>

REGISTER OF ADVERSE EFFECTS WITHOUT 1080						
ID	Formulation	Activity/Risk	Potential Receptors and Description of Exposure to CYANIDE and CYANIDE FORMULATIONS	How likely?	Magnitude of effect	Level of risk
			<p><i>Risk Profile</i></p> <p>As the risks vary significantly depending on the exposure pathway, two risks have been assigned.</p> <p><b>For the ingestion pathway</b>, the likelihood of exposure to cyanide during encapsulated paste application is considered to be IMPROBABLE [only occurring in exceptional circumstances]; however the magnitude of any effects could potentially be EXTREME [fatality and/or significant irreversible effects reaching beyond the immediate community], and the risk is therefore assessed as E [Risks generally warrant further controls].</p> <p><b>For the inhalation pathway</b>, the likelihood of exposure to cyanide during encapsulated paste application is considered to be VERY UNLIKELY [occurring only in unusual circumstances]; the magnitude of any effects have been assessed as MINOR [mild reversible short term effects], and the risk is therefore assessed as C [Risks ALARP, tolerable subject to ongoing monitoring and control].</p>			
H-CN-A10	<b>Sodium Cyanide Paste</b> – non-encapsulated (500 g/kg).	Placement of ready-made paper bait bags containing paste. Placement of paste on natural features.	<p><b>Pest control workers</b> may be exposed to non-encapsulated cyanide paste during ground application through inadvertent inhalation, ingestion or dermal exposure either directly from the paste, from contaminated hands or indirectly from clothing. Although sodium cyanide paste contains oil, which protects the cyanide from exposure to air and hence slows down the release of hydrogen cyanide gas, the substance is still fairly unstable, particularly when compared to the encapsulated formulations. Paste is contained with 500gram tubes that contain approximately 1230 “baits” (of 0.4grams each).</p> <p><i>Controls</i></p> <p>The use of sodium cyanide paste must comply with the relevant HSNO Regulations for that substance, and the substance registration as approved by the ACVM Group, NZFSA. The controls in place to prevent exposure to sodium cyanide paste can be viewed at <a href="http://www.ermanz.govt.nz/search/registers.html?id=12049">http://www.ermanz.govt.nz/search/registers.html?id=12049</a>.</p> <p>Cyanide is a controlled substance and can only be used by those holding an Approved Handler Test Certificate and a Controlled Substance Licence. In addition, the pest control agencies and pest control contractors have their own procedures and controls to ensure the health and safety of their employees as required of all employers under the Health and Safety in Employment Act 1992. These controls include strict operating procedures, the use of appropriate PPE including overalls, gloves (rubber or plastic) and masks. Many pest control workers wear respirators to reduce inhalation of gas when using non-encapsulated paste.</p>	<p><b>Ingestion</b> Improbable</p> <p><b>Inhalation</b> Unlikely</p>	<p>Major</p> <p>Moderate</p>	<p>D</p> <p>E</p>

