

ESRA 2,4-D

This template follows a similar format to that of Annex 2 within the FSC Pesticides Policy FSC-POL-30-001 V3-0 EN. Therefore, it may be used by SDGs and Organizations in their Environmental and Social Risk Assessment (ESRA), and by certification bodies as a checklist to assess conformance with the minimum requirements for ESRA.

Date	April 2020
Proposed chemical pesticide	Products containing 2,4-D
Pesticide type	Herbicide
CAS number(s)	<ul style="list-style-type: none"> 94-75-7 2,4-D ((2,4-dichlorophenoxy)acetic acid) 1928-43-4 2,4-D 2-ethylhexyl ester 2008-39-1 2,4-D, Dimethylamine salt 5742-19-8 2,4-D Diethanolamine salt
Common trade name(s) (Listed brand names may have different formulations including combinations with other chemical pesticides)	<p>Numerous trade names. Usually available in water dispersed granules (WG), dry flowable (DF) and suspended concentrates (SC). Names include:</p> <ul style="list-style-type: none"> ADAMA 2,4-D AMINE 625 Corteva ESTERON™ LV Farmalinx Rebel Imtrade Atrazine 900 WG and Atrazine 600 SC KELPIE® AMINE 625 Kenso Agcare Ken-Amine 720 (Au) and Ken-Amine 625 (NZ) Nufarm SPRINTER® 700DS (NZ), AMINE 625 (Au) and 2,4-D Ester 700 (Canada) Orion Synergy 2,4-D Ravensdown Pasture Guard 2,4-D 680 <p>Refer to the APVMA PubCRIS database for the full list of registered products in Australia with this active ingredient.</p>
FSC pesticide classification (prohibited HHP, highly restricted HHP, restricted HHP, or other chemical pesticide)	<p>Restricted HHP (94-75-7)</p> <p>Other chemical (1928-43-4, 2008-39-1, 5742-19-8)</p>
Purpose of use (protection of vegetation, human health, native species, seeds or seedlings, weed control, others)	Used for pre and post-planting control of broad-leaved weeds and wildings, e.g. ink bush, groundsel bush, and parthenium. Most grasses are relatively unaffected. 2,4-D is often used in conjunction with other herbicides, e.g. with glyphosate for Pinus wilding control.
Location where used (forest, office, fire store, nursery)	Forest.
Application method (hand, ground machine, aerial)	<ul style="list-style-type: none"> All application methods used including aerial, boom, handgun and knapsack.
Scale and intensity of use	Variable. Dependent on the size of the operational area and method of application.

Alternatives considered (burning, mechanical land prep, hand, mechanical releasing, oversowing, grazing, weed mats, biological control, alternative chemicals)	<p>A wide range of alternatives have been considered consist with Criterion 10.7 of FSC-STD-01-001 V5-2 FSC Principles and Criteria.</p> <p>Further information on alternatives is within the IPM.</p>
Pesticide used individually or in conjunction with other pesticide(s)	<ul style="list-style-type: none"> • Used in conjunction with aminopyralid, Glyphosate, Picloram and Triclopyr. Effective with Glyphosate for Pinus wilding control. • Always check the product label, and if there are other pesticide additives, consult their ESRA's too. • Risks will likely increase with additional herbicide products, especially those known to have effects on the soil, water, air and aquatic or terrestrial life. Little is known about potential compounding risks of mixes, as risk assessments are generally made on individual active ingredients.
Reference documents	<ul style="list-style-type: none"> • Integrated Pest Management document • FSC Pesticides Policy FSC-POL-30-001 V3-0 EN • FSC Lists of highly hazardous pesticides FSC-POL-30-001a V3-0 EN D2-0 • SDS ADAMA 2,4-D AMINE 625 • SDS Corteva ESTERON™ LV • SDS Farmalinx Rebel • SDS Imtrade Atrazine 900 WG and Atrazine 600 SC • SDS KELPIE® AMINE 625 • SDS Kenso Agcare Ken-Amine 720 (Au) and Ken-Amine 625 (NZ) • SDS Nufarm SPRINTER® 700DS (NZ), AMINE 625 (Au) and 2,4-D Ester 700 (Canada) • SDS Orion Synergy 2,4-D • SDS Ravensdown Pasture Guard 2,4-D 680 • APVMA website including the PubCRIS database https://portal.apvma.gov.au/pubcris • NZ EPA website including the Chemical Classification and Information Database (CCID) https://www.epa.govt.nz/database-search/chemical-classification-and-information-database-ccid/ • PAN Pesticides Database http://pesticideinformation.org/Search_Chemicals.jsp • Pesticide properties database http://sitem.herts.ac.uk/ • Herbiguide herbiguide.com.au/InformationHerbicides.aspx • APVMA, 2019, '2,4 D (2,4 dichlorophenoxyacetic acid) Review Technical Report'. • European Food Safety Authority (EFSA) 2017 'Conclusion on the peer review of the pesticide risk assessment of the active substance 2,4-D'.
Note	<ul style="list-style-type: none"> • It appears that the 2,4-D variants respond similarly except 2,4-D 2-ethylhexyl ester which is highly toxic to aquatic organisms on an acute basis. • There are at least three major metabolites.

Risk profiling

The risk matrix below helps frame the level of risk for each ESRA exposure variable, and to also assist in comparing risk between the ESRA of different chemical pesticides. A score assessed as 3/2 means the likelihood is 'possible' and the consequence of the event 'minor'.

		LIKELIHOOD					
		1 - Negligible	2 - Unlikely	3 - Possible	4 - Likely	5 - Almost Certain	6 - Certain
CONSEQUENCE	6 - Catastrophic	Medium	High	Extreme	Extreme	Extreme	Extreme
	5 - Extreme	Medium	Medium	High	High	Extreme	Extreme
	4 - Major	Low	Medium	Medium	High	High	Extreme
	3 - Moderate	Low	Low	Medium	Medium	High	High
	2 - Minor	Low	Low	Low	Low	Medium	Medium
	1 - Insignificant	Low	Low	Low	Low	Low	Medium

The risk for some attributes will change between pre-control assessment risk and post-mitigation control risk (residual risk), after initiating the mitigation control measures within the ESRA.

Exposure	List of values	HHP Hazards Acute toxicity mammals and birds LD50< 200mg/kg body weight	Assessment of Other potential risks – Pre-controls ^{1, 2}	Assessment of Other potential risks - Post mitigation controls ^{1, 2}	Descriptor of why / why not a risk ²	Mitigation strategies defined to minimise risk
Environmental	Soil (erosion, degradation, biota, carbon storage)	Na	3/3 = Medium	3/2 = Low	<p>Risk levels to soil vary. Risks include:</p> <ul style="list-style-type: none"> Classed as very toxic to the soil environment in NZ (NZ EPA 9.2A). Also, refer to the non-target species row below. Moderate to very highly mobile in soil (K_{oc} 31-275 ml/g, K_{Foc} 12 - 382 ml / g). 2,4-D has moderate water solubility (620 mg/L). The metabolites have medium to low mobility in soil and groundwater, but there are data deficiencies. Low to moderate persistent in soil (DT50 (soil) (field) 1.2 - 60 days). Half-life in the soil is typically 4.4 – 7 days. Data gaps exist for the degradation of 2,4-D in acidic soils (pH < 6). The metabolites are similar, but there are data deficiencies. Factors affecting degradation include temperature, rainfall, and soil type and organic content. Light is unlikely to assist in its breakdown. Bioaccumulation potential is low (BCF 1-10 l/kg, LogP = -0.82 (low). Potential increased erosion due to vegetation dieback. Risk increases with scale and intensity, especially in the erosion-prone country where infrastructure and slopes near waterways are prone to surface erosion. However, the risks reduce if oversown or hydro seeded cut/fill batters are not sprayed. 	<p>Refer to Appendix 1: ‘Generic Mitigation and Monitoring Measures for Herbicides, Fungicides, Vertebrate Toxins, and Insecticides’.</p> <p>The Appendix describes the mitigation requirements to minimise risk from the exposure variables.</p>
	Water (groundwater, surface water, water supplies)	Na	3/3 = Medium	3/2 = Low	<p>Risk levels to water vary and include:</p> <ul style="list-style-type: none"> Entering water. There are three pathways to enter water: directly into waterways from the spray, overland flow from rain or wind, and via the soil to groundwater. <ul style="list-style-type: none"> Low to moderate risk of migration into water sources via all three. 2,4-D’s moderate to very high mobility is offset by rapid degradation in soil and aquatic environments. Despite this, it’s been detected in groundwater supplies in at least five states and in Canada. Likely low potential to leach to groundwater for forest applications. Risks when in water: <ul style="list-style-type: none"> Hazard classed as very toxic to aquatic life with long-lasting effects in most SDSs (Aust and NZ). Moderately fast to fast degradation in water and sediment (DT50 (water-sediment) 18.2 days, DT50 (water phase only) 7.7 days, and DT50 (whole system, 200C) 6 – 52 days. Hydrolysis increases under acidic or basic conditions. In normal water conditions, biological degradation is faster than breakdown by light. The risk profile to water increases with: <ul style="list-style-type: none"> Site factors that increase the potential for surface runoff, e.g. steep slopes, poorly draining soils and soils with shallow groundwater. Site factors that increase the potential of leaching to groundwater, e.g. sites with permeable soils with shallow water tables. Poor product application, e.g. spraying before heavy rain, direct spray or drift over water, or locating storage or load zones that increase the risk to water from accidental spillage. 	<p>Although Appendix 1’s mitigation measures should significantly reduce pre-control risks, not all risk can be eliminated as seen in the post-mitigation controls column. Depending on the residual risk, some sites may require more stringent versions of individual mitigation measures than those in Appendix 1. Also, in some situations, additional company mitigation measures may need to be included.</p>
	Non-target species (vegetation, wildlife, bees and other pollinators, pets)	3/3 = Medium	<p>Fish 3/4 = Medium Aquatic organisms 3/3 = Medium Bees 2/2 = Low Birds 2/2 = Low Soil organisms 3/3 = Medium</p>	<p>Fish 3/3 = Medium Aquatic organisms 3/2 = Low Bees 2/2 = Low Birds 2/2 = Low Vegetation 2/2 = Low Soil organisms 3/2 = low</p>	<p>Aquatic and terrestrial risks vary depending on non-target species:</p> <ul style="list-style-type: none"> Aquatic: <ul style="list-style-type: none"> Hazard classed as Harmful to aquatic life with long-lasting effects. Moderate acute toxicity to fish (LC50 (96hr) (rainbow trout) 1.4 - 100 mg/L, (Bluegill sunfish) > 5 mg/L. Some SDS listed 2,4-D as practically non-toxic to fish). Note: 2,4-D 2-ethylhexyl ester is highly toxic to aquatic organisms on an acute basis (LC50/EC50 between 0.1 and 1 mg/L in the most sensitive species tested). Moderate <i>chronic</i> toxicity to fish (NOEC (21 days) (<i>Oryzias latipes</i>) 27.2 mg/L, (32 day) (fathead minnow) (growth) 63.4 mg/L). Low to moderately acute toxicity to aquatic invertebrates depending on the source (LC50 (48 hrs) (<i>Daphnia</i>) 25 - 184 mg/L). Low <i>chronic</i> toxicity for aquatic invertebrates (NOEC (<i>Daphnia</i>) (21 days) 46.2-79 mg/L, with 2,4-D 2-ethylhexyl ester 0.015 mg/L)). Acute toxicity for sediment-dwelling organisms is data deficient. Low acute toxicity to aquatic algae (EC50 (72hr) (<i>Raphidocelis subcapitata</i>) 24.2 mg/L). Low acute toxicity to aquatic plants (EC50 (14 days) (common duckweed) 0.27 – 0.58 mg/L). Terrestrial: <ul style="list-style-type: none"> Classed as harmful to terrestrial vertebrates in NZ (NZ EPA 9.3C). For mammal toxicity, see the health section below. Severely affects non-target vegetation, including commercial crops and fruit. Low to moderately acute for earthworms, and low to moderate chronic toxicity depending on the source (LC50 (14day) (earthworm) 350 mg/kg, NOEC (reproduction) 62.5 mg/kg). Low risk to other soil organisms (soil mites, collembolan and soil microorganisms). Low to moderate toxicity to birds depending on the source (LD50 (mallard duck) >1000 mg/kg, LD50 (12day) (Bobwhite quail) 415 - 668 mg/kg). Some SDS listed it as non-toxic to birds based off this evidence. There is a low risk of secondary poisoning to earthworm and fish-eating birds and mammals. No to moderate acute toxicity to bees depending on the source (LD50 (contact and oral acute) (worst case up to 72hr) 94->104 ug/bee). Moderate doses of 2,4-D severely impaired honeybees brood production. 2,4-D variants are not considered to be persistent, bioaccumulating and toxic (PBT). This substance is not considered to be very persistent and very bioaccumulating (vPvB). 	<p>The Appendix also describes mitigation measures for other pesticides that may be used in conjunction with 2,4-D to improve the efficacy of the treatment.</p>

	List of values	HHP Hazards Acute toxicity mammals and birds LD50< 200mg/kg body weight	Assessment of Other potential risks – Pre-controls ^{1, 2}	Assessment of Other potential risks - Post mitigation controls ^{1, 2}	Descriptor of why / why not a risk ²	Mitigation strategies defined to minimise risk
Social	Atmosphere (air quality, greenhouse gases)	Na	1/1 = Low	1/1 = Low	The risk to the atmosphere is low. Risks vary and include the application method, scale and intensity, location relative to adjoining properties, and weather conditions. Aerial spraying has a potentially higher risk as it will result in having pesticide in the air over the application area until the spray settles	Refer to Appendix 1: ‘Generic Mitigation and Monitoring Measures for Herbicides, Fungicides, Vertebrate Toxins, and Insecticides’.
	Non-timber forest products (as FSC-STD-01-001 V5-2 FSC principles and criteria, criterion 5.1)	Na	2/2 = Low Aquaculture 3/4 = Medium	2/2 = Low Aquaculture 2/2 = Low	2,4-D is applied to bare land or newly established trees so risks to under the canopy, non-timber products aren’t applicable. However, risks will occur from potential leaching to water, especially where aquaculture is nearby, e.g. koura ponds, as koura can be highly sensitive to some pesticides.	
	High conservation values (particularly HCV 1-4)	2/2 = Low	4/5 = Extreme	2/2 = Low	The risk of 2,4-D to high conservation values in some situations could be extreme. Poor application adjoining or near a high conservation value area will compound the risk. The recent controversy in Australia over aerial and boom use of 2,4-D in non-forest situations, causing off-site damage to crops, resulted in a temporary ban and then tight restrictions on how to manage drift.	
	Landscape (aesthetics, cumulative impacts)	Na	Small scale 1/1 = low to Large aerial 6/3 = High	Small scale 1/1 = low to Large aerial 4/3 = Medium	The risk to landscape increases with scale and intensity. Large operational areas may significantly impact aesthetics. This could depend on the location of the treatment area and public sentiment. For example, treatment size, visibility, proximity to and type/sensitivity of neighbours, impact on public recreation, perceived impact on nearby parks, forest, or spray sensitive land users like orchards or organic farming.	
	Ecosystem services (water, soil, carbon sequestration, tourism)	2/2 = Low	2/2 = Low	2/2 = Low	Risks to ecosystem services are likely low after mitigation measures are in place. Refer to the water, soil, atmosphere and non-target species exposure variable assessments. However, specific circumstances may raise the risk profile. For example, if the treatment area was part of a municipal water catchment zone.	
	High conservation values (especially HCV 5-6)	Na	2/2 = Low	2/2 = Low	The risk is likely to be low in most situations.	
	Health (fertility, reproductive health, respiratory health, dermatologic, neurological and gastrointestinal problems, cancer and hormone imbalance)	2/2 = Low	3/3 = Medium	2/2 = Low	<p>Risks to human health from 2,4-D are likely to be low when used according to label, SDS and good practice:</p> <ul style="list-style-type: none"> The following are oral, dermal or inhalation toxicity risks: <ul style="list-style-type: none"> Low to high acute oral toxicity depending on the source and species (LD50 (rat) 300 - 1045 mg/kg, (dog) 100 mg/kg (high)). Harmful if swallowed. Low to moderate acute dermally toxicity depending on the source (LD50 (rat) 1500->5050 mg/Kg, LD50 (rabbits) 1400 - >4000 mg/kg). May cause an allergic skin reaction. However, repeated exposure may cause skin dryness or cracking. Low to moderate acute inhalation toxicity. Avoid breathing spray. 2,4-D can irritate the nose, throat and respiratory system. Caused respiratory tract irritation in a repeated dose toxicity study in rats. (LC50 (4hr) (Rat) 1.79 - >3.5 mg/L). Causes serious eye damage. Eye contact will cause stinging, blurring, tearing, severe pain and possible burns, necrosis, permanent damage and blindness. 2,4-D produced severe irritation to rabbit eyes. Carcinogenicity, mutagenicity, teratogenicity, reproduction, and endocrine risks: <ul style="list-style-type: none"> Carcinogenicity: There is controversy around 2,4-D’s carcinogenicity. The research is not clearcut. 2,4-D fed to rats for 2 years caused an increase in malignant tumours. Female mice were given a single injection of 2,4-D developed cancer (reticulum-cell sarcomas). Another study in rodents shows a low incidence of brain tumours at moderate exposure levels (45 mg/kg/day) over a lifetime. Mutagenicity: Not known. Result of animal studies are inconclusive. Some references list as not mutagenic or genotoxic. Teratogenicity: Unlikely to be teratogenic at expected exposure levels. 2,4-D may cause birth defects at high doses. Rats fed 150 mg/kg/day on days 6 to 15 of pregnancy had offspring with increased skeletal abnormalities, such as delayed bone development and wavy ribs. Reproduction or reproductive toxicity: Unlikely to be a reproductive risk. The evidence suggests 2,4-D causes reproductive effects in animals only at very high doses, e.g. excessive dietary levels of 2,4-D have caused decreased weight and survival in offspring in rats in a reproduction study. Endocrine disruption potential: Data deficient. There is evidence of effects on the thyroid hormone system, e.g. decreased levels of T4 and T3 and increased TSH levels, correlated with increased thyroid weight and changes at higher dose levels (150 mg/kg bw per day). Specific Target Organ Systemic Toxicity (Single Exposure): <ul style="list-style-type: none"> STOT (single exposure) – Category 3 - produce transient (short duration or temporary) target organ effects Chronic toxicity: <ul style="list-style-type: none"> Classed as ‘may cause organ damage from prolonged or repeat exposure at high doses’ in NZ SDSs (NZ EPA 6.9B). 2,4-D is rapidly and almost completely absorbed if eaten. The active substance is poorly metabolised and eliminated rapidly, mainly via urine excretion. Rats given high amounts (50 mg/kg/day) of 2,4-D in their diet for 2 years showed no adverse effects. Studies in dogs have found higher sensitivity to the toxic effects of 2,4-D in comparison with other species, including humans. Dogs fed lower amounts in their food for 2 years died, likely due to dogs not able to excrete organic acids efficiently. Some sources state they are not considered the most relevant species to extrapolate 2,4-D toxicity to humans. NZ EPA uses this study for its assessment for health and environment hazard classing. Target organs are kidneys, thyroid and the liver. Repeated absorption of relatively large amounts of 2,4-D presents a risk to the liver and kidneys. The Australian Acceptable Daily Intake (ADI) for 2,4-D for a human is 0.01 mg/kg/day, (some SDSs are different) set for the public for daily, lifetime exposure (based on the NOEL of 1 mg/kg/day). 	<p>The Appendix describes the mitigation requirements to minimise risk from the exposure variables.</p> <p>Although Appendix 1’s mitigation measures should significantly reduce pre-control risks, not all risk can be eliminated as seen in the post-mitigation controls column. Depending on the residual risk, some sites may require more stringent versions of individual mitigation measures than those in Appendix 1. Also, in some situations, additional company mitigation measures may need to be included.</p> <p>The Appendix also describes mitigation measures for other pesticides that may be used in conjunction with 2,4-D to improve the efficacy of the treatment.</p>

	List of values	HHP Hazards Acute toxicity mammals and birds LD50< 200mg/kg body weight	Assessment of Other potential risks – Pre-controls ^{1, 2}	Assessment of Other potential risks - Post mitigation controls ^{1, 2}	Descriptor of why / why not a risk ²	Mitigation strategies defined to minimise risk
Social	Welfare	2/2 = Low	3/3 = Medium	2/2 = Low	<p>Australian GHS hazardous substances classification codes on all reviewed SDSs for health and environmental hazards include:</p> <ul style="list-style-type: none"> ED1 Eye Damage/Irritation: Category 1, OT4 Acute Toxicity - Oral: Category 4, SS-1 Sensitization - Skin: Category 1, STOT (single exposure) – Category 3, Hazardous to the aquatic environment (chronic) – Category 3, H318 Causes serious eye damage, H302 Harmful if swallowed, H317 May cause an allergic skin reaction, H318 Causes serious eye damage, H335 May cause respiratory irritation, H412 Harmful to aquatic life with long lasting effects. Note: Australian SDSs are not consistent in their listing of hazard classifications. Refer to safe work Australia’s summary tables https://www.safeworkaustralia.gov.au/system/files/documents/1702/classification_and_labelling_workplace_hazardous_chemicals_poster_a4.pdf <p>NZ hazardous substances classification codes for health and environmental hazards taken from the NZ EPA CCID database:</p> <ul style="list-style-type: none"> Health: Classification 6.1C (All), 6.1C (O), 6.3A, 6.4A, 6.5B, 6.9A (All), 6.9A (O) Environment: 9.1B (All), 9.1B (A), 9.1D (F), 9.1D (C), 9.2A, 9.3B Note: NZ SDSs may have some, all, or additional hazard classifications. Refer to NZ EPA for definitions of hazardous substances classification codes https://www.epa.govt.nz/industry-areas/hazardous-substances/rules-for-hazardous-substances/hazardous-substances-classification-codes/ <p>Refer to health and other social exposure elements as that can also influence welfare too.</p>	<p>Refer to Appendix 1: ‘Generic Mitigation and Monitoring Measures for Herbicides, Fungicides, Vertebrate Toxins, and Insecticides’.</p> <p>The Appendix describes the mitigation requirements to minimise risk from the exposure variables.</p> <p>Although Appendix 1’s mitigation measures should significantly reduce pre-control risks, not all risk can be eliminated as seen in the post-mitigation controls column. Depending on the residual risk, some sites may require more stringent versions of individual mitigation measures than those in Appendix 1. Also, in some situations, additional company mitigation measures may need to be included.</p> <p>The Appendix also describes mitigation measures for other pesticides that may be used in conjunction with 2,4-D to improve the efficacy of the treatment.</p>
	Food and water	2/2 = Low	3/2 = Low	2/2 = Low	The risk to food and water is likely low. 2,4-D is used in food-producing primary sectors like cereals and orchards, and infrastructure maintenance, e.g. in crops like wheat, oats, maize and Lucerne. Eliminate the potential risk of accidental or ongoing oral ingestion by pesticide workers with poor on-the-job personal hygiene around food and drink.	
	Social infrastructure (schools and hospitals, recreational infrastructure, infrastructure adjacent to the management unit)	1/1 = Low to 3/2 = Low	1/1 = Low to 3/5 = High	1/1 = Low to 3/2 = Low	The risk to social infrastructure is likely low if the treatment area is well within the forest and away from in-forest or adjoining infrastructure. Risks increase if there are water takes that are within, or drain from, the treatment area. Also, the risk is likely to increase with scale and intensity. For example, if the operation is on a boundary close to infrastructure or where there are in-forest rights. However, access and recreation would likely be restricted only during the operation.	
	Economic viability (agriculture, livestock, tourism)	Na	1/1 = Low to 3/5 = High	1/1 = Low to 3/3 = Medium	The risk to economic viability is likely low if the treatment area is well within the forest. Risk increases with scale, intensity and operational complexity, especially if the operation is on a boundary. For example, an aerial overspray and have an economic impact on adjoining agriculture, aquaculture or horticulture, leading to costly compensation or legal action. Organics are especially vulnerable. Susceptible crops or plants include cotton, tobacco, tomatoes, flowers, vines, and fruit trees. There has been recent controversy in Australia over aerial and boom use of 2,4-D in non-forest situations causing off-site damage to crops resulted in a temporary ban and then tight restrictions on how to manage drift.	
	Rights (legal and customary)	Na	2/2 = Low	2/2 = Low	Risks to rights are likely to be low unless in specific situations like easements for water extraction or grazing. Also, operational areas will likely be closed off to those with rights only during the operation, e.g. utility companies or those with road access easements.	
	Other	----	----	----	----	
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1 = The risk profile is only for the pesticide listed in the table. Often other pesticides are added to improve treatment efficacy or solubility. Also, risk will vary between sites, methods and scale and intensity of the treatment.