## Section 4.1C Effects on Human Health and Safety

REGISTER OF ADVERSE EFFECTS WITHOUT 1080						
ID	Formulation	Activity/Risk	Potential Receptors and Description of Exposure to CYANIDE and CYANIDE FORMULATIONS	How likely?	Magnitude of effect	Level of risk
			<p><i>Potential Effects</i></p> <p>The potential effects are the same as for H-CN-A8. Published information relating directly to occupational exposure during ground application of cyanide paste could not be found. Anecdotally, it is reported that some workers experience headaches when using non-encapsulated paste.</p> <p><i>Risk Profile</i></p> <p>As the risks vary significantly depending on the exposure pathway, two risks have been assigned.</p> <p><b>For the ingestion pathway</b>, the likelihood of exposure to cyanide during paste application is considered to be IMPROBABLE [only occurring in exceptional circumstances]; however the magnitude of any effects could potentially be MAJOR [significant irreversible effects], and the risk is therefore assessed as D [Risks ALARP, tolerable subject to ongoing monitoring and control].</p> <p><b>For the inhalation pathway</b>, the likelihood of exposure to cyanide during paste application is considered to be UNLIKELY [could occur, but not expected to occur under normal operating conditions]; the magnitude of any effects have been assessed as MODERATE [minor irreversible effects], and the risk is therefore assessed as E [risks generally warrant further controls]. This ranks as a significant adverse health risk (see Section 4.2).</p>			
			<p><b>PUBLIC EXPOSURE</b></p> <p>The assessment of public exposure to cyanide formulations has been conducted on an application basis, as the actions required for the public to come into contact with the poison vary with control method.</p>			
H-CN-A11	<p><b>All formulations:</b></p> <p><b>Feratox Pellets</b> Potassium Cyanide (475 g/kg)</p> <p><b>Cyanara Ferapaste-</b> encapsulated Potassium Cyanide (500 g/kg)</p> <p><b>Sodium Cyanide Paste – non-</b></p>	Public exposure through contained application: ready-made bait bags and bait stations	<p><b>The public</b> (including hunters, farmers and the general public) may have access to cyanide baits if they enter the treatment area before clearance is given by the operator, or in the event that baits remain intact in the environment for a long period of time (for which time the cyanide baits remains toxic). All formulations of cyanide may be applied in “contained” application methods, being bait stations, pellet feeders and bait bags.</p> <p>How long cyanide baits will remain poisonous in the environment depends greatly on rainfall and on how well they are protected from rain, however they must be regarded as toxic for as long as they remain identifiable as baits (ACVM 2002). Feratox pellets are stable in the pellet form until the encapsulated core is crushed or exposed to direct moisture for more than 24 hours (Eason &amp; Warburton 1995). Trials have demonstrated that cyanide pellets exposed directly to moist conditions</p>	Improbable	Extreme	E

REGISTER OF ADVERSE EFFECTS WITHOUT 1080						
ID	Formulation	Activity/Risk	Potential Receptors and Description of Exposure to CYANIDE and CYANIDE FORMULATIONS	How likely?	Magnitude of effect	Level of risk
	encapsulated (500 g/kg)		<p>(i.e. on the ground) degrade after 1-4 months, for which period of time they should be considered potentially hazardous. Potassium cyanide paste applied in bait stations is therefore likely to remain toxic for a longer period of time than hand-laid paste. The potential for public exposure to encapsulated paste in bait stations is prevented by its containment and different signage controls, described below.</p> <p>For people to come into contact with poison baits applied by contained application methods, it would require an intentional act. The specially designed pellet feeders are designed with a narrow opening which force possum to feed directly from the feeder rather than picking the pellets up in their paws, and a magnetic catch to prevent bird access. Although these design functions exist for the purpose of pest control and conservation, they also act as a measure of protection to public exposure, and more specifically, inadvertent ingestion by a child. The waterproof bait bags containing Feratox pellets are pre-prepared at the manufacturing site, and would require considerable force to break into. Pellets are not laid directly on the ground, and if the baits did accidentally contact the ground, exposure is very unlikely as the reaction to form hydrogen cyanide gas leaching of cyanide into water from soil occurs simultaneously (Eason &amp; Wickstrom 2001).</p> <p><i>Controls</i> Refer to H-CN-A8 through A10 for controls.</p> <p>Permission is required from the Medical Officer of Health (MoH) where there is a risk to public health i.e. where the public might normally have access. Certain times of the year such as public holidays are avoided, and controls to avoid public exposure are particularly stringent in peri-urban areas. Application to the MoH requires the pest control operator to identify and assess risks relating to access areas, tramping huts, tracks and roads, exclusion areas, nearby schools, the completion of an Assessment of Environmental Effects, and details of actions taken on notification as well as community and Maori consultation. A model application form can be viewed at <a href="http://www.ermanz.govt.nz/resources/publications/word/MoH-VTA.doc">http://www.ermanz.govt.nz/resources/publications/word/MoH-VTA.doc</a>.</p> <p>Warning signs must be placed at all entrances to areas where baits will be used. As cyanide can only be sold to and/or used by a person holding a controlled substances licence then further requirements set by the ACVM are that signs must be posted in prominent places around the perimeter of the treated area, not just access points. Sign information must be in simple language and readable from 10 metres. All warning signs must show the name of the person or body who is applying the substance, skull and crossbones, the name and nature of bait, colour, the word "POISON", and the intended date of application and rules to reduce risk. Controls for signage vary for different methods of cyanide application.</p>			

REGISTER OF ADVERSE EFFECTS WITHOUT 1080						
ID	Formulation	Activity/Risk	Potential Receptors and Description of Exposure to CYANIDE and CYANIDE FORMULATIONS	How likely?	Magnitude of effect	Level of risk
			<p>For cyanide pellets, signs containing potassium cyanide, signs are legally required to remain for 2 months after the substance has been retrieved from the place. Pellet feeders are removed from the location and all unused cyanide pellets are removed from each pellet feeder and either returned to their original container or disposed of (ACVM 2002). For pellets in a biodegradable bait bag, baits signs must remain until such time that the substance is no longer toxic, but not less than 4 months after the last application. For cyanide paste containing potassium cyanide, signs must remain until the substance has been retrieved, disintegrated, destroyed or is no longer toxic, but not less than 4 months after the last application. For sodium cyanide, signs are legally required to remain until the substance has been retrieved, disintegrated, destroyed or is no longer toxic, but not less than 2 months after the last application.</p> <p><i>Potential Exposure Pathways</i>                      For the public, ingestion poses a far greater risk that either inhalation or dermal exposure. While ingestion of cyanide would require an intentional act, only a small amount of poison bait would be required to potentially cause death. If ingestion was to occur, the LD<sub>50</sub> value for humans is 0.5 – 3.0 mg/kgbw (Eisler 1991). In the unlikely event of accidental ingestion of a cyanide pellet, a 60 kg person would need to ingest between 30 and 210 grams of cyanide bait to receive the LD<sub>50</sub> dose. For the purposes of this assessment, an estimate of 100 grams of cyanide has been used, as a mid-point value between 30 and 210 grams, as this is a relatively wide-ranging set of LD<sub>50</sub> values. 100 mg equates to the amount of pure cyanide present in one Feratox pellet; therefore, a 60 kg person would need to eat the equivalent of one Feratox pellet to receive the LD<sub>50</sub> dose. This is consistent with the calculated LD<sub>50</sub> dose presented in a study by Yu (2001), which estimated the LD<sub>50</sub> range to be 40 – 100 mg for a 70-kg adult. As public exposure takes into account the possibility of a small child coming into contact with cyanide baits, a 20 kg child would need to ingest between 10 and 60 mg of cyanide bait to receive the LD<sub>50</sub> dose, which equates to approximately less than half of a Feratox pellet (Eisler 1991).</p> <p><i>Risk Profile</i>                      The likelihood of exposure of the public to CN when use in contained application methods is considered to be IMPROBABLE [only occurring in exceptional circumstances]; however the magnitude of any effects could potentially be EXTREME [fatality and/or significant irreversible effects reaching beyond the immediate community], and the risk is therefore assessed as E [risks generally warrant further controls]. This ranks as a significant adverse health risk (see Section 4.2).</p>			

REGISTER OF ADVERSE EFFECTS WITHOUT 1080						
ID	Formulation	Activity/Risk	Potential Receptors and Description of Exposure to CYANIDE and CYANIDE FORMULATIONS	How likely?	Magnitude of effect	Level of risk
H-CN-A12	<p><b>Paste formulations only:</b></p> <p><b>Cyanara Ferapaste-</b> encapsulated Potassium Cyanide (500 g/kg)</p> <p><b>Sodium Cyanide Paste</b> – non-encapsulated (500 g/kg)</p>	Public exposure through uncontained application: applied to natural features	<p><b>The public</b> (including hunters, farmers and the general public) may have access to cyanide paste if they enter the treatment area before clearance is given by the operator, or in the event that baits remain intact in the environment for a long period of time (for which time the cyanide baits remains toxic). Only pastes may be applied using “uncontained” application methods, such as hand-laying on stones, sticks, vegetation or pieces of cardboard.</p> <p>How long cyanide paste will remain poisonous in the environment depends greatly on rainfall. When hand-laying, potassium cyanide paste should be left for no more than 3 days. Contact with poison baits applied in contained application methods would require intentional force by a person.</p> <p><i>Controls</i> Refer to H-CN-A8 through A10 for controls.</p> <p>Permission is required from the Medical Officer of Health (MoH) where there is a risk to public health i.e. where the public might normally have access. Certain times of the year such as public holidays are avoided, and controls to avoid public exposure are particularly stringent in peri-urban areas. Application to the MoH requires the pest control operator to identify and assess risks relating to access areas, tramping huts, tracks and roads, exclusion areas, nearby schools, the completion of an Assessment of Environmental Effects, and details of actions taken on notification as well as community and Maori consultation. A model application form can be viewed at <a href="http://www.ermanz.govt.nz/resources/publications/word/MoH-VTA.doc">http://www.ermanz.govt.nz/resources/publications/word/MoH-VTA.doc</a>.</p> <p>Warning signs must be placed at all entrances to areas where baits will be used. As cyanide can only be sold to and/or used by a person holding a controlled substances licence then further requirements set by the ACVM are that signs must be posted in prominent places around the perimeter of the treated area, not just access points. Sign information must be in simple language and readable from 10 metres. All warning signs must show the name of the person or body who is applying the substance, skull and crossbones, the name and nature of bait, colour, the word “POISON”, and the intended date of application and rules to reduce risk. Controls for signage vary for different methods of cyanide application. For cyanide paste containing potassium cyanide, signs must remain until the substance has been retrieved, disintegrated, destroyed or is no longer toxic, but not less than 4 months after the last application. For sodium cyanide, signs are legally required to remain until the substance has been retrieved, disintegrated, destroyed or is no longer toxic, but not less than 2 months after the last application.</p>	Very Unlikely	Extreme	E