2 = It is recommended to take a precautionous approach. New research may bring to light risks that were not identified in previous assessments. Current research is not exhaustive, is often agricultural based from northern hemisphere studies, and the effects on some exposure variables are not known or fully understood. **Also, between SDS’s there can be conflicting data, variation in both amount and quality of information, and differing judgements of risks. Some SDSs are more current than others. Therefore, consider reviewing SDS’s of similar pesticide products.** For example, the Kelpie Amine 625 in section 12’s mobility section discusses Glyphosate, yet there is no Glyphosate in the product. Kenso NZ Ken-Amine 625 (03/2020) lists NZ EPA 6.9A as ‘May cause eye damage from repeated oral exposure at high doses’ when it is ‘substances that are toxic to human target organs or systems’. Nufarm NZ SDS (05/2018) lists hazard class 6.8B ‘reproductive or developmental toxicant yet it is not classed as one on the NZ EPA website <https://www.epa.govt.nz/database-search/approved-hazardous-substances-with-controls/view/11386> Farmalinx Rebel’s section 12 simply had ‘Harmful to aquatic organisms, may cause long-term adverse effects to the aquatic environment. Insufficient data to be sure of status.’ when there is plenty of data (the product has been around since 1950). NZ SDSs list 2,4-D as NZ EPA 9.2A ‘very toxic to the soil environment’ and NZ EPA 9.3C ‘harmful to terrestrial vertebrates’ but Australia appears to have no soil hazard statements.

ESRA 1080 (Sodium monofluoroacetate)

This template follows a similar format to that of Annex 2 within the FSC Pesticides Policy FSC-POL-30-001 V3-0 EN. Therefore, it may be used by SDGs and Organisations in their Environmental and Social Risk Assessment (ESRA), and by certification bodies as a checklist to assess conformance with the minimum requirements for ESRA.

Date	May 2020
Proposed chemical pesticide	1080 (Sodium Monofluoroacetate)
Pesticide type	Vertebrate poison
CAS number(s)	62-74-8
Common trade name(s) (Listed brand names may have different formulations including combinations with other chemical pesticides)	<p>Numerous product names. Formulations are often in cereal baits or dried meat. Sometimes sold in capsule, gel or liquid concentrate form. Names include:</p> <ul style="list-style-type: none"> • 4Farmers 1080 liquid • 4Farmers 1080 impregnated oats (wild dog control) • Acta Pigout Feral Pig Bait • Acta 1080 Concentrate • Acta 1080 Dried Meat Fox bait • Acta FOXOFF® Fox Bait • Acta DOGGONE® Wild Dog Bait • Acta Canid Pest ejector 1080 wild fox capsules • De-K9 1080 Wild Dog Bait • Pestoff! Possum and Rodent Pellets • Pestoff! Rabbit Control Pellets • Pestoff! Stock Solution 20% • Pestoff! Deer and Wallaby Gel <p>Refer to the APVMA PubCRIS database for the full list of registered products in Australia with this active ingredient.</p> <p>In NZ, a Crown-owned company, Animal Control Products Ltd (Orillion), manufactures more than 90% of products containing 1080 under the brand 'Pestoff'.</p>
FSC pesticide classification (prohibited HHP, highly restricted HHP, restricted HHP, or other chemical pesticide)	Restricted HHP
Purpose of use (protection of vegetation, human health, native species, seeds or seedlings, weed control, others)	<p>Animal pest control in forests. Used to manage a wide range of mammals in Australia and New Zealand.</p> <p>Aust: Used for the control of feral animals, e.g. dogs, European fox, rabbits, and pigs that have a significant environmental and economic impact.</p> <p>NZ: Used to control possums, rabbits and hares, wallabies, mustelids and rats.</p>
Location where used	Forest.

(forest, office, fire store, nursery)	
Application method (hand, ground machine, aerial)	Laid as a bait. Ground or aerial application depending on location, accessibility, cost, and preferred method for target pest.
Scale and intensity of use	Variable. Dependent on the size of the operational area, the level of pest infestation, forest location and terrain, and method of application. Ranges from large annual aerial programmes across multiple forest areas, to small targeted 'hotspots' to control pest incursions.
Alternatives considered (non-pesticide alternatives e.g. shooting, other pesticides e.g. PAP)	<p>Alternatives have been considered consistent with Criterion 10.7 of FSC-STD-01-001 V5-2 FSC Principles and Criteria.</p> <p>Further information on alternatives is within the IPM.</p>
Pesticide used individually or in conjunction with other pesticide(s)	<ul style="list-style-type: none"> 1080 is often used with a non-toxic prefeed to improve kill rates of bait wary species.
Reference documents	<ul style="list-style-type: none"> Integrated Pest Management document FSC Pesticides Policy FSC-POL-30-001 V3-0 EN FSC Lists of highly hazardous pesticides FSC-POL-30-001a V3-0 EN D2-0 SDS 4Farmers 1080 liquid SDS 4Farmers 1080 impregnated oats (wild dog control) SDS Acta Pigout Feral Pig Bait SDS Acta 1080 Concentrate SDS Acta 1080 Dried Meat Fox bait Acta DOGGONE® Wild Dog Bait Acta DOGGONE® Wild Dog Bait SDS Acta FOXOFF® Fox Bait SDS Acta Canid Pest ejector 1080 wild fox capsules SDS Paks De-K9 1080 Wild Dog Bait SDS Pestoff! Possum and Rodent Pellets SDS Pestoff! Rabbit Control Pellets SDS Pestoff! Stock Solution 20% SDS Pestoff! Deer and Wallaby Gel APVMA, 2008, 'SODIUM FLUOROACETATE FINAL REVIEW REPORT AND REGULATORY DECISION - The reconsideration of registrations of products containing sodium fluoroacetate and approvals of their associated labels. Environmental Risk Management Authority Decision, Amended August 2008, 'Application for the Reassessment of a Hazardous Substance under Section 63 of the Hazardous Substances and New Organisms Act 1996, Name of Substance(s): Sodium Fluoroacetate (1080) and Formulated Substances Containing 1080, Application Number: HRE05002 Australian and New Zealand 1080 past derogation applications Australian derogation process, 2016 report 'Response to Request for Additional Information From FSC Technical Advisors – 1080' Animal Health Board (AHB) and the Department of Conservation (DoC) 1080 Reassessment Application, October 2006

	<ul style="list-style-type: none"> • Landcare Research, 2014, 'Sodium fluoroacetate - Pesticide Information Review • New Zealand Journal of Marine and Freshwater Research, 2006, Vol. 40: 159–167, 'Quantifying contamination of streams by 1080 baits, and their fate in water' • 1080: the facts website (A joint Federated Farmers – Forest and Bird protection society initiative) http://www.1080facts.co.nz/research.html • PAN Pesticides Database http://pesticideinformation.org/Search_Chemicals.jsp • APVMA website including the PubCRIS database https://portal.apvma.gov.au/pubcris • NZ EPA CCID database • Environmental risk management authority, 2009, 'Communications guideline for aerial 1080 operations'
Note	<ul style="list-style-type: none"> • 1080 has been used and studied since the 1940s. There are hundreds of peer-reviewed papers examining its behaviour, properties and persistence. • Over the decades, there has been reduced application rates, improved consultation and notification procedures, improved application technology to reduce non target poisoning, and more precise and reliable navigational systems in aircraft, e.g. New Zealand uses around 30 times less 1080 per hectare compared to 50 years ago.

Risk profiling

The risk matrix below helps frame the level of risk for each ESRA exposure variable, and to also assist in comparing risk between the ESRAs of different chemical pesticides. A score assessed as 3/2 means the likelihood is 'possible' and the consequence of the event 'minor'.

		LIKELIHOOD					
		1 - Negligible	2 - Unlikely	3 - Possible	4 - Likely	5 - Almost Certain	6 - Certain
CONSEQUENCE	6 - Catastrophic	Medium	High	Extreme	Extreme	Extreme	Extreme
	5 - Extreme	Medium	Medium	High	High	Extreme	Extreme
	4 - Major	Low	Medium	Medium	High	High	Extreme
	3 - Moderate	Low	Low	Medium	Medium	High	High
	2 - Minor	Low	Low	Low	Low	Medium	Medium
	1 - Insignificant	Low	Low	Low	Low	Low	Medium

The risk for some attributes will change between pre-control assessment risk and post-mitigation control risk (residual risk), after initiating the mitigation control measures within the ESRA.

Exposure	List of values	HHP Hazards ² Acute 2.1a, 2.1b, 2.1c <ul style="list-style-type: none"> Extremely or highly hazardous (WHO 1a, b) Acute toxicity for mammals and birds Fatal if inhaled (H330) 	Assessment of Other potential risks – Pre-controls¹	Assessment of Other potential risks - Post mitigation controls¹	Descriptor of why / why not a risk ¹	Mitigation strategies defined to minimise risk
Environmental	Soil (erosion, degradation, biota, carbon storage)	1/1 = Low	3/2 = Low	1/1 = Low	Risk levels to soil vary and include: <ul style="list-style-type: none"> Low mobility. High solubility in water (1110000 mg/L). Low to high persistence in soil, depending on biotic factors (DT50 (27°C, 10°C, 5°C, Kaitoke soil) 10, 30, 80 days respectively). Soil micro-organisms readily metabolise 1080 in 1-2 weeks in favourable conditions, e.g. temp 11-20 °C and 8-15% moisture. In extreme cold and drought, 1080 residues might persist in baits or the soil for several months or even up to a year in drought. Also, 1080 can persist in dead target animals for months. Low potential for bioaccumulation because of its high water solubility and degradation by biotic metabolism. However, there are no published bioconcentration factor values (BCF), or octanol-water coefficient (Kow or LogP). 	Refer to Appendix 1: 'Generic Mitigation and Monitoring Measures for Herbicides, Fungicides, Vertebrate Toxins, and Insecticides'. Also, refer to the additional derogation specific requirements listed at the end of this matrix. The Appendix describes the mitigation requirements to minimise risk from the exposure variables. Although Appendix 1's mitigation measures should significantly reduce pre-control risks, not all risk can be eliminated as seen in the post-mitigation controls column. Depending on the residual risk, some sites may require more stringent versions of individual mitigation measures than those in Appendix 1. Also, in some situations, additional company mitigation measures may need to be included.
	Water (groundwater, surface water, water supplies)	1/1 = Low	3/2 = Low	1/1 = Low	Risk levels to water are low and include: <ul style="list-style-type: none"> Entering water. There are three pathways to enter water: directly into waterways, overland flow from rain, and via the soil to groundwater. <ul style="list-style-type: none"> Aerially applied baits will enter streams directly, especially in operations with numerous gullies and low order streams, e.g. NZ hill country. Even then, aerial applications will result in only minute quantities of 1080 leaching into surface water. Low risk of overland flow. 1080 cereal baits leach rapidly with rain. AUST: Other substrates, such as carrots, are more resistant to leaching but quickly desiccate and become unpalatable under dry conditions. Meat baits also detoxify by rainfall (and particularly by blowfly larvae). If not eaten, meat baits are likely to remain lethally toxic to dogs and foxes for up to 8 weeks, depending on rainfall and temperature. Application rates of 1080 are low, a few grams per hectare for herbivore control and a gram or less for carnivore control. Risks when in water: <ul style="list-style-type: none"> Hazard classed as very toxic to aquatic life for liquid products. These are unlikely to be used anywhere near water as they are preparatory products rather than in a useable form. Low risk caused by direct entry into waterways as 1080 rapidly dilutes and biodegrades. <ul style="list-style-type: none"> 1080 rapidly dilutes to extremely low concentration levels. In cereal baits, half the concentration is leached within 5 hours, and eliminated in 30 hours. In a NZ study, 2098 water samples were taken following 1080 operations. Only three per cent of samples were found to contain traces of 1080 after 24 hours and, apart from one test suspected of contamination, the levels were around 0.2 parts per billion (ppb) for a short time after application, well below the NZ Ministry of Health drinking-water standard of 3.5 ppb. 1080 Rapidly biodegrades in the presence of aquatic plants and micro-organisms. Laboratory studies show that concentrations decrease below detectable levels in 1 day at 23°C and 3 days at 7°C. Decomposition is slower in colder waters. 1080 is stable in sterile water. At least 70% of biotic degradation in the aquatic environment within 28 days. Low risk of 1080 entering water via overland flow. Any 1080 entering soil and groundwater becomes extremely diluted, often below detection levels. Low risk to groundwater due to low application rates and rapid biological degradation. Column leaching studies and groundwater monitoring downstream from a landfill confirm that 1080 is mobile in soil. However, there is a low risk of 1080 in groundwater at concentrations above government health limits. 	
	Atmosphere (air quality, greenhouse gases)	1/1 = Low	1/1 = Low	1/1 = Low	No to low risk to the atmosphere.	
	Non-target species (vegetation, wildlife, bees and other pollinators, pets)	Aust Mammals, birds 3/2 = Med to 4/2 = Low NZ Birds, deer, pig 3/2 = Low All other species 2/2 = Low	Fish, other Aquatic organisms and vegetation 3/2 = Low Soil organisms, invertebrates, Bees 3/2 = Low Aust Mammals, birds 3/3 = Med to 5/4 = High NZ Birds, deer, pig 3/3 = Medium	Aust Mammals, birds 3/2 = Med to 4/2 = Low NZ Birds, deer, pig 3/2 = Low All other species 2/2 = Low	1080, when applied according to label, will likely kill non-targeted species. It can also lead to unintentional secondary kills. 1080's risks vary depending on non-target species: <ul style="list-style-type: none"> Aquatic: <ul style="list-style-type: none"> No to low acute toxicity to fish in most sources (LC50 (96hr) (rainbow trout) 36-54 mg/L, NOEL (bluegill sunfish) 930-970 mg/L). Some SDSs say 1080 is toxic to fish. Fingerling trout were subjected to 1080 concentrations of 500 and 1000 ppm without any visible effect on the fish, and in a separate study, rainbow trout were maintained in 580 ppm 1080 for 24 hours with no ill-effects. New Zealand: No mortality of longfin eels, kōaro or upland bullies was observed during experiments where high densities of cereal 1080 pellets were placed in water just upstream of them. Eels and koura have survived experimental feeding of cereal 1080 pellets, and eels have survived feeding on possum tissue containing 1080. Practically non-toxic to low acute toxicity to aquatic invertebrates (LC50 (48 hrs) (Daphnia, water flea) 301-350 mg/L). There have also been no detectable effects on aquatic invertebrate communities in field studies when 1080 baits were placed at high densities in streams. Low acute toxicity to aquatic crustaceans. New Zealand: A study has shown koura can consume 1080 and metabolise it noticeable effects. Moderate to high acute toxicity to aquatic algae (EC50 (72hr) ((Selenastrum capricornutum & S. subspicatus)) 0.012-0.12 mg/L, (C.vulgaris) <124 mg/L). High acute toxicity to some aquatic plants, e.g. duckweeds was sensitive in contrast to other plant species 	

	List of values	HHP Hazards ² Acute 2.1a, 2.1b, 2.1c <ul style="list-style-type: none"> Extremely or highly hazardous (WHO 1a, b) Acute toxicity for mammals and birds Fatal if inhaled (H330) 	Assessment of Other potential risks – Pre-controls ¹	Assessment of Other potential risks - Post mitigation controls ¹	Descriptor of why / why not a risk ¹	Mitigation strategies defined to minimise risk
	Non-target species (vegetation, wildlife, bees and other pollinators, pets)		As above	As above	<ul style="list-style-type: none"> Terrestrial: <ul style="list-style-type: none"> Moderately toxic to some plant species. Sensitivity to 1080 is species dependent (EC50) (lettuce, inhibition of germination) 47 mg/kg soil). Lettuce seedling emergence time increased with increasing 1080 concentration (LOEC) of 10 mg 1080/kg soil). Growth was also significantly inhibited at this concentration. Detoxification of 1080 has been demonstrated in plants. Aust: about 40 species of endemic Western Australian plants produce fluoroacetate as a chemically mediated, anti-herbivore defence strategy. High to extreme acute toxicity to mammals (LD50 (sheep, possums, macropods, wombats) <1 mg/kg). Refer to health section below. Potential hazard to a range of non-target animals that may take the baits although confirmatory residue analyses are usually not available. 1080 can persist in dead tissue for months and lead to secondary kills. Moderate acute toxicity to amphibians/reptiles (LD50 (US bullfrog) 54 mg/kg, (Aust bearded dragon) <110 mg/kg, (Aust blotched blue-tongue lizard) 336 mg/kg). NZ: No toxicity data on amphibian or reptile species are available. Aust: 1080 is known to kill goannas. Low to moderate acute toxicity for terrestrial invertebrates (LC50 (14 day) (earthworm) 296 mg/kg, LC50 (garden snails) 1500 mg/kg). NZ: High residues (up to 130 mg/kg) have been recorded in invertebrates collected from high potency baits (0.15% active). Low <i>chronic</i> toxicity for terrestrial invertebrates (NOEC, EC50 (earthworm) 50 mg/kg, 90 mg/kg respectively). Moderate to high acute toxicity for birds (LD50 (mallard duck) 4.8-9.11 mg/kg, (Aust wedge-tail eagle) 9.6 mg/kg, (NZ weka) 8 mg/kg, (Aus magpie) 9.9 mg/kg). Aust: Moderate sensitivity for most Australian birds, but high for red-browed firetail, crimson rosella and white-winged chough. NZ: A range of NZ native bird species including insectivores, have been found dead after aerial poisoning operations and many had residues of 1080. High acute toxicity to some insect species (LD50 (24hr) (bee, oral) 0.8 ug/bee, (common wasp) <10 mg/kg, (NZ tree weta) 91 mg/kg, (housefly) 21 mg/kg). Invertebrates will encounter and eat 1080 baits following aerial application. Individual toxicity is likely, however adverse impacts at the population level have not been observed and are considered unlikely. NZ: invertebrate populations have been monitored in nine aerial poisoning operations, and none have shown significant population effects on any species studied, or evidence to suggest poisoned invertebrates are a significant factor in secondary poisoning of other animals. 	<p>Refer to Appendix 1: 'Generic Mitigation and Monitoring Measures for Herbicides, Fungicides, Vertebrate Toxins, and Insecticides'.</p> <p>Also, refer to the additional derogation specific requirements listed at the end of this matrix.</p> <p>The Appendix describes the mitigation requirements to minimise risk from the exposure variables.</p> <p>Although Appendix 1's mitigation measures should significantly reduce pre-control risks, not all risk can be eliminated as seen in the post-mitigation controls column. Depending on the residual risk, some sites may require more stringent versions of individual mitigation measures than those in Appendix 1. Also, in some situations, additional company mitigation measures may need to be included.</p>
	Non-timber forest products (as FSC-STD-01-001 V5-2 FSC principles and criteria, criterion 5.1)	Na	1/1 = Low to 3/5 – High	1/1 = Low to 3/3 = Medium	<p>1080 operations occur because there are strong short, medium and long term environmental, social and economic benefits to undertake them. Some non-timber forest products will be impacted within the treatment area until 1080 has degraded and companies' re-open areas. Also, refer to the economic section below. These include:</p> <ul style="list-style-type: none"> Restricting all non-company access, even those potentially not affected by the application, due to health and safety. This includes in-forest access to aquaculture and honey production Requiring forest graziers to shift stock out of the treatment area as cattle and sheep will eat baits Eliminating meat hunting and fur trapping Requiring apiarists to shift hives 	
	High conservation values (esp. HCV 1-4)	3/2 = Low	3/5 – High	3/2 = Low	<ul style="list-style-type: none"> 1080 helps protect indigenous biodiversity in HCVs. Without 1080 indigenous biodiversity would be hit harder by mammal pests. Both the Australian and NZ governments acknowledge that lethal baiting is the most cost-effective control method currently available and is the only practical means for achieving population control in remote and inaccessible areas. 1080 is used by government agencies as a primary tool to help protect HCV across Crown, federal or state land. 1080 is used to control mammalian pests that have decimated indigenous biodiversity, e.g. Aust: feral cats have contributed to the extinction of 28 Australian mammal species, NZ: DOC (govt) and OSPRI (govt-sector partnership) are the two largest users of 1080. According to these agencies, 'without weapons like biodegradable 1080 and the rat poison brodifacoum, New Zealand would lose whole populations of native birds and vast tracts of native forest to rats, stoats and possums', NZ had no indigenous mammals (except bat species). The introduction of mammals has led to dozens of species extinctions and continue to do so. 1080 will kill non-target species, but this has been significantly reduced over time through research and improved operational procedures: <ul style="list-style-type: none"> Aust: Macropods, possums, wombats and rodents and other non-target mammals may be killed by grain or carrot baits, and meat baits. scavenging birds (currawongs, corvids, raptors) are likely to take meat baits under open field conditions. Grain feeding birds may feed on grain baits laid for herbivores. In forest situations, baits are more likely to be taken by mammals, such as bandicoots, rats, antechinus and quolls, with some interference by forest birds such as lyrebirds also recorded. Native animals, particularly those from the southwest corner of WA that have co-evolved in close association with fluoroacetate-bearing vegetation, tend to have greater tolerance to 1080 than their counterparts from the eastern states of Australia. NZ: to reduce the incidence of bird death, 1080 moved from carrot to green-dyed cereal baits, reduction in application rate, and more targeted pest application. 	
	Landscape (aesthetics, cumulative impacts)	Na	1/1 = low	1/1 = low	Generally considered to have a significant positive benefit to biodiversity across the landscape. Refer to other ESRA sections, including the HCV values, ecosystem services, economics, rights and others.	
	Ecosystem services (water, soil, carbon sequestration, tourism)	2/2 = Low	2/2 = Low	2/2 = Low	Unlikely to negatively impact soil or water for the reasons described in the water and soil sections above. Likely to have little or no effect on tourism. NZ: 1080 application will significantly improve carbon storage due to the significant reduction in browsing animals. DOC estimates that every night an estimated 70 million possums eat 21 000 tonnes of leaves and berries from NZ's native forests.	
Social	High conservation values (especially HCV 5-6)	2/2 = Low	1/1 = Low to 5/5 - Extreme	2/2 = Low	Over the medium and long term, 1080 application generally enhances community needs/cultural values are because of the reduced presence of the destructive pests. However, there are strong diverse views around some aspects of 1080. These include the impact of 1080 on access into traditional hunting areas, and some individual or organisation's core value around the application of poison onto land or water. NZ: Several submitters on the 2007 ERMA 1080 decision report 'the use of 1080 (particularly aerial application) to be inconsistent with tikanga and mātauranga Māori. In particular, they expressed concern that the aerial application of toxins on Papatūānuku (the primordial mother) compromised her ability to maintain the physical and spiritual value and integrity of flora, fauna and other taonga (including waterways).	

	List of values	HHP Hazards ² Acute 2.1a, 2.1b, 2.1c • Extremely or highly hazardous (WHO 1a, b) • Acute toxicity for mammals and birds Fatal if inhaled (H330)	Assessment of Other potential risks – Pre-controls ¹	Assessment of Other potential risks - Post mitigation controls ¹	Descriptor of why / why not a risk ¹	Mitigation strategies defined to minimise risk
	Health (fertility, reproductive health, respiratory health, dermatologic, neurological and gastrointestinal problems, cancer and hormone imbalance)	2/2 = Low	2/2 = Low	2/2 = Low	<p>Human health risks will be dependent on the product's active ingredient percentage, and its bait form (liquid, gel, cereal or meat). Extreme care will be required working with liquid 1080. The hazard ratings for 1080 are in the welfare section below. The risks to health are likely to be low when used according to label, SDS and good practice:</p> <ul style="list-style-type: none"> The following are oral, dermal or inhalation toxicity risks: <ul style="list-style-type: none"> High acute oral toxicity (LD₅₀ (rat) 1.2 mg/kg, (dog) 0.06- 0.35 mg/kg, (cat) 0.35 mg/kg, (deer) 1.0 mg/kg, (human, estimated) 0.7 – 2.1 mg/kg). There are some marked differences in susceptibility between, and even within, species. Dogs are very susceptible to 1080. Most deaths of pest species occur 8 – 48 hours after ingestion of a lethal dose. Herbivores generally die of cardiac failure, while carnivores experience central nervous system disturbances and convulsions before dying of respiratory failure. In omnivores, death tends to result from disorders of both the heart and central nervous system. Poisoned animals recover from sub-lethal doses as fluoroacetate is readily metabolised and excreted. Based on the lowest known lethal dose for humans (0.71 mg/kg bw), an 80 kg person would have to consume approximately 56mg of fluoroacetic acid. A single bait is unlikely to cause risk in humans, and no immediate or long-term symptoms would be expected. Consumption of the contents of multiple baits would pose a risk to life. In humans, the onset of clinical signs usually ranges from 30 minutes to about 2-3 hours. Signs of poisoning include nausea, vomiting, and abdominal pain initially, then followed by respiratory distress, anxiety, agitation, muscle spasms, stupor, seizures, and coma. Lowest reported dermal toxicity value in a mammal is for rabbit (LD50 (rabbit) 277 mg/Kg). 1080 can be absorbed through wounds but less readily absorbed through intact skin. Low to moderate acute inhalation toxicity depending on the product. Inhalation can lead to convulsions, laboured breathing, and unconsciousness. Data deficient on the risk of absorption through eyes, although considered a risk in liquid products. In rabbit, 1080 caused no corneal opacity or iritis, and slight conjunctival irritation. Carcinogenicity, mutagenicity, teratogenicity, reproduction, and endocrine risks: <ul style="list-style-type: none"> Carcinogenicity: Not listed as an IARC carcinogen. US EPA listed 'as no data available'. There are no scientific publications on 1080 and human or animal cancer. 1080 is not anticipated to cause cancer because it is not mutagenic. Mutagenicity: Results of three different, complementary tests indicate that 1080 is not mutagenic. No mutagenicity was observed in the Ames assay (bacterial gene mutation assay), mouse lymphoma assay (mammalian gene mutation assay), or the mouse micronucleus assay (bone marrow assay to detect chromosome anomalies). Teratogenicity: Relatively high doses of fluoroacetate can cause teratogenicity in rats. 1080 caused developmental defects in rats when pregnant females were exposed to relatively high doses (0.33 and 0.75 mg/kg) daily during the period of organogenesis (from days 6 through to 17 of gestation). A NZ study simulated potentially realistic sublethal exposure of non-target livestock (sheep) to 1080 where pregnant ewes were administered a single high sublethal dose (0.25 mg/kg) or multiple oral doses (0.05 mg/kg over three consecutive days) of a 1080 cereal pellet. In those ewes that survived these doses, there were no differences in growth rates between lambs from dosed and non-dosed pregnant ewes. Reproduction or reproductive toxicity: 1080 is listed as a US EPA TRI reproductive toxin and in NZ classed as 6.8A – a substance that is a known or presumed human reproductive or developmental toxicant. This is based on the effects of 1080 on testes in mammals, birds (>1 spp) and reptiles (one spp). Many SDSs state it is 'not considered to be toxic to reproduction.' Endocrine disruption potential: No information available. Specific Target Organ Systemic Toxicity (Single Exposure): <ul style="list-style-type: none"> Neurological effects include convulsion, respiratory depression, tremulousness, hallucinations and coma. Cardiac effects include hypertension then hypotension, arrhythmias, ventricular fibrillation and cardiac failure. Chronic affects: <ul style="list-style-type: none"> Classed as repeated oral exposure may cause reproductive or developmental damage (NZ 9.3B). Long term exposure at high doses may lead to cardiac and or testicular damage. Studies into the effects of chronic (90 day) exposure in rats have found damage to the heart and in males the testis, at a dose of 0.25mg/kg/day. In herbivores especially sublethal doses cause damage to heart muscle, e.g. in sheep, lesions and scarring resulting from toxin-induced damage. In rats, the heart to body weight ratio was significantly increased when compared to controls at 0.25 mg/kg/day after 90 days. Absolute spleen weights were significantly decreased in male rats receiving 1080 dose of 0.50 mg/kg/day for 13 weeks. No significant changes in organ weights of adrenals were noted in female and male rats. A possible thyroid and kidney toxicant. Most 1080 absorbed by animals is rapidly metabolised or excreted, with only low levels retained in the carcass. Residues in rabbit carcasses were below 1 mg/kg. Some animals retain higher residues, with up to 9 mg/kg measured in rat carcasses. Stomach contents may also retain high residues, in excess of 50 mg/kg for possums and ground squirrels following use in New Zealand and the USA. Pig vomit can, therefore, be expected to contain significant levels. 	<p>Refer to Appendix 1: 'Generic Mitigation and Monitoring Measures for Herbicides, Fungicides, Vertebrate Toxins, and Insecticides'.</p> <p>Also, refer to the additional derogation specific requirements listed at the end of this matrix.</p> <p>The Appendix describes the mitigation requirements to minimise risk from the exposure variables.</p> <p>Although Appendix 1's mitigation measures should significantly reduce pre-control risks, not all risk can be eliminated as seen in the post-mitigation controls column. Depending on the residual risk, some sites may require more stringent versions of individual mitigation measures than those in Appendix 1. Also, in some situations, additional company mitigation measures may need to be included.</p>
	Social infrastructure (schools and hospitals, recreational infrastructure, infrastructure adjacent to the management unit)	1/1 = Low to 3/3 = Medium	1/1 = Low to 5/5 – Extreme	1/1 = Low to 3/3 = Medium	<p>The risk to social infrastructure is likely low. Risk is likely to increase with:</p> <ul style="list-style-type: none"> Proximity of in-forest or adjoining infrastructure to operational areas Scale and intensity, e.g. area treated, type of species targeted, and application method External infrastructure reliant on the forest, e.g. water takes that are within, or drain from, the treatment area Restrictions on access, including recreation and legal and customary rights (see rights section below). 	

	List of values	HHP Hazards ² Acute 2.1a, 2.1b, 2.1c • Extremely or highly hazardous (WHO 1a, b) • Acute toxicity for mammals and birds Fatal if inhaled (H330)	Assessment of Other potential risks – Pre-controls ¹	Assessment of Other potential risks - Post mitigation controls ¹	Descriptor of why / why not a risk ¹	Mitigation strategies defined to minimise risk
	Welfare	2/2 = Low	3/3 = Medium	2/2 = Low	<ul style="list-style-type: none"> 1080 is not explosive, flammable, oxidising, or corrosive. Hazards relate to toxicity and ecotoxicity. The risks to health depend on the product type. High concentration liquid products pose a significant risk, but all pose a health risk. <p>Australian GHS hazardous substances classification codes on all reviewed SDSs for health and environmental hazards include:</p> <ul style="list-style-type: none"> Liquid concentrate (3%) Health: H310 Fatal in contact with skin, H332 Harmful if inhaled (4Farmers list it as H322) Environment: Aquatic Acute 1, H400 Liquid in a plastic capsule (0.3%), e.g. Canid pest ejector, Health: H301 Toxic if swallowed, H311 Toxic in contact with skin Environment: None Pellets (6%) Health: H301 Toxic if swallowed, H311 Toxic in contact with skin, H331 Toxic if inhaled Environment: H401 Toxic to aquatic life. Pellets (0.01-0.03%), e.g. Pigout feral pig bait, Doggone wild dog bait. Not classified as hazardous. Some with H302: Harmful if swallowed. Note: Australian SDSs are not consistent in their listing of hazard classifications. Refer to safe work Australia's summary tables https://www.safeworkaustralia.gov.au/system/files/documents/1702/classification_and_labelling_workplace_hazardous_chemicals_poster_a4.pdf <p>NZ hazardous substances classification codes for health and environmental hazards taken from the NZ EPA CCID database:</p> <ul style="list-style-type: none"> Liquid concentrate (20%) Health: 6.1A (acutely toxic – Fatal), 6.3B (mildly irritating to the skin), 6.4A (irritating to the eye), 6.8A (known or presumed human reproductive or developmental toxicants), 6.9A (toxic to human target organs or systems). Environment: 9.1A (very ecotoxic in the aquatic environment), 9.3A (very ecotoxic to terrestrial vertebrates), 9.4B (ecotoxic to terrestrial invertebrates). Gel (10%) Health: 6.1A, 6.3B, 6.4A, 6.8A, 6.9A Environment: 9.1A, 9.3A, 9.4B Gel (5%) Health: 6.1A, 6.8A, 6.9B Environment: 9.1D, 9.3A, 9.4B Pellets (0.04%) Health: 6.1C. Environment: 9.3B. Pellets (0.15%) Health: 6.B, 6.8A. Environment: 9.1D, 9.3A. Note: NZ SDSs may have some, all, or additional hazard classifications. Refer to NZ EPA for definitions of hazardous substances classification codes https://www.epa.govt.nz/industry-areas/hazardous-substances/rules-for-hazardous-substances/hazardous-substances-classification-codes/ <p>Refer to health and other social exposure elements as that can also influence welfare.</p>	<p>Refer to Appendix 1: 'Generic Mitigation and Monitoring Measures for Herbicides, Fungicides, Vertebrate Toxins, and Insecticides'.</p> <p>Also, refer to the additional derogation specific requirements listed at the end of this matrix.</p> <p>The Appendix describes the mitigation requirements to minimise risk from the exposure variables.</p>
	Food and water	2/2 = Low	3/3 = Medium	2/2 = Low	<p>The risk to food and water is likely low even with water takes down steam of the operation for the reasons described in the water section. Low risk of eating affected game because 1080 drops are widely advertised and signposted. Also, sub-lethal doses are rapidly metabolised or excreted.</p>	<p>Although Appendix 1's mitigation measures should significantly reduce pre-control risks, not all risk can be eliminated as seen in the post-mitigation controls column. Depending on the residual risk, some sites may require more stringent versions of individual mitigation measures than those in Appendix 1. Also, in some situations, additional company mitigation measures may need to be included.</p>
Social	Economic viability (agriculture, livestock, tourism)	Na	1/1 = Low to 3/3 = Medium	1/1 = Low to 3/3 = Medium	<p>The impact of animal pests on economic viability are huge. Pest control is an essential service. There are statutory requirements of landowners to reduce the huge economic, social and environmental impacts. Neighbours are often concerned that plantations provide habitat for vertebrate pests that could affect their crops or domestic stock. Also, all acknowledge the importance of community and neighbourhood control programs. Refer to the rights and other sections below for additional considerations. There will be short term impacts for the medium and long-term benefits of vertebrate pest control. Impacts could include in-forest graziers will need to move stock out of operational areas or tourism associated with the operational area, e.g. mountain bike park, hunting block.</p>	
	Rights (legal and customary)	Na	3/3 = Medium	2/2 = Low	<p>There are statutory requirements of landowners, in both Australia and NZ, to control declared pest animals. Aust: Feral Cats, Wild Dogs, Feral Pigs and Foxes are all listed under Australian Federal Law as Threatening Processes to biodiversity. Therefore, although in some states it may not be the law to control pest animals, it is incumbent on all landholders to play their part in protecting Australian native wildlife.</p> <p>NZ: OSPRI, has powers to apply 1080 on private land for Tb control with or without landowner approval (authority seldom used). Also, some regional councils require landowners to keep possum numbers down to a residual trap catch (RTC) of a certain percent, often 5%. There will be short term impacts to both legal and customary access until it is safe to open it, e.g. rights to hunt or graze.</p>	
	Other	Na	2/2 = Low to 4/4 – High	2/2 = Low to 4/4 – High	<p>1080 is a controversial tool. Public opinion is deeply divided on the continued use of 1080. The public benefit of 1080 in controlling predatory pest animal species is well recognised. There is strong support of its use by government agencies and major ENGOs. However, even supporters view aerial application of 1080 and the product generally as something of a "necessary evil" pending the development of a suitable alternative.</p> <p>Objections come from right across society from concerned citizens, neighbours, hunting organisations, some indigenous groups, and some ENGOs. Concerns are raised about the scale of operations, the application method, and that 1080 is not targeted enough and creates too much by kill and secondary kill. There are also concerns on its humaneness and broader cruelty to animals, meddling with ecological balance and that it restricts access for long periods. Aust: Aircraft application of pig meat baits across large areas are contentious. NZ: The major concern is broadcast aerial 1080 drops. Also, hunters are deeply concerned about the loss of a food source and dog mortality as they are the most common non-target casualty. Deer repellent may be used in high recreation areas to reduce deer kill (typically 30 and 60% after a 1080 drop).</p>	
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1 = It is recommended to take a precautionous approach when using 1080. New research may bring to light risks that were not identified in previous assessments. Research is not exhaustive, and the effects on some exposure variables are not known or fully understood. **Also, between SDS's there can be conflicting data, variation in both amount and quality of information, and differing judgements of risks. Some SDSs are more current than others. Therefore, consider reviewing SDS's of similar pesticide products. Depending on the form of the product, the GHS rating will change from 'not classified' to having several toxicity classifications.**
2= Post mitigation risk.

Derogation specific requirements



Type of document:	FSC® Pesticide Derogation Approval
Confidentiality:	No restrictions
Approved by:	FSC Pesticides Committee
Effective Date:	20 July 2016
Expiration Date:	20 July 2021
Related Documents:	FSC-POL-30-001 FSC Pesticides Policy FSC-STD-30-001 Indicators and thresholds for the identification of 'highly hazardous' pesticides (RHP) FSC-PRO-30-001 Pesticide Derogation Procedure

Pesticide derogation:	Use of Sodium fluoroacetate (1080) in New Zealand
FSC reference code:	FSC-DER-30-V1-0 EN Sodium Fluoroacetate New Zealand 200716

Date: 20 July 2016.