## Section 4.1C Effects on Human Health and Safety

REGISTER OF ADVERSE EFFECTS WITHOUT 1080						
ID	Formulation	Activity/Risk	Potential Receptors and Description of Exposure to CYANIDE and CYANIDE FORMULATIONS	How likely?	Magnitude of effect	Level of risk
			<p><i>Potential Exposure Pathways</i></p> <p>For the public, ingestion poses a far greater risk than either inhalation or dermal exposure, although dermal contact with paste is more likely in uncontained applications than in contained applications. While ingestion of cyanide would require an intentional act, only a small amount of poison bait would be required to potentially cause death. If ingestion was to occur, the LD<sub>50</sub> value for humans is 0.5 -3.5 mg/kgbw (Eisler, 1991). A person weighing 60 kg would need to eat between 30 a 210 grams of cyanide bait to receive the LD<sub>50</sub> dose. For the purposes of this assessment, an estimate of 100 grams of cyanide has been used, as a mid-point value between 30 and 210 grams, as this is a relatively wide ranging set of LD<sub>50</sub> values. This is consistent with the calculated LD<sub>50</sub> dose presented in a study by Yu (2001), which estimated the LD<sub>50</sub> range to be 40 – 100 mg for a 70-kg adult. As public exposure takes into account the possibility of a small child coming into contact with cyanide baits, a 20 kg child would need to ingest between 10 and 60 mg of cyanide bait to receive the LD<sub>50</sub> dose</p> <p><i>Risk Profile</i></p> <p>The likelihood of exposure of the public to cyanide when use in un-contained application methods is considered to be VERY UNLIKELY [only occurring in exceptional circumstances]; however the magnitude of any effects could potentially be EXTREME [fatality and/or significant irreversible effects reaching beyond the immediate community], and the risk is therefore assessed as E [risks generally warrant further controls]. This ranks as a significant adverse health risk (see Section 4.2).</p>			
			<p><b>INDIRECT (SECONDARY) EXPOSURE</b></p> <p>Secondary poisoning occurs when the exposure to the poison is not direct but via another medium, for example, meat from an animal that has been poisoned or has been exposed to a sub-lethal dose of the poison. The potential exposure pathways are described below. The pathways apply to all formulations and all application methods.</p>			
H-CN-A13	All formulations	Public poisoning through consumption of cyanide contaminated water	<p><b>Direct contact with cyanide-contaminated water</b></p> <p>Cyanide is registered only for use in bait stations or as a hand-laid paste, and is not laid in or around water. Some cyanide baits may be washed into the ground, but will not be strongly absorbed or retained in soil, and cyanide salts will be degraded by micro-organisms (Eason et al. 2001). It is therefore highly unlikely that cyanide will enter waterways during normal operations (Fisher and</p>	Highly improbable	Minimal	A