FSC Board Committee decision: The Pesticides Committee has approved a derogation to use sodium fluoroacetate ("1080") in certified forests in New Zealand for control of the common brushtail possum (*Trichosurus vulpecula*), and of other identified pest animals⁴⁴ such as ship rat (*R. rattus*) for which a product is registered, within national TB vector control programmes and regional pest management plans established under the Biosecurity Act 1993 (latest version), or the Biosecurity (National Bovine Tuberculosis Pest Management Plan) Order 1998,⁴⁵ provided that the certificate holders:

1. (where TBFree NZ or the Department of Conservation NZ conduct operations): encourage the responsible agencies and contracted staff to limit aerial application to areas where a regional Council has established a strict goal for control (e.g. residual trap catch 5% or less), and in the medium or long term aim at improved exclusion of pest animals from pastures where feasible and supplementing control with periodic vaccination against bovine tuberculosis of cattle or wild animal populations in FMUs near farming areas (once a vaccine has been registered);⁴⁶

⁴⁴ Evidence presented did not show that hares (*Lepus europaeus occidentalis*), rabbits (*Oryctolagus cuniculus*), or rats (*Rattus exulans*, *R. norvegicus*, *R. rattus*) are significant vectors of bovine tuberculosis in NZ. (See also: Lughton I.W. (1997) The contribution of wild mammals to the epidemiology of tuberculosis (*M. bovis*) in New Zealand. <http://www.massey.ac.nz/massey/fms/Collages/Collage4620a/%20Sciences/Epicenter/docs/Ian.LughtonPhD.pdf>, pp. 255-7)

⁴⁵ Multi-species management of mustelid predators (feral ferret, stoat, weasel) appears to be accepted practice in NZ. NZ Legislation: Biosecurity Act 1993. <http://legislation.govt.nz/act/public/1993/0095/1/assent/DLM314623.html> Biosecurity (National Bovine Tuberculosis Pest Management Plan) Order 1998. <http://legislation.govt.nz/regulation/public/1998/0179/1/0/DLM252646.html>

⁴⁶ E.g. see: Vordermeier et al (2016). TB in cattle: vaccines. <http://dx.doi.org/10.1146/annurev-animal-021815->

2. encourage the agencies to follow all protocols for risk mitigation strictly,⁴⁷ use only aircraft with GPS guidance / calibrated outlet, minimize 1080 rate (1-2 kg/ha, e.g. clustered baiting), map target areas, maintain buffer zone near surface waters and catchment areas for drinking-water strictly, and reduce risk for birds and non-target animals as far as possible by colouring bait (green), adding scent to deter birds, applying bait in the late afternoon and early evening or using bird scare device, and adding deer repellent to bait (in areas where deer are present);
3. (where the landowner controls possums to protect forest plantation): monitor tree damage and possums regularly,⁴⁸ define a threshold for the maximum acceptable possum density to achieve silvicultural objectives (e.g. based on residual trap catch, % trees browsed, fallen-leaf browse and canopy condition), and limit aerial 1080 application to sites where threshold is exceeded;
4. consider using another toxin, e.g. cholecalciferol (for possum and rodents) or cyanide (both requiring a derogation), para-aminopropiophenone (control of stoats), sodium nitrite (possum and feral pig), other toxins registered for certain pest species,⁴⁹ use of approved traps, shooting, or applying chemical repellent or an emetic (conditioned taste aversion) to seedlings/saplings;
5. participate in trials on alternatives by collaborating with research institutions (e.g. Landcare Research, Scion, AgResearch, universities, PhD students), government agencies (TBFree NZ, DoC), commercial enterprises (e.g. Connovation Ltd), or other forest companies;
6. record total annual use of 1080 (kg active ingredient), application method and controlled area in FMUs; include data in audit reports; provide a mid-term report to certifier (informs FSC IC) until end of December 2018 on recent use, participation in field trials and progress with use of alternatives (unless external agency conducted all applications); and aim at gradually reducing the amount applied aerially (e.g. - 20% per year) or encourage responsible agency to reduce use;
7. prior to each baiting operation notify authorities, neighbours and local residents, media, place warning signs on roads or tracks at the boundary of controlled areas,⁵⁰ and inform concerned stakeholders (such as hunters) about the measures which will be taken for mitigating risks.⁵¹

¹¹¹³¹¹

⁴⁷ Use directions on product label and safety guidelines from WorkSafe NZ and NPCA need to be strictly followed, e.g. see: <http://www.business.govt.nz/worksafe-information-evidence/evidence-in-household-chemicals> See also: Landcare Research. Vertebrate pest control decision support system. <https://pestids.landcareresearch.co.nz/>

⁴⁸ E.g. see Animal pests monitoring. <http://www.doc.govt.nz/our-work/biodiversity-inventory-and-monitoring/animal-pests/>

⁴⁹ Brown K, Elliott G, Innes J, Kemp J. Ship rat, stoat and possum control on mainland New Zealand. 2015 DoC <http://www.doc.govt.nz/Documents/conservation/threats-and-insects/animal-pests/ship-rat-stoat-possum-control.pdf>

⁵⁰ E.g. sign template for vertebrate toxic agent, <http://www.business.govt.nz/worksafe-information-evidence/all-evidence-items/chemicals-evidence-chemicals-warnings-of-chemicals>

⁵¹ E.g. see ERMA Aerial 1080 communications guideline: <http://www.ema.govt.nz/Publications/ERMA-1080-Guidelines.pdf>

ESRA Alpha cypermethrin

This template follows a similar format to that of Annex 2 within the FSC Pesticides Policy FSC-POL-30-001 V3-0 EN. Therefore, it may be used by SDGs and Organisations in their Environmental and Social Risk Assessment (ESRA), and by certification bodies as a checklist to assess conformance with the minimum requirements for ESRA.

Date	May 2020
Proposed chemical pesticide	Products containing Alpha cypermethrin
Pesticide type	Insecticide
CAS number(s)	67375–30–8
Common trade name(s) (Listed brand names may have different formulations including combinations with other chemical pesticides)	<p>Numerous trade names. Available in emulsifiable concentrates (EC) and suspension concentrates (SC). Names include:</p> <ul style="list-style-type: none"> • 4FARMERS ALPHA-CYPERMETHRIN 100 EC INSECTICIDE • Alpha-Scud Elite Insecticide • Adria Picture® 100SC • BASF FENDONA 15SC and RIPCORDER PLUS • Grow Choice ALPHA DUOP 100 • GENFARM ALPHA CYPERMETHRIN 250SC • Imtrade Dictate Duo 100 • Kenso Agcare Ken-Tac 100 • TITAN ALPHA-CYPERMETHRIN 250 SC <p>Refer to the APVMA PubCRIS database for the full list of registered products in Australia with this active ingredient.</p>
FSC pesticide classification (prohibited HHP, highly restricted HHP, restricted HHP, or other chemical pesticide)	Highly restricted HHP
Purpose of use (protection of vegetation, human health, native species, seeds or seedlings, weed control, others)	Herbivore insect control in Eucalypt plantations. To manage a wide range of insects that suck or chew leaves, shoots and roots. In the right conditions, insect damage can lead to re-establishing large areas. Insects can damage large areas in newly planted seedlings and also older plantations. Alpha-cypermethrin has a wide efficacy window as it kills in all growth stages (early larvae, late larvae, adult life stage).
Location where used (forest, office, fire store, nursery)	Forest.
Application method (hand, ground machine, aerial)	Aerial or ground base application. Method selection depends on factors like tree size (aerial typically >10 m (about age 5 years)), terrain, soil, weather, stakeholder feedback and access. Ground applied using boom sprayers or misters.
Scale and intensity of use	Variable. Dependent on the size of the treatment area and method of application.
Alternatives considered (burning, mechanical land prep, hand, mechanical releasing, oversowing,	A range of alternatives has been considered consistent with Criterion 10.7 of FSC-STD-01-001 V5-2 FSC Principles and Criteria. For example, in Australia, Clothianidin (Shield®) to protective new young seedlings and potentially second rotation coppice sites.

grazing, weed mats, biological control, alternative chemicals)	Further information on alternatives is within the IPM.
Pesticide used individually or in conjunction with other pesticide(s)	Used individually
Reference documents	<ul style="list-style-type: none"> • Integrated Pest Management document • FSC Pesticides Policy FSC-POL-30-001 V3-0 EN • FSC Lists of highly hazardous pesticides FSC-POL-30-001a V3-0 EN D2-0 • SDS 4FARMERS ALPHA-CYPERMETHRIN 100 EC INSECTICIDE • SDS Alpha-Scud Elite Insecticide • SDS Adria Picture® 100SC • SDS BASF FENDONA 15SC and RIPCORDER PLUS • SDS Grow Choice ALPHA DUOP 100 • SDS GENFARM ALPHA CYPERMETHRIN 250SC • SDS Imtrade Dictate Duo 100 • SDS Kenso Agcare Ken-Tac 100 • SDS TITAN ALPHA-CYPERMETHRIN 250 SC • Pesticide properties database http://sitem.herts.ac.uk/ • APVMA website including the PubCRIS database https://portal.apvma.gov.au/pubcris • NZ EPA website including the Chemical Classification and Information Database (CCID) https://www.epa.govt.nz/database-search/chemical-classification-and-information-database-ccid/ • PAN Pesticides Database http://pesticideinformation.org/Search_Chemicals.jsp • RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION FROM FSC TECHNICAL ADVISORS – ALPHA CYPERMETHRIN 2016 • FSC Highly Hazardous Pesticide Derogation 2015-2016 - Recommendations from Advisory Group • Australian Alpha-Cypermethrin Derogation Application – 19/08/2016 • US EPA 12/2017, 'Cypermethrin, Zeta-cypermethrin, and Alpha-cypermethrin. Draft Human Health Risk Assessment for Registration Review' • European Food Safety Authority (EFSA), 07/2018, 'Peer review of the pesticide risk assessment of the active substance alpha-cypermethrin.' • US National Center For Biotechnology Information (NCBI) https://pubchem.ncbi.nlm.nih.gov/
Note	<ul style="list-style-type: none"> • Clothianidin (Shield®) is an alternate pesticide to Alpha-Cypermethrin on seedlings and potentially second rotation coppice sites. Clothianidin product labels only list ground base applications up to a tree height of 8 metres.

Risk profiling

The risk matrix below helps frame the level of risk for each ESRA exposure variable, and to also assist in comparing risk between the ESRA of different chemical pesticides. A score assessed as 3/2 means the likelihood is 'possible' and the consequence of the event 'minor'.

		LIKELIHOOD					
		1 - Negligible	2 - Unlikely	3 - Possible	4 - Likely	5 - Almost Certain	6 - Certain
CONSEQUENCE	6 - Catastrophic	Medium	High	Extreme	Extreme	Extreme	Extreme
	5 - Extreme	Medium	Medium	High	High	Extreme	Extreme
	4 - Major	Low	Medium	Medium	High	High	Extreme
	3 - Moderate	Low	Low	Medium	Medium	High	High
	2 - Minor	Low	Low	Low	Low	Medium	Medium
	1 - Insignificant	Low	Low	Low	Low	Low	Medium

The risk for some attributes will change between pre-control assessment risk and post-mitigation control risk (residual risk), after initiating the mitigation control measures within the ESRA.

Exposure	List of values	HHP Hazards (Acute & environmental) ³ <ul style="list-style-type: none"> Extremely or highly hazardous Acute mammals & Birds Fatal if inhaled Aquatic Toxicity 	Assessment of Other potential risks – Pre-controls ^{1, 2}	Assessment of Other potential risks - Post mitigation controls ^{1, 2}	Descriptor of why / why not a risk ³	Mitigation strategies defined to minimise risk
Environmental	Soil (erosion, degradation, biota, carbon storage)	3/2 = Low	3/3 = Medium	3/2 = Low	<p>Risk levels to soil vary. Risks include:</p> <ul style="list-style-type: none"> Non-mobile in soil (K_{oc} 288735 mL/g). It has low water solubility (0.004mg/L). Low to moderately persistent in soil (DT50 (soil) (field) 11.7- 114 days). Soil half-life (field) is typically 35-42 days. Threshold for concern for its bioaccumulation potential (BCF 910 l/kg, LogP = 5.8 (high)). Alpha cypermethrin has three major soil metabolites: <ul style="list-style-type: none"> DCVA ((cis)DCVA). There is limited data available, and it has no CAS#. It is moderate to very high mobility (K_{Foc} 37–318 mL/g), has high solubility in water, and low to moderate persistence (DT50 (lab) 2.7-13.5 days). It has low to moderate acute toxicity to mammals, aquatic life and earthworms. Sources vary on toxicity. 3PBA (3-phenoxybenzoic acid) (CAS 3739-38-6). It has low solubility in water, moderate to very high mobility (K_{Foc} 46–215 mL/g), very low to low persistence in soil (DT50 (lab) 0.38-5 days), degrades rapidly in water. It is low to moderately toxic to mammals and aquatic invertebrates but not fish. Also, it is low to moderate toxicity to soil-dwelling organisms. Sources vary on toxicity. M3110I017 (4-hydroxy-alpha-cypermethrin) (CAS 600-23-20)). It has low solubility in water, non-mobile (K_{doc} 139,148–365,806 mL/g), low persistence in soil (DT50 (lab) 4.9-43 days). Limited data are available for other parameters. Low risk of ecotoxicity to soil-dwelling organisms (EFSA). Low risk to aquatic organisms (EFSA). 	<p>Refer to Appendix 1: ‘Generic Mitigation and Monitoring Measures for Herbicides, Fungicides, Vertebrate Toxins, and Insecticides’.</p> <p>The Appendix describes the mitigation requirements to minimise risk from the exposure variables.</p> <p>Although Appendix 1's mitigation measures should significantly reduce pre-control risks, not all risk can be eliminated as seen in the post-mitigation controls column. Depending on the residual risk, some sites may require more stringent versions of individual mitigation measures than those in Appendix 1. Also, in some situations, additional company mitigation measures may need to be included.</p>
	Water (groundwater, surface water, water supplies)	3/2 = Low	3/3 = Medium	3/2 = Low	<p>Risk levels to water vary and include:</p> <ul style="list-style-type: none"> Entering water. There are three pathways to enter water: directly into waterways from the spray, overland flow from rain or wind, and via the soil to groundwater. Low risk of migration into water sources via all three routes in forestry treatments, however, agricultural applications can result in cypermethrin reaching surface and groundwater, both of which can serve as sources of drinking water (US EPA). <ul style="list-style-type: none"> Low risk of entering surface water via runoff. Low risk of a groundwater contaminant. Low potential leachability (GUS leaching potential index -2.38) Risks when in water: <ul style="list-style-type: none"> Hazard classed as very toxic to aquatic life with long-lasting effects in most SDSs. Low persistence in water and sediment tests (DT50 (water phase) 1.3 days, (water sediment) 21 days). Breakdown in water through light (aqueous photolysis) is moderately fast (DT50 (pH7) 6.3 days, but moderately persistent in sterile water (DT50 (hydrolysis, 20°C, pH7) 70-101 days). The risk profile to water increases with poor product application, e.g. spraying before heavy rain, direct spray or drift over water, or locating storage or load zones that increase the risk to water from accidental spillage. 	
	Atmosphere (air quality, greenhouse gases)	2/2 = Low	2/2 = Low	2/2 = Low	There are risks to air quality over the application area until the spray settles. Risk varies and depends on many factors. These include scale and intensity, method, location relative to adjoining properties, and weather conditions. Aerial spraying has potentially greater risk. Alpha cypermethrin has low volatility (vapour pressure, 20°C 0.00038). Refer also to health and welfare sections.	
	Non-target species (vegetation, wildlife, bees and other pollinators, pets)	<p>Fish 3/2 = Low</p> <p>Aquatic invertebrates 3/2 = Low</p> <p>Aquatic algae/plants 3/2 = Low</p> <p>Bees 3/3 = Medium</p> <p>Birds 2/2 = Low</p> <p>Vegetation 2/2 = Low</p>	<p>Fish 3/4 = Medium</p> <p>Aquatic invertebrates 3/4 = Medium</p> <p>Aquatic algae/plants 3/4 = Medium</p> <p>Bees 3/4 = Medium</p> <p>Birds 2/2 = Low</p> <p>Vegetation 2/2 = Low</p>	<p>Fish 3/2 = Low</p> <p>Aquatic invertebrates 3/2 = Low</p> <p>Aquatic algae/plants 3/2 = Low</p> <p>Bees 3/3 = Medium</p> <p>Birds 2/2 = Low</p> <p>Vegetation 2/2 = Low</p>	<p>Aquatic and terrestrial risks vary depending on non-target species:</p> <ul style="list-style-type: none"> Aquatic: <ul style="list-style-type: none"> Hazard classed as very toxic in the aquatic environment (all SDSs) with lasting effects (some SDSs). High acute toxicity to most aquatic organisms. High acute toxicity to fish (LC50 (96hr) (rainbow trout) 0.0018 mg/L, (Nile tilapia) 0.0043 mg/L, (silver barb) 0.0004 mg/L). High <i>chronic</i> toxicity to fish (LC50 (96hr) (rainbow trout) 0.00003 mg/L). High acute toxicity to aquatic invertebrates (LC50 (48 hrs) (Daphnia) 0.00022 mg/L). High <i>chronic</i> toxicity for aquatic invertebrates (NOEC (Daphnia) (21 days 0.00003 mg/L)). High acute toxicity to sediment-dwelling organisms (LC50 (96hr) (bloodworms) 0.000013 mg/L) High acute toxicity to aquatic algae (EC50 (72hr) (<i>Raphidocelis subcapitata</i>) 0.084 mg/L). High acute toxicity to aquatic plants (EC50 (7 days) (common duckweed) 0.00139 mg/L). Terrestrial: <ul style="list-style-type: none"> Classed as very ecotoxic to terrestrial invertebrates NZ EPA). Low to high mammalian toxicity. Significantly contrasting views. For data on mammals see the health section below. Very high acute toxicity to insects both targeted and non-target species. The method of application is unlikely to affect the risk. Moderate acute toxicity for earthworms (LC50 (7 day) (earthworm) >100 mg/kg). Moderate <i>chronic</i> toxicity for earthworms (NOEC (earthworm) 4.22 mg/kg). Low acute toxicity to birds (LD50 (mallard duck) >10000 mg/kg, (bobwhite quail) >2025 mg/kg). Low reproductive risk to birds. High acute toxicity to bees (LD50 (contact and oral acute) (worst case up to 72hr) 0.033 & 0.059 ug/bee). 	

	List of values	HHP Hazards (Acute & environmental) ³ <ul style="list-style-type: none"> Extremely or highly hazardous Acute mammals & Birds Fatal if inhaled Aquatic Toxicity 	Assessment of Other potential risks – Pre-controls ^{1, 2}	Assessment of Other potential risks - Post mitigation controls ^{1, 2}	Descriptor of why / why not a risk ²	Mitigation strategies defined to minimise risk
Environmental	Non-timber forest products (as FSC-STD-01-001 V5-2 FSC principles and criteria, criterion 5.1)	2/2 = Low Bee keeping 3/3 = Medium	2/2 = Low Bee keeping 3/4 = Medium	2/2 = Low Bee keeping 3/3 = Medium	Risks are site-dependent but likely to be low if bees are not present. Clothianidin poses a high risk to bees and other pollinators. This has led to the banning of the pesticide in Europe and other countries. Both Australia and NZ are currently reviewing the use of neonicotinoids. Before operations contact the apiarist to try and get the hives shifted, including those outside the boundary if bees are known to forage within the target areas. If bees cannot be moved, and there are no other effective non-insecticide options, targeted for early morning application when bees are not foraging.	
	High conservation values (particularly HCV 1-4)	2/2 = Low	2/2 = Low to 3/5 = High	2/2 = Low	The risk of Alpha cypermethrin to high conservation values in some situations could be high. Poor application adjoining or near a high conservation value area compounds the risk. It is a non-selective insecticide that has high acute toxicity to the aquatic environment. It also impacts other terrestrial fauna. Refer to the non-target species section above for additional details.	
	Landscape (aesthetics, cumulative impacts)	Na	2/2 = Low	2/2 = Low	Low risk to landscape. Spraying is likely to improve aesthetics by having a healthier forest in the landscape.	
	Ecosystem services (water, soil, carbon sequestration, tourism)	2/2 = Low	2/2 = Low	2/2 = Low	Risks to ecosystem services are likely low after mitigation measures are in place. Refer to the water, soil, atmosphere and non-target species exposure variable assessments. However, specific circumstances may raise the risk profile. For example, if the treatment area was part of a municipal water catchment zone.	
Social	High conservation values (especially HCV 5-6)	2/2 = Low	3/3 = Medium	2/2 = Low	The risk is likely to be situation-dependent but likely to be low in most situations. For HCV 5, the risk involves community acceptance of insecticide as the best method to reduce insect pest numbers to protect the forest resource. For HCV 6, Alpha cypermethrin is unlikely to damage a cultural site physically but could create a cultural offence by impacting on the 'spirit' of the site (NZ: mauri)	<p>Refer to Appendix 1: 'Generic Mitigation and Monitoring Measures for Herbicides, Fungicides, Vertebrate Toxins, and Insecticides'.</p> <p>The Appendix describes the mitigation requirements to minimise risk from the exposure variables.</p> <p>Although Appendix 1's mitigation measures should significantly reduce pre-control risks, not all risk can be eliminated as seen in the post-mitigation controls column. Depending on the residual risk, some sites may require more stringent versions of individual mitigation measures than those in Appendix 1. Also, in some situations, additional company mitigation measures may need to be included.</p>
	Health (fertility, reproductive health, respiratory health, dermatologic, neurological and gastrointestinal problems, cancer and hormone imbalance)	2/2 = Low	3/3 = Medium	2/2 = Low	<p>Risks to human health from Alpha cypermethrin are likely to be low when used according to label, SDS and good practice:</p> <ul style="list-style-type: none"> The following are oral, dermal or inhalation toxicity risks: <ul style="list-style-type: none"> Low to high acute oral toxicity depending on source (LD50 (rat) 40 mg/kg, (mouse) 35 mg/kg). However, many SDSs typically list low oral acute toxicity LD50 (rat) 1360 -5000 mg/kg, although some 79-474 mg/kg. In NZ it is classed as very ecotoxic to terrestrial vertebrates (NZ EPA) but not in Australia, and EFSA stated 'low acute and reproductive risk to birds and wild mammals'. In short-term dietary studies, alpha-cypermethrin causes neurotoxicity in rats, mice and dogs primarily. In patients with occupational poisoning, following ingestion, the initial symptoms involve the gastrointestinal tract, developing 10-60 minutes after exposure. Patients suffering from acute oral poisoning usually develop prominent digestive symptoms such as epigastric pain, nausea and vomiting. Severely poisoned patients may have frequent convulsive attacks, coma, or pulmonary oedema. The prognosis is good if treated, with usually full recovery even in severely poisoned patients. Death may occur from respiratory paralysis Low acute dermal toxicity (LD50 (rat) >2000 mg/Kg), LC50 (rabbit) >2000 mg/kg. May cause skin irritation, itchiness, reddening, numbness and paraesthesia. Moderate acute inhalation toxicity. Not likely to be an aspiration hazard (LC50 (Rat) (4 hr) 0.953-1.33 mg/L). May cause irritation. May cause mild eye irritation, e.g. May cause skin irritation, itchiness, reddening, numbness and paraesthesia. Carcinogenicity, mutagenicity, teratogenicity, reproduction, and endocrine risks: <ul style="list-style-type: none"> Carcinogenicity: Unlikely to be a carcinogen. It is not listed as carcinogenic by IARC. No tumours were seen in cypermethrin cancer studies in rats or a cancer study in mice with alpha-cypermethrin. Mutagenicity: Unlikely to be genotoxic based on the available guidelines studies (EFSA). The metabolites are considered unlikely to be genotoxic or to be more toxic than the parent. Teratogenicity: Data deficient. Specific data not listed in SDSs, either 'no information' or reference to a mix of non-specific data pyrethrins/pyrethroid research (Alpha cypermethrin is the latter class). Reproduction or reproductive toxicity: Unlikely to be a reproductive risk. Not listed on the US TRI Developmental or Reproductive Toxin databases. Specific data not listed in SDSs, either 'no information' or reference to a mix of non-specific data on pyrethrins/pyrethroids. Neurological toxicity: In short-term dietary studies, alpha-cypermethrin causes primarily neurotoxicity in rats, mice and dogs. Apha-cypermethrin did not exhibit evidence of immunotoxicity in a 4-week rat study. Regarding the potential link between pyrethroids and neurodegenerative disease, no robust animal or epidemiological studies exist indicating a causal relationship between Parkinson's disease and exposure to pyrethroids, including alpha-cypermethrin. Endocrine disruption potential: Data deficient for mammals and non-target organisms (EFSA). Specific Target Organ Systemic Toxicity (Single Exposure): <ul style="list-style-type: none"> Not classed as STOST (single exposure). Chronic toxicity: <ul style="list-style-type: none"> Classed as Harmful to human target organs or systems (NZ EPA) and in some Aust SDSs (H373 May cause damage to organs through prolonged or repeated exposure). The Australian Acceptable Daily Intake (ADI) for Alpha cypermethrin for a human is 0.05 mg/kg/day, set for the public for daily, lifetime exposure (based on the NOEL of 4.5 mg/kg/day). 	