## Section 4.1C Effects on Human Health and Safety

REGISTER OF ADVERSE EFFECTS WITHOUT 1080						
ID	Formulation	Activity/Risk	Potential Receptors and Description of Exposure to CYANIDE and CYANIDE FORMULATIONS	How likely?	Magnitude of effect	Level of risk
			<p>Fairweather 2004).</p> <p><i>Controls</i> Refer to H-CN-A8–A12.</p> <p><i>Potential Exposure Pathways</i> If baits were to enter water, cyanide is highly soluble (Fisher and Fairweather 2004) with water solubility figures of 37g/100mL for sodium cyanide (non-encapsulated paste) and 41g/100mL for potassium cyanide (encapsulated paste and feratox pellets) and is expected to degrade within hours. A literature search failed to find published or verified unpublished data on the range of toxic residue levels observed in natural water, however it is expected that the degradation of cyanide is fast (within hours) (Fisher and Fairweather 2004). Sodium cyanide and potassium cyanide react with water to form hydrogen cyanide gas, however this is most effective under conditions of high temperature, high dissolved oxygen and high carbon levels (Eisler 1991), and is unlikely to pose a health risk to the public under ambient conditions.</p> <p><i>Risk Profile</i> The likelihood of human poisoning via consumption of cyanide-contaminated water is therefore HIGHLY IMPROBABLE [almost certainly not occurring but cannot be totally ruled out]; the magnitude of effect has been assessed to be MINIMAL [no effects], and the risk is therefore assessed as A [either insignificant or minor and not warranting further assessment].</p>			
H-CN-A14	All formulations	Public Poisoning through consumption of cyanide contaminated meat from domestic stock	<p><b>Farmed meat</b></p> <p>Indirect exposure could occur if people consumed meat from domestic stock (cattle, deer, sheep, goats) that had received sub-lethal doses of cyanide, and if the cyanide persisted in the meat. Cyanide does not bioaccumulate in food webs, possibly due to rapid detoxification of sub-lethal doses by most species and deaths at higher doses (Eisler 1991).</p> <p><i>Controls</i> Refer to H-CN-A8 to A12.</p> <p><i>Potential Exposure Pathways</i> In sub-lethally poisoned animals, cyanide is metabolised to thiocyanate, which is over 100 times less toxic than cyanide, and is excreted over several days (Eason &amp; Wickstrom 2001). In a USA study of chickens, most of a sub-lethal cyanide dose was recovered as thiocyanate within 6 hours (Eisler 1991). However, as cyanide is so toxic, ingesting very small doses will result in death (for cattle: LD<sub>50</sub> 2.0 mg/kgbw; and for a sheep: LD<sub>50</sub> 2.3 mg/kgbw), and there is very small scope</p>	Highly improbable	Minor	A

## Section 4.1C Effects on Human Health and Safety

REGISTER OF ADVERSE EFFECTS WITHOUT 1080						
ID	Formulation	Activity/Risk	Potential Receptors and Description of Exposure to CYANIDE and CYANIDE FORMULATIONS	How likely?	Magnitude of effect	Level of risk
			<p>for the potential of sub-lethal exposure. As cyanide is metabolised so quickly, it is highly unlikely that human poisoning would result from ingesting meat from an animal that has received a sub-lethal dose of cyanide.</p> <p><i>Risk Profile</i> The likelihood of human poisoning via consumption of cyanide-contaminated meat is therefore HIGHLY IMPROBABLE [almost certainly not occurring but cannot be totally ruled out] and the magnitude of effect has been assessed to be MINOR [Mild reversible short-term effects in localised area] therefore the level of risk is A [either insignificant or minor and not warranting further assessment].</p>			
H-CN-A15	All formulations	Public poisoning through consumption of cyanide contaminated vegetation	<p><b>Vegetation / Wild harvested plants</b></p> <p>The risk profile of public exposure to cyanide poisoning via ingestion of vegetation has been combined with wild harvested plants as the likelihood of exposure is considered to be the same. It is likely that plants may take up cyanide salts due to their solubility, and evidence exists to confirm this (Eisler 1991), however research which assesses the persistence of cyanide in plants could not be found (Fisher and Fairweather, 2004). Research by Eisler (1991) Eason &amp; Wickstrom (2001) failed to find free cyanide in intact plant cells.</p> <p><i>Controls</i> Refer to H-CN-A8 to A12.</p> <p><i>Risk Profile</i> The likelihood of human poisoning via consumption of cyanide-contaminated vegetation is therefore HIGHLY IMPROBABLE [almost certainly not occurring but cannot be totally ruled out] and the magnitude of effect has been assessed to be MINOR [Mild reversible short-term effects in localised area] therefore the level of risk is A [either insignificant or minor and not warranting further assessment].</p>	Highly improbable	Minor	A
H-CN-A16	All formulations	Public poisoning through consumption of cyanide contaminated game meat	<p><b>Meat from wild animals</b></p> <p>Indirect exposure could occur if people consumed meat from wild animals that had received sub-lethal doses of cyanide, and if the cyanide persisted in the meat. Cyanide does not bioaccumulate in food webs, possibly due to rapid detoxification of sub-lethal doses by most species and deaths at higher doses (Eisler 1991). There are no hunting restrictions in place in areas where cyanide is in use for pest control, and no stand-down period of consumption of animals caught in these areas. Literature that assesses the potential for sub-lethal effects on birds, mammals, reptiles/amphibians, fish, arthropods, or molluscs could not be found (Fisher &amp; Fairweather 2004).</p>	Highly improbable	Minor	A