	List of values	HHP Hazards (Acute & environmental) ³ <ul style="list-style-type: none"> Extremely or highly hazardous Acute mammals & Birds Fatal if inhaled Aquatic Toxicity 	Assessment of Other potential risks – Pre-controls ^{1, 2}	Assessment of Other potential risks - Post mitigation controls ^{1, 2}	Descriptor of why / why not a risk ²	Mitigation strategies defined to minimise risk
Social	Welfare	2/2 = Low	3/3 = Medium	2/2 = Low	<p>Australian GHS hazardous substances classification codes on all reviewed SDSs for health and environmental hazards include:</p> <ul style="list-style-type: none"> Health: Flammable Liquids - Category 4, STOT RE 2, Acute Toxicity Oral - Category 4, Acute Tox. 3, Skin Corrosion/Irritation - Category 2, Acute Toxicity Oral Category 4, Aspiration Hazard Category 1, Acute Toxicity Dermal Category 4, Serious Eye Damage/Eye, Irritation - Category 2B, Specific Target Organ Toxicity - Repeated Exposure - Category 2, , H227: Combustible liquid, H301 Toxic if swallowed, H302: Harmful if swallowed, H304: May be fatal if swallowed and enters airways. H312: Harmful in contact with skin, H373 May cause damage to organs through prolonged or repeated exposure, H315: Causes skin irritation, H320: Causes eye irritation, H336: May cause drowsiness or dizziness. Environmental: Hazardous to Aquatic Environment Short Term/Acute - Category 1, Hazardous to aquatic environment. Short term/Chronic Category 1 H400: Very toxic to aquatic life. H410: Very toxic to aquatic life with long-lasting effects. Note: Australian SDSs for Alpha cypermethrin can be widely disparate in their listing of hazard classifications. Refer to safe work Australia's summary tables https://www.safeworkaustralia.gov.au/system/files/documents/1702/classification_and_labelling_workplace_hazardous_chemicals_poster_-a4.pdf <p>NZ hazardous substances classification codes for health and environmental hazards taken from the NZ EPA CCID database:</p> <ul style="list-style-type: none"> Health: 6.1B (All), 6.1B (O), 6.9B (All), 6.9B (O), Environment: 9.1A (All), 9.1A (F), 9.1A (C), 9.3A, 9.4A Note: NZ SDSs may have some, all, or additional hazard classifications. Refer to NZ EPA for definitions of hazardous substances classification codes https://www.epa.govt.nz/industry-areas/hazardous-substances/rules-for-hazardous-substances/hazardous-substances-classification-codes/ US EPA state 'there is potential for occupational and residential handlers to be exposed via the dermal and inhalation routes of exposure while mixing/loading the pesticide and during application. There is also the potential for post-application exposure to occupational workers entering treated fields and to non-occupational bystanders who may be exposed to spray drift from occupational applications'. Refer to health and other social exposure elements as that can also influence welfare too. 	<p>Refer to Appendix 1: 'Generic Mitigation and Monitoring Measures for Herbicides, Fungicides, Vertebrate Toxins, and Insecticides'.</p> <p>The Appendix describes the mitigation requirements to minimise risk from the exposure variables.</p> <p>Although Appendix 1's mitigation measures should significantly reduce pre-control risks, not all risk can be eliminated as seen in the post-mitigation controls column. Depending on the residual risk, some sites may require more stringent versions of individual mitigation measures than those in Appendix 1. Also, in some situations, additional company mitigation measures may need to be included.</p>
	Food and water	2/2 = Low	3/3 = Medium	2/2 = Low	<p>The risk to food and water is likely low from forestry treatments if mitigation methods are followed.</p> <ul style="list-style-type: none"> Cypermethrins are registered for use on a wide variety of agricultural food/feed crops, livestock, and farms; recreational sites (i.e., golf courses, athletic fields); indoor residential/commercial/industrial sites/structural/perimeter and lawn uses; gardens and trees; as well as a mosquito adulticide, termiticide, and pet uses. Eliminate the potential risk of accidental or ongoing oral ingestion by pesticide workers with poor on-the-job personal hygiene around food and drink. 	
	Social infrastructure (schools and hospitals, recreational infrastructure, infrastructure adjacent to the management unit)	1/1 = Low to 3/2 = Low	1/1 = Low to 3/2 = Low	1/1 = Low to 3/2 = Low	<p>The risk to social infrastructure is likely low if the treatment area is well within the forest and away from in-forest or adjoining infrastructure. Risks increase if there are water takes that are within, or drain from, the treatment area. Also, the risk is likely to increase with scale and intensity, or if weather or other site conditions weren't ideal for the treatment. There is a risk of public outrage over insecticide spray treatments that inadvertently affect people or property.</p>	
	Economic viability (agriculture, livestock, tourism)	1/1 = Low to 3/3 = Medium	1/1 = Low to 3/5 = High	1/1 = Low to 3/3 = Medium	<p>The risk to economic viability is likely low if the treatment area is well within the forest. Risk increases with scale, intensity, and application type (aerial vs ground) and operational complexity, especially if the operation is on a boundary. For example, an aerial overspray or drift could have an economic impact on adjoining aquaculture or organics, leading to costly compensation or legal action.</p> <p>Labels advise 'DO NOT GRAZE PASTURE WITHIN 7 DAYS OF TREATMENT OR CUT FOR STOCKFEED WITHIN 14 DAYS OF TREATMENT.'</p>	
	Rights (legal and customary)	2/2 = Low	2/2 = Low	2/2 = Low	<p>Risks to rights are likely to be low and for short periods. Assess site specific risks like easements for water extraction or grazing. Operational areas will be briefly restricted for those with access rights, e.g. utility companies or those with road access easements.</p>	
	Other	2/2 = Low	2/2 = Low	2/2 = Low	<p>There is a risk of public outrage over insecticide spray treatments that inadvertently affect people or property. There are strong diverging public opinions around the use of insecticides. Aust: A survey for the Australian 2016 Alpha cypermethrin derogation application highlighted respondents concern over the insecticide. Survey respondents predominantly disagreed (60%) with the use of Alpha cypermethrin as provided in the draft derogation applications, with 21% agreeing with its use. Also, 48% stakeholders did not accept that there was a need to use it. Stakeholders were concerned about potential toxicity to the environment and human health especially if aerially applied, and that control measures were not adequate for perceived risks. There was large regional variation in views.</p>	
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1 = The risk profile is only for the pesticide listed in the table. Often other pesticides are added to improve treatment efficacy or solubility. Also, risk will vary between sites, methods and scale and intensity of the treatment.

2 = It is recommended to take a precautionous approach. New research may bring to light risks that were not identified in previous assessments. Current research is not exhaustive, is often agricultural-based from northern hemisphere studies, and the effects on some exposure variables are not known or fully understood. **Also, between SDS's there can be conflicting data, variation in both amount and quality of information, and differing judgements of risks. Some SDSs are more current than others. Therefore, consider reviewing SDS's of similar pesticide products. For example, BASF Fendona 07/01/2017 SDS states' Virtually nontoxic after a single ingestion. Virutally nontoxic after a single skin contact. Virtually nontoxic by inhalation'. A broad and sweeping statement.**

3= Post mitigation

ESRA Amitrole (and Ammonium thiocyanate)

This template follows a similar format to that of Annex 2 within the FSC Pesticides Policy FSC-POL-30-001 V3-0 EN. Therefore, it may be used by SDGs and Organisations in their Environmental and Social Risk Assessment (ESRA), and by certification bodies as a checklist to assess conformance with the minimum requirements for ESRA.

Date	May 2020
Proposed chemical pesticide	Products containing Amitrole (with the additive Ammonium thiocyanate)
Pesticide type	Herbicide
CAS number(s)	61-82-5 Amitrole 1762-95-4 Ammonium thiocyanate
Common trade name(s) (Listed brand names may have different formulations including combinations with other chemical pesticides)	Numerous trade names. Unless otherwise stated, products also contain Ammonium thiocyanate. Available in suspension concentrates (SC) and soluble concentrates (SC). Names include: <ul style="list-style-type: none"> • 4 FARMERS AMITROLE 250SL • AGPRO Activated Amitrol • Apparent Troller • FarmaLinx Amitat • Nufarm AMITROLE T • Fisher Scientific 3-Amino-1H-1,2,4-triazole (USA, sole ingredient Amitrole, international comparison) • Sabakem Amitrole 47T • TITAN AMITROLE 250 SL <p>Refer to the APVMA PubCRIS database for the full list of registered products in Australia with this active ingredient.</p>
FSC pesticide classification (prohibited HHP, highly restricted HHP, restricted HHP, or other chemical pesticide)	Restricted HHP (Amitrole) Other chemical (Ammonium thiocyanate)
Purpose of use (protection of vegetation, human health, native species, seeds or seedlings, weed control, others)	Weed control. Used for pre and post-planting control of a range of annual and perennial grasses and broad-leaved hard to kill weeds in eucalypt plantations. Often used for 2nd-year weed control where heavy infestation is impacting tree growth.
Location where used (forest, office, fire store, nursery)	Forest.
Application method (hand, ground machine, aerial)	Ground base application, predominantly by boom.
Scale and intensity of use	Variable. Dependent on the size of the operational area and method of application.
Alternatives considered (burning, mechanical land prep, hand, mechanical releasing, oversowing,	A wide range of alternatives has been considered consistent with Criterion 10.7 of FSC-STD-01-001 V5-2 FSC Principles and Criteria.

grazing, weed mats, biological control, alternative chemicals)	Further information on alternatives is within the IPM.
Pesticide used individually or in conjunction with other pesticide(s)	<ul style="list-style-type: none"> • Most Amitrole products contain Ammonium thiocyanate as a synergist. It improves efficacy by increasing the translocation of Amitrole. • Amitrole is used with non-HH listed chemicals, Simazine and Sulfometuron-methyl, to maintain efficacy but lower Amitrole application rates. It can also be applied with Atrazine.
Reference documents	<ul style="list-style-type: none"> • Integrated Pest Management document • FSC Pesticides Policy FSC-POL-30-001 V3-0 EN • FSC Lists of highly hazardous pesticides FSC-POL-30-001a V3-0 EN D2-0 • SDS 4 FARMERS AMITROLE 250SL • SDS AGPRO Activated Amitrol • SDS Apparent Troller • SDS FarmaLinux Amitat • SDS Nufarm AMITROLE T • SDS Fisher Scientific 3-Amino-1H-1,2,4-triazole (USA, sole ingredient Amitrole, international comparison) • SDS Sabakem Amitrole 47T • SDS TITAN AMITROLE 250 SL • Pesticide properties database http://sitem.herts.ac.uk/ • APVMA website including the PubCRIS database https://portal.apvma.gov.au/pubcris • NZ EPA website including the Chemical Classification and Information Database (CCID) https://www.epa.govt.nz/database-search/chemical-classification-and-information-database-ccid/ • Herbiguide herbiguide.com.au/InformationHerbicides.aspx • PAN Pesticides Database http://pesticideinformation.org/Search_Chemicals.jsp • US National Center For Biotechnology Information (NCBI) https://pubchem.ncbi.nlm.nih.gov/ • 'FSC Highly Hazardous Pesticide Derogation 2015-2016 Recommendations from Advisory Group' • 2016, 'RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION FROM FSC TECHNICAL ADVISORS – Amitrole' • European Food Safety Authority (EFSA) 08/2015, 'Conclusion on the peer review of the pesticide risk assessment of the active substance amitrole'.
Note	<ul style="list-style-type: none"> • Most Amitrole products contain Ammonium thiocyanate. It improves efficacy by increasing the translocation of Amitrole. • Amitrole has one major metabolite: 1,2,4-triazole (CAS 288-88-0). Risks are similar to parent amitrole for aquatic organisms; however, it may have a high risk for soil non-target macro- and microorganisms. Further details are in the ESRA.

Risk profiling

The risk matrix below helps frame the level of risk for each ESRA exposure variable, and to also assist in comparing risk between the ESRA of different chemical pesticides. A score assessed as 3/2 means the likelihood is 'possible' and the consequence of the event 'minor'.

		LIKELIHOOD					
		1 - Negligible	2 - Unlikely	3 - Possible	4 - Likely	5 - Almost Certain	6 - Certain
CONSEQUENCE	6 - Catastrophic	Medium	High	Extreme	Extreme	Extreme	Extreme
	5 - Extreme	Medium	Medium	High	High	Extreme	Extreme
	4 - Major	Low	Medium	Medium	High	High	Extreme
	3 - Moderate	Low	Low	Medium	Medium	High	High
	2 - Minor	Low	Low	Low	Low	Medium	Medium
	1 - Insignificant	Low	Low	Low	Low	Low	Medium

The risk for some attributes will change between pre-control assessment risk and post-mitigation control risk (residual risk), after initiating the mitigation control measures within the ESRA.

Exposure	List of values	HHP Hazards ³ <ul style="list-style-type: none">• Suspected carcinogen• Endocrine disruptor	Assessment of Other potential risks – Pre-controls ^{1, 2}	Assessment of Other potential risks - Post mitigation controls ^{1, 2}	Descriptor of why / why not a risk ³	Mitigation strategies defined to minimise risk
Environmental	Soil (erosion, degradation, biota, carbon storage)	Na	3/3 = Medium	3/2 = Low	<p>Risk levels to soil vary. Risks include:</p> <ul style="list-style-type: none">• Classed as very ecotoxic in the soil environment (NZ EPA 9.2A)• High to moderate mobility in soil for Amitrole and its metabolite 1,2,4-triazole (K_{foc} 20-202 ml/g). Amitrole has high water solubility (264000 mg/L). Metabolite: high (730000 mg/L). Ammonium thiocyanate: also high (630000 mg/L).• Low to moderate persistence in soil for Amitrole (DT50 (soil) (field) 7.7- 28 days), however the DT90 show moderate to high persistence (range 109.3-717.6 days). Half-life is typically 14 days. Degradation is mostly by microbial action, so persistence is influenced by factors affecting biological activity like temperature, rainfall, and soil type. The persistence of the metabolite 1,2,4-triazole ranges from non-persistent to highly persistent, depending on source. Persistence is increased in anaerobic soil (DT50 186 days). Ammonium thiocyanate: No data.• Low bioaccumulation potential (BCF 1.8 - 2.4 l/kg, LogP = -0.97 (low). Ammonium thiocyanate: Likely low potential (LogP = -0.97 (low).• Potential increased erosion due to vegetation dieback. Risk increases with scale and intensity, and the number of water bodies.	<p>Refer to Appendix 1: ‘Generic Mitigation and Monitoring Measures for Herbicides, Fungicides, Vertebrate Toxins, and Insecticides’.</p> <p>The Appendix describes the mitigation requirements to minimise risk from the exposure variables.</p> <p>Although Appendix 1's mitigation measures should significantly reduce pre-control risks, not all risk can be eliminated as seen in the post-mitigation controls column. Depending on the residual risk, some sites may require more stringent versions of individual mitigation measures than those in Appendix 1. Also, in some situations, additional company mitigation measures may need to be included.</p> <p>The Appendix also describes mitigation measures for other pesticides that may be used in conjunction with Amitrole to improve the efficacy of the treatment.</p>
	Water (groundwater, surface water, water supplies)	3/2 = Low	3/3 = Medium	3/2 = Low	<p>Risk levels to water vary and include:</p> <ul style="list-style-type: none">• Entering water. There are three pathways to enter water: directly into waterways from the spray, overland flow from rain or wind, and via the soil to groundwater.<ul style="list-style-type: none">• Moderate risk of migration into water sources likely via all three routes, because of Amitrole and metabolite's high solubility, moderate to high mobility and moderate persistence.• Potentially moderate risk of entering surface water via runoff.• Amitrole's risk to groundwater is likely low to anticipated depending on the source. Risk increases if used in areas where soils are permeable and particularly where the water table is shallow.• Risks when in water:<ul style="list-style-type: none">• Hazard classed as very toxic to aquatic life (with long-lasting effects in some SDSs).• Stable or highly persistent in water and sediment tests. Stable in water ((DT50 (sterile water) (20°, pH7) stable, (water phase) 71 days, (sediment phase) 309 days). The metabolite is likely to be more persistent ((DT50 (sterile water) (20°, pH5-9) stable, (water phase) 300 days, (sediment phase) 300 days). Ammonium thiocyanate: Data deficient.• The risk profile to water increases with:<ul style="list-style-type: none">• Site factors that increase the potential for surface runoff, e.g. steep slopes, poorly draining soils and shallow groundwater.• Site factors that increase the potential of leaching to groundwater, e.g. sites with permeable soils with shallow water tables.• Poor product application, e.g. spraying before heavy rain, direct spray or drift over water, or locating storage or load zones that increase the risk to water from accidental spillage.	
	Atmosphere (air quality, greenhouse gases)	Na	1/1 = Low	1/1 = Low	The risk to the atmosphere is low as the product only uses ground application. However, risks vary and include scale and intensity, location relative to adjoining properties, and weather conditions.	
	Non-target species (vegetation, wildlife, bees and other pollinators, pets)	Fish 3/2 = Low Aquatic invertebrates 3/2 = Low Bees 2/2 = Low Birds 2/2 = Low	Fish 3/2 = Low Aquatic invertebrates 3/2 = Low Aquatic algae/plants 3/3 = Medium Bees 2/2 = Low Birds 2/2 = Low Vegetation 4/4 = High	Fish 3/2 = Low Aquatic invertebrates 3/2 = Low Aquatic algae/plants 3/2 = Low Bees 2/2 = Low Birds 2/2 = Low Vegetation 2/2 = Low	<p>Aquatic and terrestrial risks vary depending on non-target species:</p> <ul style="list-style-type: none">• Aquatic:<ul style="list-style-type: none">• Hazard classed as H412 Harmful to aquatic life with long lasting effects (Aust) and 9.1C Harmful in the aquatic environment (NZ). Ammonium thiocyanate: 9.1C Harmful in the aquatic environment (NZ).• Low to moderate acute toxicity to fish for both amitrole and metabolite depending on source (LC50 (96hr) (rainbow trout) >1000 mg/L, (fathead minnow) >100 mg/L). Metabolite: (LC50 (96hr) (rainbow trout) 498 mg/L). Ammonium thiocyanate: Moderate (LC50 (96hr) (fathead minnow) >100 mg/L, (rainbow trout) 65 mg/L).• Low chronic toxicity to fish (LC50 (21 day, NOEL) (rainbow trout) >100 mg/L). Metabolite: Moderate chronic toxicity (LC50 (21 day, NOEL) (rainbow trout) 3.2 mg/L).• Moderate acute toxicity to aquatic invertebrates (LC50 (48 hrs) (Daphnia) 6.1-21 mg/L, (LC50 (96 hrs) (shrimp) 2.8 mg/L, (crayfish) 100 mg/L). Metabolite: Low acute toxicity (LC50 (48 hrs) (Daphnia) >100 mg/L). Ammonium thiocyanate: Low to moderate depending on the source (LC50 (48 hrs) (Daphnia) 3.56-170 mg/L).• Moderate to high <i>chronic</i> toxicity for aquatic invertebrates depending on the source (NOEC (Daphnia) (21 days) 0.02-0.32 mg/L)).• High chronic risk of metabolite to sediment-dwelling organisms (NOEC (bloodworms) (21 days) 0.32 mg/L)).• Moderate acute toxicity to aquatic algae (EC50 (72hr) (<i>Scenedemus subspicatus</i>) 2.3 mg/L). Metabolite: Low acute risk (EC50 (72hr) (<i>Scenedemus subspicatus</i>) 22.5 mg/L). Ammonium thiocyanate: Low risk (EC50 (72hr) (<i>Selenastrum capricornutum</i>) 116 mg/L).• Moderate acute toxicity to aquatic plants (EC50 (7 days) (common duckweed) 2.5 mg/L).• Terrestrial:<ul style="list-style-type: none">• Low acute mammalian toxicity. For data on mammals see the health section below.• Severely affects non-target vegetation affected by Amitrole.• Low risks to terrestrial invertebrates and micro- organisms from Amitrole. However, metabolite may have high risk for soil non-target macro- and microorganisms.• Low to moderate acute toxicity for earthworms depending on source (LC50 (7 day) (earthworm) >448 mg/kg). Metabolite: Low risk (LC50 (7 day) (earthworm) >1000 mg/kg).• Low acute toxicity to birds (bobwhite quail) 2150 mg/kg).• Low acute toxicity to bees (LD50 (contact and oral acute) (worst case up to 72hr) >100ug/bee).	