## Section 4.1C Effects on Human Health and Safety

REGISTER OF ADVERSE EFFECTS WITHOUT 1080						
ID	Formulation	Activity/Risk	Potential Receptors and Description of Exposure to CYANIDE and CYANIDE FORMULATIONS	How likely?	Magnitude of effect	Level of risk
			<p><i>Controls</i></p> <p>Refer to H-CN-A8-A12.</p> <p><i>Risk Profile</i></p> <p>The likelihood of human poisoning via consumption of cyanide-contaminated game is therefore HIGHLY IMPROBABLE [almost certainly not occurring but cannot be totally ruled out] and the magnitude of effect has been assessed to be MINOR [Mild reversible short-term effects in localised area] therefore the level of risk is A [either insignificant or minor and not warranting further assessment].</p>			
H-CN-A17	All formulations	Public poisoning through consumption of cyanide contamination in milk	<p><b>Milk Products</b></p> <p>There have been no reported incidences of cyanide-contamination in milk during pest control operations nor any reports of cyanide poisoning via ingestion of contaminated milk products. Given the high toxicity of cyanide, its rapid detoxification in the environment, and the rapid rate at which it is metabolised in animals, the likelihood of human exposure via ingestion of cyanide-contaminated milk products is HIGHLY IMPROBABLE [almost certainly not occurring but cannot be totally ruled out] and the magnitude of effect could be MINOR [mild reversible short-term effects in localised area], therefore the risk is assessed as A [either insignificant or minor and not warranting further assessment].</p>	Highly improbable	Minor	A
<b>DISPOSAL OF CYANIDE WASTE</b>						
H-CN-A18	All formulations of cyanide pellets (feratox); and pastes (cyanara ferapaste and sodium cyanide paste).	Ingestion or inhalation through occupational exposure	<p><b>OCCUPATIONAL EXPOSURE</b></p> <p><b>Workers</b> may be exposed to cyanide and cyanide contaminated waste when washing down their equipment and PPE, and disposing of cyanide waste in the field. Potential exposure pathways include inadvertent ingestion, inhalation and dermal exposure either directly from contaminated hands or indirectly from clothing.</p> <p><i>Controls</i></p> <p>Refer to H-CN-A8 - A10 for controls.</p> <p><i>Potential Exposure Pathways and Effects</i></p> <p>The potential exposure pathways and effects are similar to those for occupational exposure during application of cyanide (H-CN-A8 through A10).</p> <p><i>Risk Profile</i></p> <p>As the risks vary significantly depending on the exposure pathway, two risks have</p>	<p><b>Ingestion</b></p> <p>Highly improbable</p> <p><b>Inhalation</b></p> <p>Unlikely</p>	<p>Extreme</p> <p>Minor</p>	<p>D</p> <p>D</p>

## Section 4.1C Effects on Human Health and Safety

REGISTER OF ADVERSE EFFECTS WITHOUT 1080						
ID	Formulation	Activity/Risk	Potential Receptors and Description of Exposure to CYANIDE and CYANIDE FORMULATIONS	How likely?	Magnitude of effect	Level of risk
			<p>been assigned.</p> <p><b>For the ingestion pathway</b>, the likelihood of exposure to CN during paste application is considered to be HIGHLY IMPROBABLE [only occurring in exceptional circumstances], however the magnitude of any effects could potentially be EXTREME [fatality and/or significant irreversible effects reaching beyond the immediate community] and the risk is therefore assessed as D [Risks ALARP, tolerable subject to ongoing monitoring and control].</p> <p><b>For the inhalation pathway</b>, the likelihood of exposure to CN during paste application is considered to be UNLIKELY [could occur, but not expected to occur under normal operating conditions], and the magnitude of any effects have been assessed as MINOR [mild reversible short term effects] and the risk is therefore assessed as D [Risks ALARP, tolerable subject to ongoing monitoring and control].</p>			