	List of values	HHP Hazards ³ • Suspected carcinogen • Endocrine disruptor	Assessment of Other potential risks – Pre-controls ^{1, 2}	Assessment of Other potential risks - Post mitigation controls ^{1, 2}	Descriptor of why / why not a risk ²	Mitigation strategies defined to minimise risk
Environmental	Non-timber forest products (as FSC-STD-01-001 V5-2 FSC principles and criteria, criterion 5.1)	Na	2/2 = Low	2/2 = Low	Amitrole is applied to bare land or newly established trees so risks to under the canopy, non-timber products aren't applicable.	
	High conservation values (particularly HCV 1-4)	2/2 = Low	3/3 = Medium	2/2 = Low	The risk of Amitrole to high conservation values is likely low because target areas are typically small, and application is ground-based. Poor application adjoining or near a high conservation value area will compound the risk. It is a selective herbicide and kill some plant species or cause dieback in others. Also, Amitrole's high solubility, moderate to high mobility and moderate persistence indicates there is a risk of downslope soil leaching into non-treatment areas.	
	Landscape (aesthetics, cumulative impacts)	3/3 = Medium	3/3 = Medium	2/2 = Low	Application of Amitrole over large areas is unlikely. The risk to landscape increases with scale and intensity. For example, treatment size, visibility, proximity to and type/sensitivity of neighbours, impact on public recreation, perceived impact on nearby parks, forest, or spray sensitive land users like orchards or organic farming.	
	Ecosystem services (water, soil, carbon sequestration, tourism)	Na	2/2 = Low	2/2 = Low	Risks to ecosystem services are likely low after mitigation measures are in place. Refer to the water, soil, atmosphere, landscape and non-target species exposure variable assessments. However, specific circumstances may raise the risk profile. For example, if the treatment area was part of a municipal water catchment zone.	
Social	High conservation values (especially HCV 5-6)	Na	2/2 = Low	2/2 = Low	The risk is likely to be low in most situations.	<p>Refer to Appendix 1: 'Generic Mitigation and Monitoring Measures for Herbicides, Fungicides, Vertebrate Toxins, and Insecticides'.</p> <p>The Appendix describes the mitigation requirements to minimise risk from the exposure variables.</p> <p>Although Appendix 1's mitigation measures should significantly reduce pre-control risks, not all risk can be eliminated as seen in the post-mitigation controls column. Depending on the residual risk, some sites may require more stringent versions of individual mitigation measures than those in Appendix 1. Also, in some situations, additional company mitigation measures may need to be included.</p> <p>The Appendix also describes mitigation measures for other pesticides that may be used in conjunction with Amitrole to improve the efficacy of the treatment</p>
	Health (fertility, reproductive health, respiratory health, dermatologic, neurological and gastrointestinal problems, cancer and hormone imbalance)	2/3 = Low	3/3 = Medium	3/3 = Medium	<p>Risks to human health from Amitrole are likely to be low when used according to label, SDS and good practice:</p> <ul style="list-style-type: none"> The following are oral, dermal or inhalation toxicity risks: <ul style="list-style-type: none"> Low acute oral toxicity (Rat LD50 >5000 mg/kg). Poisoning by Amitrole is characterised by increased intestinal peristalsis (this may lead to diarrhoea), fluid in the lungs, and haemorrhages of various organs. Metabolite: Moderate acute oral toxicity (Rat LD50 >1650 mg/kg). Ammonium thiocyanate: Moderate (Rat LD50 750 mg/kg, guinea pig 500 mg/kg). Classed as Ecotoxic to terrestrial vertebrates (NZ). Accidental ingestion may lead to running eyes and nose. Low to moderate acute dermally toxicity (LD50 (rat) >2500->5000 mg/Kg, LC50 (rabbit) >200 mg/kg). May cause mild skin irritation and rash. Ammonium thiocyanate: Classed as acutely toxic (NZ). Moderate acute inhalation toxicity (LC50 (Rat) (4 hr) >0.439 mg/L). May cause mild respiratory irritation. Ammonium thiocyanate: Classed as acutely toxic (NZ). May cause mild eye irritation. Carcinogenicity, mutagenicity, teratogenicity, reproduction, and endocrine risks: <ul style="list-style-type: none"> Carcinogenicity: Ranges for unlikely to be a carcinogen to likely depending on dose rate and source. Classified as 3, unclassifiable by IARC, US NTP Carcinogens as reasonably anticipated, US EPA Carcinogens as likely (high doses) and not likely (low doses). Amitrole is classified by SWA as a Class 3 Carcinogen, possibly carcinogenic to humans. Ammonium thiocyanate: Not listed as an IARC carcinogen. Mutagenicity: Data suggests that Amitrole is weakly on non-mutagenic. Unlikely to be a mutagen (EFSA). Ammonium thiocyanate: No data available. Teratogenicity: Likely to be teratogenic although there is no data to show the link between animal studies and relevance to humans. Classed as Toxic to Reproduction 2, H361: Suspected of damaging fertility or the unborn child. Teratogenic effects were observed in three developmental toxicity studies in rabbits. Malformations of the head were observed even with limited maternal toxicity. Ammonium thiocyanate: No data available. Reproduction or reproductive toxicity: Both Amitrole and metabolite ,2,4-triazole are reproductive risks. classified as toxic for reproduction category 2, H361. Developmental toxicity as decrease foetal weight, visceral and skeletal variants. Ammonium thiocyanate: Not listed on the US Reproductive Toxin database. Endocrine disruption potential: Data deficient. Amitrole may have endocrine disrupting properties due to toxic effects observed in endocrine organs (thyroid) of rats and birds. The bird study indicated effects on the thyroid gland (enlarged gland size), throughout the generations, in all tested concentrations. Ammonium thiocyanate: Not listed as an EU endocrine disruptor. Specific Target Organ Systemic Toxicity (Single Exposure): <ul style="list-style-type: none"> Evaluation of available data suggests that this material is not a STOT-SE toxicant. Chronic toxicity: <ul style="list-style-type: none"> Is classified as STOT-RE 2 H373. May cause damage to organs through prolonged or repeated exposure. Harmful to human target organs or systems (NZ EPA 6.9A&B). Repeated or prolonged exposure may cause enlargement of the thyroid with the formation of reversible goitres. Amitrole may reduce the uptake of iodine and may inhibit liver enzymes in laboratory animals. Effects on the thyroid were observed in all tested species (rats, dogs, mice and rabbits). Feeding of Amitrole to rats at dietary doses of 3 or 6 kg/mg/day for 2 weeks caused enlargement of the thyroid and reduced uptake of iodine. A dietary dose of 50 mg/kg/day produced significant enlargement of the thyroid after 3 days of feeding. The Australian Acceptable Daily Intake (ADI) for Amitrole for a human is 0.0003 mg/kg/day, (some SDSs are different) set for the public for daily, lifetime exposure (based on the NOEL of 0.25 mg/kg/day). 'For all representative uses (crop and non-crop uses), the exposure estimates for operators, workers and bystanders are expected to exceed the AOEL even with the use of PPE'. (EFSA, P.19) 	

	List of values	HHP Hazards ³ • Suspected carcinogen Endocrine disruptor	Assessment of Other potential risks – Pre-controls ^{1, 2}	Assessment of Other potential risks - Post mitigation controls ^{1, 2}	Descriptor of why / why not a risk ²	Mitigation strategies defined to minimise risk
Social	Welfare	2/3 = Low	3/3 = Medium	2/3 = Low	<p>Australian GHS hazardous substances classification codes on all reviewed SDSs for health and environmental hazards include:</p> <ul style="list-style-type: none"> Health: Toxic To Reproduction 2, STOT RE 2, Acute Toxicity (Oral) 4, Acute Toxicity (Dermal) 4, H302 Harmful if swallowed, H312 Harmful in contact with skin, H351: Suspected of causing cancer (Farmalinx), H361 Suspected of damaging fertility or the unborn child, H373 May cause damage to organs through prolonged or repeated exposure. Ammonium thiocyanate: Acute Toxicity (Oral) 3, H301; Acute Toxicity (Dermal) 3, H311; Acute Toxicity (Inhalation) 4, H332 Environmental: Aquatic Chronic 3, H412 Harmful to aquatic life with long lasting effects. Note: Australian SDSs are often not consistent in their listing of hazards. For example, Nufarm's Amitrole T did not list any environmental hazards, or Apparent Troller did not list oral, dermal, or inhalation hazards for Ammonium thiocyanate. Refer to safe work Australia's summary tables https://www.safeworkaustralia.gov.au/system/files/documents/1702/classification_and_labelling_workplace_hazardous_chemicals_poster_-a4.pdf <p>NZ hazardous substances classification codes for health and environmental hazards taken from the NZ EPA CCID database:</p> <ul style="list-style-type: none"> Health: 6.4A, 6.8B, 6.9A (All), 6.9A (O), 6.9B (D). Ammonium thiocyanate: 6.1D (All), 6.1D (O), 6.1D (D), 6.1D (I) Environment: 9.1B (All), 9.1B (C), 9.1B (A), 9.1C (F), 9.2A. Ammonium thiocyanate: 9.1C (All), 9.1C (F), 9.3B. Note: NZ SDSs may have some, all, or additional hazard classifications. Refer to NZ EPA for definitions of hazardous substances classification codes https://www.epa.govt.nz/industry-areas/hazardous-substances/rules-for-hazardous-substances/hazardous-substances-classification-codes/ Refer to health and other social exposure elements as that can also influence welfare too. 	Refer to Appendix 1: 'Generic Mitigation and Monitoring Measures for Herbicides, Fungicides, Vertebrate Toxins, and Insecticides'.
	Food and water	2/2 = Low	3/3 = Medium	2/2 = Low	<p>The risk to food and water is likely low but site-dependent. Refer also to economic viability section.</p> <ul style="list-style-type: none"> Amitrole is used on a wide variety of commercial crops including wheat, barley, vineyards and orchards. Eliminate the potential risk of accidental or ongoing oral ingestion of Amitrole by pesticide workers with poor on-the-job personal hygiene around food and drink. 	The Appendix describes the mitigation requirements to minimise risk from the exposure variables. Although Appendix 1's mitigation measures should significantly reduce pre-control risks, not all risk can be eliminated as seen in the post-mitigation controls column. Depending on the residual risk, some sites may require more stringent versions of individual mitigation measures than those in Appendix 1. Also, in some situations, additional company mitigation measures may need to be included.
	Social infrastructure (schools and hospitals, recreational infrastructure, infrastructure adjacent to the management unit)	1/1 = Low to 3/2 = Low	1/1 = Low to 3/3 = Medium	1/1 = Low to 3/2 = Low	<p>The risk to social infrastructure is likely low if the treatment area is well within the forest and away from in-forest or adjoining infrastructure. Risks increase if there are water takes that are within, or drain from, the treatment area. Also, the risk is likely to increase with scale and intensity. For example, if the operation is on a boundary close to infrastructure or where there are in-forest rights. However, access and recreation would likely be restricted only during the operation.</p> <ul style="list-style-type: none"> A survey for the 2016 Amitrole derogation application highlighted respondents' concerns. 50% disagreed that Amitrole is needed for weed management compared with 35% of respondents who agreed that its use is needed. There was concern about the sufficiency of the control measures used to reduce risks, with 53% of respondents perceiving control measures as insufficient, and 33% as sufficient. Similarly, there was uncertainty regarding the acceptability of process to find alternative management approaches with 29% responding that that 'don't know' if approaches are appropriate, 33% perceiving current approaches as inappropriate and 27% seeing them as appropriate. 	
	Economic viability (agriculture, livestock, tourism)	1/1 = Low to 3/2 = Low	1/1 = Low to 3/3 = Medium	1/1 = Low to 3/2 = Low	The risk to economic viability is likely low if the treatment area is well within the forest. Risk increases with scale, intensity and operational complexity, especially if the operation is on a boundary. For example, leaching could have an economic impact on adjoining agriculture, aquaculture, or horticulture, leading to costly compensation or legal action. Organics are especially vulnerable.	
	Rights (legal and customary)	2/2 = Low	2/2 = Low	2/2 = Low	Risks to rights are likely to be low unless in specific situations like easements for water extraction or grazing. Also, operational areas will likely be closed off to those with rights only during the operation, e.g. utility companies or those with road access easements.	
	Other	----	----	----	----	
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1 = The risk profile is only for the pesticide listed in the table. Often other pesticides are added to improve treatment efficacy or solubility. Also, risk will vary between sites, methods and scale and intensity of the treatment.

2 = It is recommended to take a precautionous approach. New research may bring to light risks that were not identified in previous assessments. Current research is not exhaustive, is often agricultural based from northern hemisphere studies, and the effects on some exposure variables are not known or fully understood. **Also, between SDS's there can be conflicting data, variation in both amount and quality of information, and differing judgements of risks. Some SDSs are more current than others. Therefore, consider reviewing SDS's of similar pesticide products.** For example, AGPRO Activated Amitrol's SDS states' ACUTE DERMAL: LC50 (rabbit) inhalation >10 000 mg/Kg' which is an error. Also, it includes an additional hazard class and excludes one when compared with the NZ EPA's CCID database. Section 12 solely states 'Slightly toxic to aquatic invertebrates', so provides little data and does not mention the NZ EPA Amitrole 9.1C hazard class 'Harmful in the aquatic environment'.

3= Post mitigation risk.

ESRA Atrazine

This template follows a similar format to that of Annex 2 within the FSC Pesticides Policy FSC-POL-30-001 V3-0 EN. Therefore, it may be used by SDGs and Organizations in their Environmental and Social Risk Assessment (ESRA), and by certification bodies as a checklist to assess conformance with the minimum requirements for ESRA.

Date	April 2020
Proposed chemical pesticide	Products containing Atrazine
Pesticide type	Herbicide
CAS number(s)	1912-24-9
Common trade name(s) (Listed brand names may have different formulations including combinations with other chemical pesticides)	<p>Numerous trade names. Available in water dispersed granules (WG), dry flowable (DF) and suspended concentrates (SC). Names include:</p> <ul style="list-style-type: none"> • 4FARMERS ATRAZINE 600SC and ATRAZINE 900 WG • AGPRO Atrazine 500 • Farmalinx Atrazine 900 WG • Imtrade Atrazine 900 WG and Atrazine 600 SC • Nufarm ATRADEX® WG and NU-TRAZINE 900DF • Orion Atraflow • Syngenta AATREX® 4L (USA) <p>Refer to the APVMA PubCRIS database for the full list of registered products in Australia with this active ingredient.</p>
FSC pesticide classification (prohibited HHP, highly restricted HHP, restricted HHP, or other chemical pesticide)	Restricted HHP
Purpose of use (protection of vegetation, human health, native species, seeds or seedlings, weed control, others)	Weed control. Used for pre and post-emergent control of a range of annual and perennial grasses and broad-leaved weeds. Predominantly used in pine plantations but also eucalyptus. Atrazine provides ongoing weed control for several months which eliminates additional weed control operations.
Location where used (forest, office, fire store, nursery)	Forest.
Application method (hand, ground machine, aerial)	Broadcast methods applied as a liquid. Often aerial application but also boom spraying.
Scale and intensity of use	Variable. Dependent on the size of the operational area and method of application.
Alternatives considered (burning, mechanical land prep, hand, mechanical releasing, oversowing, grazing, weed mats, biological control, alternative chemicals)	<p>A wide range of alternatives have been considered consistent with Criterion 10.7 of FSC-STD-01-001 V5-2 FSC Principles and Criteria.</p> <p>Further information on alternatives is within the IPM.</p>
Pesticide used individually or in conjunction with other pesticide(s)	<ul style="list-style-type: none"> • Can be used in conjunction with Hexazinone.

	<ul style="list-style-type: none"> • Always check the product label, and if there are other pesticide additives, consult their ESRA's too. • Risks will likely increase with additional herbicide products, especially those known to have effects on the soil, water, air, and aquatic or terrestrial life. Little is known about potential compounding risks of mixes, as risk assessments are generally made on individual active ingredients.
Reference documents	<ul style="list-style-type: none"> • Integrated Pest Management document • FSC Pesticides Policy FSC-POL-30-001 V3-0 EN • FSC Lists of highly hazardous pesticides FSC-POL-30-001a V3-0 EN D2-0 • SDS 4FARMERS ATRAZINE 600SC and ATRAZINE 900 WG • SDS AGPRO Atrazine 500 • SDS Farmalinx Atrazine 900 WG • SDS Imtrade Atrazine 900 WG and Atrazine 600 SC • SDS Nufarm ATRADEX® WG and NU-TRAZINE 900DF • SDS Orion Atraflow • SDS Syngenta AATREX® 4L (USA) • Pesticide properties database http://sitem.herts.ac.uk/ • US EPA (12/2019) 'Atrazine - Proposed Interim Registration Review Decision, Case Number 0062' • US EPA (2016) 'Refined Ecological Risk Assessment for Atrazine' • APVMA website including the PubCRIS database https://portal.apvma.gov.au/pubcris • NZ EPA website including the Chemical Classification and Information Database (CCID) https://www.epa.govt.nz/database-search/chemical-classification-and-information-database-ccid/ • Herbiguide herbiguide.com.au/InformationHerbicides.aspx • PAN Pesticides Database http://pesticideinformation.org/Search_Chemicals.jsp • US National Center For Biotechnology Information (NCBI) https://pubchem.ncbi.nlm.nih.gov/
Note	<ul style="list-style-type: none"> • Atrazine is in the Triazine family. It is less soil fast than Simazine. • Atrazine has four major metabolites. These are generally of equal or slightly more toxicity. Assessments typically assume that the properties of Atrazine serve as a surrogate for the metabolites for terrestrial animals. However, in the aquatic environment, the hazard from the parent Atrazine is of more significant concern. • Comparing New Zealand and Australian SDS, NZ SDSs list Atrazine as NZ EPA 9.2A 'very toxic to the soil environment' and NZ EPA 9.3C 'harmful to terrestrial vertebrates', but Australia has no soil hazard statements.

Risk profiling

The risk matrix below helps frame the level of risk for each ESRA exposure variable, and to also assist in comparing risk between the ESRA of different chemical pesticides. A score assessed as 3/2 means the likelihood is 'possible' and the consequence of the event 'minor'.

		LIKELIHOOD					
		1 - Negligible	2 - Unlikely	3 - Possible	4 - Likely	5 - Almost Certain	6 - Certain
CONSEQUENCE	6 - Catastrophic	Medium	High	Extreme	Extreme	Extreme	Extreme
	5 - Extreme	Medium	Medium	High	High	Extreme	Extreme
	4 - Major	Low	Medium	Medium	High	High	Extreme
	3 - Moderate	Low	Low	Medium	Medium	High	High
	2 - Minor	Low	Low	Low	Low	Medium	Medium
	1 - Insignificant	Low	Low	Low	Low	Low	Medium

The risk for some attributes will change between pre-control assessment risk and post-mitigation control risk (residual risk), after initiating the mitigation control measures within the ESRA.

Exposure	List of values	HHP Hazards ³ Suspected carcinogen and Endocrine Disruptor	Assessment of Other potential risks – Pre-controls ^{1, 2}	Assessment of Other potential risks - Post mitigation controls ^{1, 2}	Descriptor of why / why not a risk ³	Mitigation strategies defined to minimise risk
Environmental	Soil (erosion, degradation, biota, carbon storage)	Na	3/3 = Medium	3/2 = Low	<p>Risk levels to soil vary. Risks include:</p> <ul style="list-style-type: none">Classed as very toxic to the soil environment in NZ (NZ EPA 9.2A). Also, refer to the non-target species row below.Moderate to highly mobile in soil stated in most sources (K_{oc} 89-513 ml/g). It has low water solubility (33 mg/L). Rapidly lost from sandy soils through leaching. It should not be applied to waterlogged soils.Moderately to highly persistent in soil (DT50 (soil) (field) 6-146 days). Half-life in the soil is typically 35-75 days. The main dissipation routes are microbial degradation, runoff, and leaching. Factors affecting degradation include temperature, rainfall, and soil type, especially organic content.Bioaccumulation potential is low (BCF 0.98-4.3 l/kg, LogP = 2.7).Potential increased erosion due to vegetation dieback. Risk increases with scale and intensity, especially in the erosion-prone hill country where infrastructure and slopes near waterways are prone to surface erosion. However, the risks reduce if oversown or hydro seeded cut/fill batters are not sprayed.	<p>Refer to Appendix 1: ‘Generic Mitigation and Monitoring Measures for Herbicides, Fungicides, Vertebrate Toxins, and Insecticides’.</p> <p>Although Appendix 1’s mitigation measures should significantly reduce pre-control risks, not all risk can be eliminated as seen in the post-mitigation controls column. Depending on the residual risk, some sites may require more stringent versions of individual mitigation measures than those in Appendix 1. Also, in some situations, additional company mitigation measures may need to be included.</p> <p>The Appendix also describes mitigation measures for other pesticides that may be used in conjunction with Atrazine to improve the efficacy of the treatment.</p>
	Water (groundwater, surface water, water supplies)	Na	3/3 = Medium	3/2 = Low	<p>Risk levels to water vary and include:</p> <ul style="list-style-type: none">Entering water. There are three pathways to enter water: directly into waterways from the spray, overland flow from rain or wind, and via the soil to groundwater.<ul style="list-style-type: none">Moderate to high risk of migration into water sources via all three, as confirmed in monitoring, because it does not adsorb strongly to soil particles and has a lengthy half-life.High potential for groundwater contamination. Atrazine is the second most common pesticide found in Australian private and community wells. Trace amounts have been found in drinking water and in groundwater in several Australian states.Risks when in water:<ul style="list-style-type: none">Hazard classed as very toxic to aquatic life with long-lasting effects in most SDSs.Moderately persistent in water and sediment tests (DT50 vary significantly (water-sediment) 80 days, Aqueous hydrolysis DT50 (pH7, 20°C) 86 days). Hydrolysis increases under acidic or basic conditions.The risk profile to water increases with:<ul style="list-style-type: none">Site factors that increase the potential for surface runoff, e.g. steep slopes, poorly draining soils and soils with shallow groundwater.Site factors that increase the potential of leaching to groundwater, e.g. sites with permeable soils with shallow water tables.Poor product application, e.g. spraying before heavy rain, direct spray or drift over water, or locating storage or load zones that increase the risk to water from accidental spillage.	
	Non-target species (vegetation, wildlife, bees and other pollinators, pets)	2/2 = Low	Fish 3/4 = Medium Aquatic organisms 3/3 = Medium Bees 2/2 = Low Birds 2/2 = Low Vegetation 4/4 = High Soil organisms 3/2 = low	Fish 3/3 = Medium Aquatic organisms 3/2 = Low Bees 2/2 = Low Birds 2/2 = Low Vegetation 2/2 = Low Soil organisms 3/2 = low	<p>Aquatic and terrestrial risks vary depending on non-target species:</p> <ul style="list-style-type: none">Aquatic:<ul style="list-style-type: none">Hazard classed as very ecotoxic to aquatic life with long-lasting effects in most SDSs.Moderate acute toxicity to fish (LC50 (96hr) (rainbow trout) 4.5-11 mg/L, LC50 (96hr) (Bluegill sunfish) 90 mg/L. Some SDS listed it as practically non-toxic to fish, based off this evidence).Moderate <i>chronic</i> toxicity to fish (NOEC (21 days) (rainbow trout) 2 mg/L).Moderately acute to aquatic crustaceans depending on species (LC50 (96hr) (shrimp) 1.0mg/L).Moderate to high acute toxicity to aquatic invertebrates depending on the source (LC50 (48 hrs) (Daphnia) 85 mg/L).Moderate <i>chronic</i> toxicity for aquatic invertebrates (NOEC (Daphnia) (21 days) 0.25 mg/L).Moderate acute toxicity for sediment-dwelling organisms (LC50 (96hr) (blood worm) 1.0mg/L).Moderate to high acute toxicity to aquatic algae depending on source (EC50 (96hr) (<i>Scenedemus subspicatus</i>) 0.014-0.027 mg/L).High acute toxicity to aquatic plants (EC50 (7 days) (common duckweed) 0.019 mg/L, (eel grass) 0.312 mg/L).Chronic exposure studies on fish, invertebrates, aquatic phase amphibians resulted in significant effects on survival, growth or reproduction.Terrestrial:<ul style="list-style-type: none">Classed as harmful to terrestrial vertebrates in NZ (NZ EPA 9.3C).For mammal toxicity, see the health section below.Slight acute toxicity for amphibians (LC50 (American toad) 33.4 mg/L).Severely affects non-target monocot and dicot vegetation.Moderate acute toxicity for earthworms (LC50 (14day) (earthworm) 79 mg/kg).Harmless to other arthropods (Typhlodromus pyri (mite) and Chrysoperla carnea (lacewing)).Non-toxic to low toxicity to birds depending on the source (LD50 (mallard duck) >2000-4640 mg/kg, LD50 (12day) (Bobwhite quail) 940 mg/kg). However, there is a concern for chronic exposure based on reproductive impacts observed in the most sensitive species (USA EPA).Non-toxic to low acute toxicity to bees depending on the source (LD50 (contact and oral acute) (worst case up to 72hr) >100ug/bee).Chronic toxicity risks: Chronic effects are the main concern. Risks to birds and mammals are primarily through chronic exposure. Generally exceeds the US EPA’s Level of concern (LOC) scenario modelling for chronic exposure. Forestry’s low and solely establishment based use limits this.	

	List of values	HHP Hazards ³ Suspected carcinogen and Endocrine Disruptor	Assessment of Other potential risks – Pre-controls ^{1,2}	Assessment of Other potential risks - Post mitigation controls ^{1,2}	Descriptor of why / why not a risk ²	
Social	Atmosphere (air quality, greenhouse gases)	Na	1/1 = Low	1/1 = Low	The risk to the atmosphere is low. Risks vary and include the application method, scale and intensity, location relative to adjoining properties, and weather conditions. Aerial spraying has a potentially higher risk as it will result in having pesticide in the air over the application area until the spray settles.	<p>Refer to Appendix 1: ‘Generic Mitigation and Monitoring Measures for Herbicides, Fungicides, Vertebrate Toxins, and Insecticides’.</p> <p>Although Appendix 1’s mitigation measures should significantly reduce pre-control risks, not all risk can be eliminated as seen in the post-mitigation controls column. Depending on the residual risk, some sites may require more stringent versions of individual mitigation measures than those in Appendix 1. Also, in some situations, additional company mitigation measures may need to be included.</p> <p>The Appendix also describes mitigation measures for other pesticides that may be used in conjunction with Atrazine to improve the efficacy of the treatment.</p>
	Non-timber forest products (as FSC-STD-01-001 V5-2 FSC principles and criteria, criterion 5.1)	2/2 = Low	2/2 = Low Aquaculture 3/4 = Medium	2/2 = Low Aquaculture 2/2 = Low	Atrazine’s is applied to bare land or newly established trees so risks to under the canopy, non-timber products aren’t applicable. However, risks will occur from potential leaching to water, especially where aquaculture is nearby, e.g. koura ponds, as koura can be highly sensitive to some pesticides.	
	High conservation values (particularly HCV 1-4)	2/2 = Low	4/5 = High	2/2 = Low	The risk of Atrazine to high conservation values in some situations could be extreme. Poor application adjoining or near a high conservation value area will compound the risk. Atrazine is a selective herbicide that will kill some plant species or cause dieback in others. Also, the relatively high solubility and Atrazine’s persistence means there is a risk of downslope leaching through soil into non-treatment areas.	
	Landscape (aesthetics, cumulative impacts)	2/2 = Low	Small scale 1/1 = low Large aerial 6/3 = High	Small scale 1/1 = low Large aerial 4/3 = Medium	The risk to landscape increases with scale and intensity. Large operational areas may significantly impact aesthetics. This could depend on the location of the treatment area and public sentiment. For example, treatment size, visibility, proximity to and type/sensitivity of neighbours, impact on public recreation, perceived impact on nearby parks, forest, or spray sensitive land users like orchards or organic farming.	
	Ecosystem services (water, soil, carbon sequestration, tourism)	2/2 = Low	2/2 = Low	2/2 = Low	Risks to ecosystem services are likely low after mitigation measures are in place. Refer to the water, soil, atmosphere and non-target species exposure variable assessments. However, specific circumstances may raise the risk profile. For example, if the treatment area was part of a municipal water catchment zone.	
	High conservation values (especially HCV 5-6)	Na	2/2 = Low	2/2 = Low	The risk is likely to be low in most situations.	
	Health (fertility, reproductive health, respiratory health, dermatologic, neurological and gastrointestinal problems, cancer and hormone imbalance)	2/2 = Low	3/3 = Medium	2/2 = Low	<p>Risks to human health from Atrazine are likely to be low when used according to label, SDS and good practice:</p> <ul style="list-style-type: none"> The following are oral, dermal or inhalation toxicity risks: <ul style="list-style-type: none"> Low to moderate acute oral toxicity depending on the source (Rat LD50 1869->5000 mg/kg, (rabbit) 750 mg/kg). Low acute dermally toxicity (LD50 (rat) 2000->5050 mg/Kg, LD50 (rabbits) 7500 mg/kg). Atrazine a non to minor skin irritant but rashes associated with exposure have been reported. Low acute inhalation toxicity. Not likely to be an aspiration hazard (LC50 (4hr) (Rat) 2.7-5.8 mg/L). Temporary irritation. May cause eye irritation. Carcinogenicity, mutagenicity, teratogenicity, reproduction, and endocrine risks: <ul style="list-style-type: none"> Carcinogenicity: Data deficient. Classified by IARC as ‘Group 3 - Not classifiable as to its carcinogenicity to humans’. Atrazine did not cause tumours when mice were given oral doses of 21.5 mg/kg/day from age 1 to 4 weeks, followed by dietary doses of 82 mg/kg for an additional 17 months. However, mammary tumours were observed in rats after lifetime administrations of high doses of Atrazine. Mutagenicity: Unlikely to be mutagenic. Teratogenicity: Unlikely to be teratogenic. In mice, Atrazine did not cause abnormalities in foetuses whose dams were given doses of 46.4 mg/kg/day during days 6 through 14 of gestation. Reproduction or reproductive toxicity: Unlikely to, or is (PAN) a reproductive risk depending on the source. Dietary doses of Atrazine given to rats on days 3, 6 and 9 of gestation up to about 50 mg/kg/day caused no adverse reproductive effects. Endocrine disruption potential: There are endocrine risks. Atrazine and metabolites have neuroendocrine effects in rats that can cause developmental and reproductive toxicity. Specific Target Organ Systemic Toxicity (Single Exposure): <ul style="list-style-type: none"> Evaluation of available data suggests that this material is not a STOT-SE toxicant. Chronic toxicity: <ul style="list-style-type: none"> Atrazine is slightly to moderately toxic to humans and other animals. It can be absorbed orally, dermally, and by inhalation. Classed as ‘may cause organ damage from prolonged or repeat exposure at high doses’ in many SDSs (NZ EPA 6.9B, GHS H373). Repeated and prolonged exposure may cause coma, circulatory collapse and gastric bleeding, may cause renal failure, may disturb testosterone metabolism. 40% of rats receiving oral doses of 20 mg/kg/day for 6 months died with signs of respiratory distress and paralysis of the limbs. Structural and chemical changes in the brain, heart, liver, lungs, kidney, ovaries, and endocrine organs were observed. In a 2-year study with dogs, 7.5 mg/kg/day caused decreased food intake and increased heart and liver weights. The Australian Acceptable Daily Intake (ADI) for Atrazine for a human is 0.005 mg/kg/day, (some SDSs are different) set for the public for daily, lifetime exposure (based on the NOEL of 0.5 mg/kg/day). 	
	Welfare	2/2 = Low	3/3 = Medium	2/2 = Low	<p>Australian GHS hazardous substances classification codes on all reviewed SDS for health and environmental hazards include:</p> <ul style="list-style-type: none"> Environment: H400 Very toxic to aquatic life, H410 Very toxic to aquatic life with long lasting effects. Health: H317 May cause an allergic skin reaction, H373 May cause damage to organs through prolonged or repeated exposure. Note: Australian SDSs are not consistent in their listing of hazard classifications. Refer to safe work Australia’s summary tables https://www.safeworkaustralia.gov.au/system/files/documents/1702/classification_and_labelling_workplace_hazardous_chemicals_poster_-a4.pdf <p>NZ hazardous substances classification codes for health and environmental hazards taken from the NZ EPA CCID database:</p> <ul style="list-style-type: none"> Health: 6.1D (All), 6.1D (O), 6.9B (All), 6.9B (O), Environment 9.1A (All), 9.1A (C), 9.1A (A), 9.1B (F), 9.2A, 9.3C Note: NZ SDSs are not consistent in their listing of hazard classifications. They may have some, all, or additional hazard classifications. <p>Refer to NZ EPA for definitions of hazardous substances classification codes https://www.epa.govt.nz/industry-areas/hazardous-substances/rules-for-hazardous-substances/hazardous-substances-classification-codes/</p> <p>Refer to health and other social exposure elements as that can also influence welfare too.</p>	

	List of values	HHP Hazards ³ Suspected carcinogen and Endocrine Disruptor	Assessment of Other potential risks – Pre-controls ^{1, 2}	Assessment of Other potential risks - Post mitigation controls ^{1, 2}	Descriptor of why / why not a risk ²	
Social	Food and water	2/2 = Low	3/3 = Medium	2/2 = Low	The risk to food and water is likely low: <ul style="list-style-type: none">Atrazine is used in food-producing primary sectors like cropping, orchards and infrastructure maintenance. For example, in crops like canola, sorghum, maize and sweetcorn, and in roadsides and rights-of-way.Eliminate the potential risk of accidental or ongoing oral ingestion of Atrazine by pesticide workers with poor on-the-job personal hygiene around food and drink.	Refer to Appendix 1: ‘Generic Mitigation and Monitoring Measures for Herbicides, Fungicides, Vertebrate Toxins, and Insecticides’. Although Appendix 1’s mitigation measures should significantly reduce pre-control risks, not all risk can be eliminated as seen in the post-mitigation controls column. Depending on the residual risk, some sites may require more stringent versions of individual mitigation measures than those in Appendix 1. Also, in some situations, additional company mitigation measures may need to be included.
	Social infrastructure (schools and hospitals, recreational infrastructure, infrastructure adjacent to the management unit)	3/2 = Low	1/1 = Low to 3/5 = High	1/1 = Low to 3/2 = Low	The risk to social infrastructure is likely low if the treatment area is well within the forest and away from in-forest or adjoining infrastructure. Risks increase if there are water takes that are within, or drain from, the treatment area. Also, the risk is likely to increase with scale and intensity. For example, if the operation is on a boundary close to infrastructure or where there are in-forest rights. However, access and recreation would likely be restricted only during the operation.	
	Economic viability (agriculture, livestock, tourism)	Na	1/1 = Low to 3/5 = High	1/1 = Low to 3/3 = Medium	The risk to economic viability is likely low if the treatment area is well within the forest. Risk increases with scale, intensity and operational complexity, especially if the operation is on a boundary. For example, an aerial overspray or leaching could have an economic impact on adjoining agriculture, aquaculture or horticulture, leading to costly compensation or legal action. Organics are especially vulnerable. Damage to susceptible plants can occur when soil particles are blown or washed off-target onto cropland.	
	Rights (legal and customary)	Na	2/2 = Low	2/2 = Low	Risks to rights are likely to be low unless in specific situations like easements for water extraction or grazing. Also, operational areas will likely be closed off to those with rights only during the operation, e.g. utility companies or those with road access easements.	
	Other	----	----	----	----	
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1 = The risk profile is only for the pesticide listed in the table. Often other pesticides are added to improve treatment efficacy or solubility. Also, risk will vary between sites, methods and scale and intensity of the treatment.

2 = It is recommended to take a precautionous approach when using Atrazine. New research may bring to light risks that were not identified in previous assessments. Research is not exhaustive, and the effects on some exposure variables are not known or fully understood. **Also, between SDS’s there can be conflicting data, variation in both amount and quality of information, and differing judgements of risks. Some SDSs are more current than others. Therefore, consider reviewing SDS’s of similar pesticide products.** For example, some SDSs do not mention that Atrazine is a suspected carcinogen and endocrine disruptor, also several SDSs don’t identify Atrazine as H400 and H401 ‘very toxic to aquatic life’ and ‘...with long lasting effects’. NZ SDSs list Atrazine as NZ EPA 9.2A ‘very toxic to the soil environment’ and NZ EPA 9.3C ‘harmful to terrestrial vertebrates’ but Australia appears to have no soil hazard statements.

3= Post mitigation risk.

ESRA Copper Products (Cuprous oxide and Copper oxychloride)

This template follows a similar format to that of Annex 2 within the FSC Pesticides Policy FSC-POL-30-001 V3-0 EN. Therefore, it may be used by SDGs and Organisations in their Environmental and Social Risk Assessment (ESRA), and by certification bodies as a checklist to assess conformance with the minimum requirements for ESRA.

Date	April 2020
Proposed chemical pesticide	<ul style="list-style-type: none"> Cuprous oxide (copper (1) oxide, copper oxide, dicopper oxide). Copper oxychloride (cupric oxychloride, dicopper chloride trihydroxide).
Pesticide type	Fungicide.
CAS number(s)	<ul style="list-style-type: none"> 1317-39-1 Cuprous oxide. 1332-40-7 Copper oxychloride.
Common trade name(s) (Listed brand names may have different formulations including combinations with other chemical pesticides)	<p>The product is in three formulation types; wettable powder (WP), water dispersed granules (WG) and liquid.</p> <p>Cuprous oxide trade names include:</p> <ul style="list-style-type: none"> AG COPP 75 (powder) Nordox™ 75WG YaraVita COPTREL 500 (liquid) <p>Copper oxychloride trade names include:</p> <ul style="list-style-type: none"> AGPRO Copper Oxychloride 800WP Growchem COPPOX WG
FSC pesticide classification (prohibited HHP, highly restricted HHP, restricted HHP, or other chemical pesticide)	<p>Restricted HHP</p> <ul style="list-style-type: none"> Cuprous oxide for Aquatic Toxicity (LC/EC 50 <50 µg/l). Copper oxychloride for Acute toxicity mammals and birds (LD50< 200mg/kg body weight).
Purpose of use (protection of vegetation, human health, native species, seeds or seedlings, weed control, others)	<ul style="list-style-type: none"> A broad-spectrum fungicide in nurseries. To control Dothistroma needle blight, red needle cast, and other fungal tree infections in Pinus radiata plantations.
Location where used (forest, office, fire store, nursery)	Forest and nursery.
Application method (hand, ground machine, aerial)	Predominantly aerial in forest operations, and ground-based application. Application methods will differ depending on whether it is applied in a nursery or forest.
Scale and intensity of use	Variable. Dependent on the size of the operational area, treatment purpose and method of application.
Alternatives considered (burning, mechanical land prep, hand, mechanical releasing, oversowing, grazing, weed mats, biological control, alternative chemicals)	<p>A wide range of alternatives have been considered consistent with Criterion 10.7 of FSC-STD-01-001 V5-2 FSC Principles and Criteria.</p> <p>Further information on alternatives is within the IPM.</p>
Pesticide used individually or in conjunction with other pesticide(s)	No

Reference documents	<ul style="list-style-type: none"> • Integrated Pest Management document • FSC Pesticides Policy FSC-POL-30-001 V3-0 EN. • FSC Lists of highly hazardous pesticides FSC-POL-30-001a V3-0 EN D2-0. • Australian forest companies' cuprous oxide 2015 'FSC-TPL-30-001 Application for a temporary derogation to use a 'highly hazardous' pesticide'. • Scion, 2017 'Aerial application of copper for dothistroma control in New Zealand's planted forests—effect on stream environments'. • European Food Safety Authority 2017, Conclusion on pesticides peer review 'Peer review of the pesticide risk assessment of the active substance copper compounds copper(I), copper(II) variants namely copper hydroxide, copper oxychloride, tribasic copper sulfate, copper(I) oxide, Bordeaux mixture'. • Pesticide properties database http://sitem.herts.ac.uk/ • Technical Evaluation Report USDA National Organic Program, 2011' Copper Sulfate and Other Copper Products Crops For Use as Plant Disease Control and For Use as Algicide and Invertebrate Pest Control'. • SDS AGPRO Copper Oxychloride 800WP • SDS Growchem COPPOX WG • SDS AG COPP 75 • SDS Nordox™ 75WG (2017, Australia) • SDS Nordox™ 75WG (2014, Norway) • SDS YaraVita COPTREL 500 • APVMA website including the PubCRIS database https://portal.apvma.gov.au/pubcris • NZ EPA website including the Chemical Classification and Information Database (CCID) https://www.epa.govt.nz/database-search/chemical-classification-and-information-database-ccid/ • Herbiguide herbiguide.com.au/InformationHerbicides.aspx • PAN Pesticides Database http://pesticideinformation.org/Search_Chemicals.jsp • US National Center For Biotechnology Information (NCBI) https://pubchem.ncbi.nlm.nih.gov/ • Brian Alloway' Heavy Metals in Soils - Trace Metals and Metalloids in Soils and their Bioavailability'.
Note	<ul style="list-style-type: none"> • Copper is an essential nutrient required for proper homeostasis in all organisms. Most organisms have homeostatic mechanisms efficient in maintaining a generally consistent level of copper to process excess copper or to manage the deficiency of copper levels. • Australian and NZ soil copper concentrations are generally low in comparison to both the background concentrations and concentrations influenced by anthropogenic activities reported in international literature, which could be magnitudes of order higher. • Cuprous oxide and Copper oxychloride have many similar properties but not all. Where these are different, they have been

	<p>described more fully in the risks section. Although test results will show variations, at a level where risks are classified, they may make no difference. For example, test results may vary, but both copper products are classified as moderate-risk and therefore trigger the same level of controls.</p> <ul style="list-style-type: none"> Cuprous oxide is more widely used than copper oxychloride for dothistroma treatment. Cuprous oxide has advantages due to improved efficacy and price.
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Risk profiling

The risk matrix below helps frame the level of risk for each ESRA exposure variable, and to also assist in comparing risk between the ESRAs of different chemical pesticides. A score assessed as 3/2 means the likelihood is 'possible' and the consequence of the event 'minor'.

		LIKELIHOOD					
		1 - Negligible	2 - Unlikely	3 - Possible	4 - Likely	5 - Almost Certain	6 - Certain
CONSEQUENCE	6 - Catastrophic	Medium	High	Extreme	Extreme	Extreme	Extreme
	5 - Extreme	Medium	Medium	High	High	Extreme	Extreme
	4 - Major	Low	Medium	Medium	High	High	Extreme
	3 - Moderate	Low	Low	Medium	Medium	High	High
	2 - Minor	Low	Low	Low	Low	Medium	Medium
	1 - Insignificant	Low	Low	Low	Low	Low	Medium

The risk for some attributes will change between pre-control assessment risk and post-mitigation control risk (residual risk), after initiating the mitigation control measures within the ESRA.