REGISTER OF ADVERSE EFFECTS WITHOUT 1080						
ID	Formulation	Activity/Risk	Potential Receptors and Description of Exposure to TRAPS	How likely?	Magnitude of effect	Level of risk
<b>TRAPPING</b>						
As traps are not hazardous substances, the adverse effects of traps on human health and safety have been assessed only for the activities associated with application (use of traps).						
H-T-A1	<b>Leg-hold traps</b>	Pest control worker injuries experienced during setting trap lines, checking, and killing trapped animals.	<p><b>Pest Control Workers</b> may injure themselves during the course of setting traps. The injuries most likely to occur are hand injuries.</p> <p>All workers using traps are trained in their use, in accordance with the trap manufacturer's instructions. In addition, the pest control agencies and pest control contractors have their own procedures and controls, as required of all employers under the Health and Safety in Employment Act 1992, to ensure the health and safety of their employees.</p> <p><i>Risk Profile</i></p> <p>The likelihood of pest control worker injuries occurring during trap use is considered to be UNLIKELY [could occur, but is not expected to occur under normal operating conditions], and the magnitude of any effects have been assessed a MINOR [mild reversible short term effects] and the risk is therefore assessed as D [within the ALARP band and broadly classed as tolerable subject to ongoing monitoring and control].</p>	Unlikely	Minor	D

REGISTER OF ADVERSE EFFECTS WITHOUT 1080						
ID	Formulation	Activity/Risk	Potential Receptors and Description of Exposure to TRAPS	How likely?	Magnitude of effect	Level of risk
H-T-A2	<b>Leg-hold traps</b>	Public injuries experienced during encounters with set traps	<p>The <b>public</b> may encounter traps out in the environment as there are no controls on access to land which is being treated by traps. Injury would only occur if people intentionally handled a trap; however, many people, particularly trampers, walkers and hunters who regularly go into the bush will be familiar with traps. The greatest risk of injury would be to an unsupervised young child.</p> <p><i>Risk Profile</i> The likelihood of public injuries occurring during trap use is considered to be VERY UNLIKELY [considered only to occur in very unusual circumstances]. The magnitude of any effects have been assessed a MINOR [mild reversible short term effects], and the risk is therefore assessed as C [within the ALARP band and broadly classed as tolerable subject to ongoing monitoring and control].</p>	Very Unlikely	Minor	C
H-T-A3	<b>Kill traps</b>	Pest control worker injuries experienced during setting trap lines and retrieving dead animals.	<p><b>Pest Control Workers</b> may injure themselves during the course of setting traps. The injuries most likely to occur are hand injuries. All workers using traps are trained in their use, in accordance with the trap manufacturers instructions. In addition, the pest control agencies and pest control contractors have their own procedures and controls, as required of all employers under the Health and Safety in Employment Act 1992, to ensure the health and safety of their employees.</p> <p><i>Risk Profile</i> The likelihood of pest control worker injuries occurring during trap use is considered to be UNLIKELY [could occur, but is not expected to occur under normal operating conditions], and the magnitude of any effects have been assessed a MINOR [mild reversible short term effects] and the risk is therefore assessed as D [within the ALARP band and broadly classed as tolerable subject to ongoing monitoring and control].</p>	Unlikely	Minor	D
H-T-A4	<b>Kill traps</b>	Public injuries experienced during encounters with set traps	<p>The <b>public</b> may encounter traps out in the environment as there are no controls on access to land which is being treated by traps. Injury would only occur if people intentionally handled a trap, however many people, particularly trampers, walkers and hunters who regularly go into the bush will be familiar with traps. The greatest risk of injury would be to an unsupervised young child.</p> <p><i>Risk Profile</i> The likelihood of public injuries occurring during trap use is considered to be VERY UNLIKELY [considered only to occur in very unusual circumstances]. The magnitude of any effects have been assessed a MINOR [mild reversible short term effects], and the risk is therefore assessed as C [within the ALARP band and broadly classed as tolerable subject to ongoing monitoring and control].</p>	Very Unlikely	Minor	C

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