Exposure	List of values	HHP Hazards ³ Cuprous oxide Aquatic toxicity Cu oxychloride Acute toxicity (mammals and birds)	Assessment of other potential risks – Pre-controls ^{1, 2}	Assessment of other potential risks - Post mitigation controls ^{1, 2}	Descriptor of why / why not a risk ^{2,3,4}	Mitigation strategies defined to minimise risk
Environmental	Soil (erosion, degradation, biota, carbon storage)	Na	3/2 = Low	2/2 = Low	<p>Risk levels to soil vary and include:</p> <ul style="list-style-type: none">Low mobility. The free cupric ion (Cu²⁺) has a high sorption affinity for soil, sediments and organic matter.Background concentration of copper. Copper doesn't biodegrade. It is an element, so it cannot break down any further via hydrolysis, metabolism, or any other degradation processes. (DT50 has arbitrarily been set at either 365 or 10000 days). Note that most applied copper would remain in the soil, which results in an increase of copper concentration in soil with continued applications.Low potential for bioaccumulation (LogP (Cu₂O) 0.44). Cu oxychloride: Likely low risk (LogP <3).Moderate to high toxicity to terrestrial fauna (see non-target species row below).	<p>Refer to Appendix 1: 'Generic Mitigation and Monitoring Measures for Herbicides, Fungicides, Vertebrate Toxins, and Insecticides'.</p> <p>The Appendix describes the mitigation requirements to minimise risk from the exposure variables.</p>
	Water (groundwater, surface water, water supplies)	Cuprous oxide 3/2 = Low	3/2 = Low	3/2 = Low	<p>Risk levels to water vary and include:</p> <ul style="list-style-type: none">Entering water. There are three pathways to enter the water: directly into waterways from the spray, overland flow from rain, and via the soil to groundwater.<ul style="list-style-type: none">There is an almost certain risk with aerial dothistroma spraying of copper entering streams regardless of the tree age, stream size, streamflow, riparian composition, flight line direction, or leaving a no-spray buffer along the stream edge (Baillie et al., 2017). This is because the spray method is designed to facilitate the penetration and coverage of copper into infected stands, particularly along stand edges even when a no-spray buffer is retained. Also, treatments require very high coverage levels to achieve efficacy.Copper washed off needles or from the soil into waterways during rainfall events, e.g. before the copper spray has dried. The quick-drying and adhesive properties of the copper spray fungicide solution should minimise the risk window.Low risk of in-ground copper residues reaching water. This is because they bind strongly to the organic matter in the soil, minimising the risk of leaching into waterways.Risks when in water:<ul style="list-style-type: none">Hazard classed as very toxic to aquatic life (acute and chronic).Not biodegradable. It is stable in water. Copper in sediment can be partitioned back into the water column as the organic component decomposes. However, recycling back into the water column is likely to be low.The risk profile to water increases with:<ul style="list-style-type: none">Site factors that increase the potential for surface runoff, e.g. steep slopes, poorly draining soils and soils with shallow groundwater.Poor product application, e.g. spraying before heavy rain, direct spray or drift over water, or locating storage or load zones that increase the risk to water from accidental spillage.	<p>Although Appendix 1's mitigation measures should significantly reduce pre-control risks, not all risk can be eliminated as seen in the post-mitigation controls column. Depending on the residual risk, some sites may require more stringent versions of individual mitigation measures than those in Appendix 1. Also, in some situations, additional company mitigation measures may need to be included.</p>
	Non-target species (vegetation, wildlife, bees and other pollinators, pets)	Cuprous oxide Aerial application Aquatic 5/2 = Medium Fish 5/2 = Medium Aquatic organisms 5/2 = Medium Cu oxychloride All methods Terrestrial 5/2 = Medium Birds 2/2 = Low	Fish 5/2 = Medium Aquatic organisms 5/2 = Medium Bees 2/2 = Low Birds 2/2 = Low Vegetation 1/1 = Low Soil organisms 3/2 = low Soil organisms 3/3 = Medium (Cu oxycl) 3/2 = Low (Cu oxide)	Fish 5/2 = Medium Aquatic organisms 5/2 = Medium Bees 2/2 = Low Birds 2/2 = Low Vegetation 1/1 = Low Soil organisms 3/2 = low Soil organisms 3/3 = Medium (Cu oxycl) 3/2 = Low (Cu oxide)	<p>The risks vary depending on non-target species:</p> <ul style="list-style-type: none">Aquatic:<ul style="list-style-type: none">Classed as very toxic to the aquatic life with long-lasting effects for both products (Aust, H410, NZ, 9.1A).Aquatic animals are more sensitive to copper than terrestrial animals because rather than copper solely being ingested, it can rapidly bind and causes damage to the gill membranes and interfere with osmoregulatory processes.Although copper commonly occurs as a natural metal in surface water bodies, anthropogenic activities that introduce excess quantities of copper can pose a risk to aquatic organisms.Moderate to high acute toxicity to fish (LC50 (96hr) (rainbow trout) 0.207 mg/L). Cu oxychloride: (rainbow trout) >48.3.Moderate to high acute toxicity to aquatic invertebrates (EC50 (48 hrs) Daphnia (water flea) 0.005-0.79 mg/L. Cu oxychloride: (EC50 (48 hrs) Daphnia (water flea) 0.29 mg/L.High <i>chronic</i> toxicity to aquatic invertebrates. Cu oxychloride: (NOEC (21 days) Daphnia (water flea) 0.006 mg/L).High acute toxicity to aquatic crustaceans (LC50 (96 hrs) (Cu₂O) Americamysis bahia (shrimp) 0.057 mg/L).Moderate toxicity to aquatic sediment-dwelling organisms (NOEC (28 days) (Cu₂O) (blood worm) 100 mg/L,Low to high toxicity to aquatic algae depending on copper product. High for Cu₂O (EC50 (72hrs) (Raphidocelis subcapitata) 0.147-0.333 mg/L, (96hrs) 0.03mg/L). Cu oxychloride: Low (EC50 (72hrs) (Raphidocelis subcapitata) 165.9).Terrestrial:<ul style="list-style-type: none">Hazard classed as harmful to terrestrial invertebrates (Cu oxychloride).Mammalian toxicity: See the health section below.Low risk to non-target vegetation as copper is an essential element, and the dose rate is low.Moderate toxicity for earthworms (LC50) (Cu₂O) (7 day) (earthworm) >862 mg/kg). Cu oxychloride: >490 mg/kg).Moderate toxicity to birds (LD50) (Cu₂O) (Japanese quail) 183 mg/kg). Cu oxychloride: (bobtail quail) 173 mg/kg).Low to moderate toxicity to bees depending on whether contact or oral, and type of copper product. Moderate both products for contact (LD50)(Cu₂O) (worst case up to 72hr) >22ug/bee, Cu oxychloride: 44.3 moderate. Low oral toxicity for Cu₂O (LD50) (worst case up to 72hr) >116ug/bee). Cu oxychloride: Moderate 12.1.	

	List of values	HHP Hazards ³ Cuprous oxide Aquatic toxicity Cu oxychloride Acute toxicity (mammals and birds)	Assessment of Other potential risks – Pre-controls^{1, 2}	Assessment of Other potential risks - Post mitigation controls^{1, 2}	Descriptor of why / why not a risk ^{2,3,4}	Mitigation strategies defined to minimise risk
Environmental	Non-timber forest products (as FSC-STD-01-001 V5-2 FSC principles and criteria, criterion 5.1)	Cuprous oxide Aerial application Aquaculture 2/2 = Low	2/2 = Low	2/2 = Low Aquaculture 2/2 = Low	There is likely to be a low risk irrespective of application type and purpose due to the low levels of copper in NZ and Australian forest soils compared with international comparisons. However, risks will occur where there is aquaculture, especially in aerial applications due to spray drift risks and also because of copper's high aquatic toxicity, e.g. koura ponds, as koura can be highly sensitive to some pesticides.	Refer to Appendix 1: 'Generic Mitigation and Monitoring Measures for Herbicides, Fungicides, Vertebrate Toxins, and Insecticides'. The Appendix describes the mitigation requirements to minimise risk from the exposure variables. Although Appendix 1's mitigation measures should significantly reduce pre-control risks, not all risk can be eliminated as seen in the post-mitigation controls column. Depending on the residual risk, some sites may require more stringent versions of individual mitigation measures than those in Appendix 1. Also, in some situations, additional company mitigation measures may need to be included.
	Atmosphere (air quality, greenhouse gases)	Na	1/1 = Low	1/1 = Low	The risk to the atmosphere is low, but aerial spraying will result in having pesticide in the air over the application area until the spray settles. No foreseen risks to the atmosphere. Copper products have a low volatility so minimal risk.	
	High conservation values (particularly HCV 1-4)	Cu oxychloride All methods Terrestrial 2/2 = Low	2/2 = Low	2/2 = Low	There is almost no risk to high conservation values.	
	Landscape (aesthetics, cumulative impacts)	Na	2/2 = Low	2/2 = Low	There is almost no risk to the landscape.	
	Ecosystem services (water, soil, carbon sequestration, tourism)	2/2 = Low	2/2 = Low	2/2 = Low	There is likely to be a low risk to ecosystem services. In the NZ study (Baillie et al., 2017), copper concentrations were below the analytical detection limit at the three sites during the first rainfall event after application from 2 to 7 days after treatment. Also, the risk is expected to be low because of the short duration of copper detected in the water column on the application day, and the minimal concentrations detected at the downstream sampling points indicated rapid dilution, absorption, and adsorption of copper within the stream systems. Also, copper concentrations in the stream water were well below drinking water standards and unlikely to pose a risk to human health.	
	Health (fertility, reproductive health, respiratory health, dermatologic, neurological and gastrointestinal problems, cancer and hormone imbalance)	Cu oxychloride All methods 2/2 = Low	3/3 = Medium	2/2 = Low	The risks to human health of copper products are likely to be low when used according to label, SDS and good practice: <ul style="list-style-type: none"> The following are oral, dermal or inhalation toxicity risks: <ul style="list-style-type: none"> Moderate acute toxicity if ingested for both products (LD₅₀ (rat) >300-928mg/kg). Low Acute dermal toxicity for both products. Prolonged skin contact is unlikely to result in absorption of harmful amounts. (LD50 (rat) >2000 mg/Kg), LD50 (rabbit) > 5000mg/kg). A mild skin irritant. Moderate acute inhalation toxicity for both products. An irritant (LC50) (Cu₂O) (Rat) (4 hr) 2.92-4.84 mg/L). Cu oxychloride: 2.83 mg/L. Can cause eye irritation for both products. Carcinogenicity, mutagenicity, teratogenicity, reproduction, and endocrine risks (for copper): <ul style="list-style-type: none"> Carcinogenicity: Not classified as a carcinogen. Mutagenicity: Not classified as a mutagen. Teratogenicity: Unlikely. Reproductive and teratogenic effects are usually associated with a deficiency rather than the excess of copper. Reproductive toxicity: No adverse effects were observed on the reproduction or fertility in rats. Developmental effects were observed in mice (decreased foetal weight, increased foetal mortality and incidence of abnormalities) Endocrine disruption potential: Unlikely to be an endocrine disruptor. No evidence of immunotoxicity or endocrine disruptive potential has been observed at realistic levels of copper exposure. Specific Target Organ Systemic Toxicity risks: <ul style="list-style-type: none"> Specific Target Organ Systemic Toxicity (Single Exposure): Not classified as a STOT-SE toxicant. Specific Target Organ Systemic Toxicity (Repeated Exposure): Not classified as STOT-RE. However, repeated exposure to copper salts results in liver, lung, kidney, and blood damage. Chronic toxicological effects: Potential heavy metal poisoning. Kidneys, lungs, and liver toxicant. The acceptable daily intake (ADI) in Australia is 0.2 mg Cu/kg bw/day, NZ recommended 0.17 (EU 0.15). This value is supported by animal data (90-day rat study) with a NOAEL of 16 mg Cu/kg bw/day. 	
	Welfare	Cu oxychloride All methods 2/2 = Low	3/3 = Medium	2/2 = Low	Refer to health and other social exposure elements as that can also influence welfare too. Australian GHS hazardous substances classification codes on all reviewed SDSs for health and environmental hazards include: <ul style="list-style-type: none"> Acute Toxicity: Oral: Category 4, Skin Corrosion/Irritation: Category 2, Serious Eye Damage / Eye Irritation: Category 2A, Aquatic Toxicity (Acute): Category 1, Aquatic Toxicity (Chronic): Category 1, H302 Harmful if swallowed, H315 Causes skin irritation, H319 Causes serious eye irritation, H400 Very toxic to aquatic life, H410 Very toxic to aquatic life with long lasting effects. Note: Australian SDSs are not consistent in their listing of hazard classifications. Refer to safe work Australia's summary tables. NZ hazardous substances classification codes for health and environmental hazards <ul style="list-style-type: none"> Health: 6.1D (All), 6.1D (O), 6.1D (I), 6.4A, 6.9B (All), 6.9B (I), 6.9B (O) Environment: 9.1A (All), 9.1A (F), 9.1A (C), 9.1A (A), 9.3B Note: NZ SDSs may have some, all, or additional hazard classifications. Refer to NZ EPA for definitions of hazardous substances classification codes https://www.epa.govt.nz/industry-areas/hazardous-substances/rules-for-hazardous-substances/hazardous-substances-classification-codes/	

	List of values	HHP Hazards ³ Cuprous oxide Aquatic toxicity Cu oxychloride Acute toxicity (mammals and birds)	Assessment of Other potential risks – Pre-controls ^{1, 2}	Assessment of Other potential risks - Post mitigation controls ^{1, 2}	Descriptor of why / why not a risk ^{2,3, 4}	Mitigation strategies defined to minimise risk
Social	High conservation values (especially HCV 5-6)	Cuprous oxide Cu oxychloride All methods 2/2 = Low	3/2 = Low	2/2 = Low	The risk is likely to be low. Refer to the social attributes of the ESRA table, below.	<p>Refer to Appendix 1: ‘Generic Mitigation and Monitoring Measures for Herbicides, Fungicides, Vertebrate Toxins, and Insecticides’.</p> <p>The Appendix describes the mitigation requirements to minimise risk from the exposure variables.</p> <p>Although Appendix 1's mitigation measures should significantly reduce pre-control risks, not all risk can be eliminated as seen in the post-mitigation controls column. Depending on the residual risk, some sites may require more stringent versions of individual mitigation measures than those in Appendix 1. Also, in some situations, additional company mitigation measures may need to be included.</p>
	Food and water	2/2 = Low	2/2 = Low	2/2 = Low	<p>The risk to food and water is likely low:</p> <ul style="list-style-type: none"> Background copper (Cu) concentrations in soil depend on geology and typically vary between 2 and 50 mg Cu/kg. The copper concentrations measured in NZ plantation stream sediments and plantation forest soils were sediment 1.7 and 6.1 mg/kg (sprayed and unsprayed stands), and soil 4.27 and 2.67 mg/kg (sprayed and unsprayed stands). The low copper concentrations likely reflect the infrequent use of copper over a 28-year forest rotation (≈ 2–5 treatments; maximum—two treatments in one year). Copper products are used in food-producing primary sectors to control fungus and pathogens for affecting the product, for example, in crops and pip fruit like avocado, grapes, kiwifruit and tomatoes. Potential risk of accidental or ongoing oral ingestion of copper products by pesticide workers with poor on-the-job personal hygiene around food and drink. 	
	Social infrastructure (schools and hospitals, recreational infrastructure, infrastructure adjacent to the management unit)	Cu oxychloride All methods 1/1 = Low to 3/2 = Low	1/1 = Low to 3/3 = Medium	1/1 = Low to 3/2 = Low	The risk to social infrastructure is likely to be low but will depend on vicinity to social infrastructure and scale and intensity.	
	Economic viability (agriculture, livestock, tourism)	Na	1/1 = Low to 3/3 = Medium	1/1 = Low to 3/2 = Low	The risk to economic viability is likely low if the treatment area is well within the forest. Risk increases with scale, intensity and operational complexity, especially if the operation is on a boundary. For example, an aerial overspray or leaching could have an economic impact, especially to organic growers.	
	Rights (legal and customary)	Na	3/2 = Low	2/2 = Low	Risks to rights are likely to be low. Also, operational areas will likely be closed off to those with rights only during the operation, e.g. utility companies or those with road access easements.	
	Other	----	----	----	----	
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1 = The risk profile is only for the pesticides listed in the table. Also, risk will vary between sites, methods, and the scale and intensity of the treatment.

2 = It is recommended to take a precautionous approach. New research may bring to light risks that were not identified in previous assessments. Current research is not exhaustive, is often agriculturally based from northern hemisphere studies, and the effects on some exposure variables are not known or fully understood. **Also, between SDS's there can be conflicting data, variation in both amount and quality of information, and differing judgements of risks. Some SDSs are more current than others. Therefore, consider reviewing SDS's of similar pesticide products.**

3 = Post mitigation measures.

ESRA Fipronil

This template follows a similar format to that of Annex 2 within the FSC Pesticides Policy FSC-POL-30-001 V3-0 EN. Therefore, it may be used by SDGs and Organisations in their Environmental and Social Risk Assessment (ESRA), and by certification bodies as a checklist to assess conformance with the minimum requirements for ESRA.

Date	May 2020
Proposed chemical pesticide	Products containing Fipronil
Pesticide type	Insecticide
CAS number(s)	120068-37-3
Common trade name(s) (Listed brand names may have different formulations including combinations with other chemical pesticides)	<p>Numerous trade names. Sold as suspension concentrates (SC) or water dispersed granules (WG). Names include:</p> <ul style="list-style-type: none"> • 4Farmers FIPRONIL 800 WDG • Adama Albatross 200 SC • Apparent Onslaught • BASF REGENT 200 SC • Imtrade Regal 800 WG • Kenso Agcare Brutus 800 <p>Refer to the APVMA PubCRIS database for the full list of registered products in Australia with this active ingredient.</p>
FSC pesticide classification (prohibited HHP, highly restricted HHP, restricted HHP, or other chemical pesticide)	FSC Restricted HHP
Purpose of use (protection of vegetation, human health, native species, seeds or seedlings, weed control, others)	European wasp control. It is used to control individual wasp nests only where wasps are creating an on-the-job operational health and safety risk or creating hazards in high visitor use areas.
Location where used (forest, office, fire store, nursery)	Forest.
Application method (hand, ground machine, aerial)	Elevated, target specific, cage traps. Fipronil laced meat bait.
Scale and intensity of use	Low scale and intensity. Only used at sites where wasps profoundly impact worker safety and health or tourism activities. An application rate of approximately 10g/ha.
Alternatives considered (burning, mechanical land prep, hand, mechanical releasing, oversowing, grazing, weed mats, biological control, alternative chemicals)	<p>A range of alternatives has been considered consistent with Criterion 10.7 of FSC-STD-01-001 V5-2 FSC Principles and Criteria.</p> <p>Further information on alternatives is within the IPM.</p>
Pesticide used individually or in conjunction with other pesticide(s)	Used individually

Reference documents	<ul style="list-style-type: none"> • Integrated Pest Management document • FSC Pesticides Policy FSC-POL-30-001 V3-0 EN • FSC Lists of highly hazardous pesticides FSC-POL-30-001a V3-0 EN D2-0 • SDS 4Farmers FIPRONIL 800 WDG • SDS Adama Albatross 200 SC • SDS Apparent Onslaught • SDS BASF REGENT 200 SC • SDS Imtrade Regal 800 WG • SDS Kenso Agcare Brutus 800 • Pesticide properties database http://sitem.herts.ac.uk/ • APVMA website including the PubCRIS database https://portal.apvma.gov.au/pubcris • NZ EPA website including the Chemical Classification and Information Database (CCID) https://www.epa.govt.nz/database-search/chemical-classification-and-information-database-ccid/ • PAN Pesticides Database http://pesticideinformation.org/Search_Chemicals.jsp • FSC Australia 02/2016 'FSC Highly Hazardous Pesticide Derogations – 2016 Stakeholder Feedback Report- SUMMARY' • FSC Highly Hazardous Pesticide Derogation 2015-2016 Recommendations from Advisory Group • 2016 Fipronil Derogation Application • FSC Board Pesticides Committee derogation decision 11/2016 'Use of Fipronil in Australia' • European Food Safety Authority (EFSA), 2013, 'CONCLUSION ON PESTICIDE PEER REVIEW Conclusion on the peer review of the pesticide risk assessment for bees for the active substance fipronil' • European Food Safety Authority (EFSA), 2006 'Conclusion regarding the peer review of the pesticide risk assessment of the active substance fipronil'
Note	<ul style="list-style-type: none"> • Fipronil is not approved for use in the EU.

Risk profiling

The risk matrix below helps frame the level of risk for each ESRA exposure variable, and to also assist in comparing risk between the ESRA of different chemical pesticides. A score assessed as 3/2 means the likelihood is 'possible' and the consequence of the event 'minor'.

		LIKELIHOOD					
		1 - Negligible	2 - Unlikely	3 - Possible	4 - Likely	5 - Almost Certain	6 - Certain
CONSEQUENCE	6 - Catastrophic	Medium	High	Extreme	Extreme	Extreme	Extreme
	5 - Extreme	Medium	Medium	High	High	Extreme	Extreme
	4 - Major	Low	Medium	Medium	High	High	Extreme
	3 - Moderate	Low	Low	Medium	Medium	High	High
	2 - Minor	Low	Low	Low	Low	Medium	Medium
	1 - Insignificant	Low	Low	Low	Low	Low	Medium

The risk for some attributes will change between pre-control assessment risk and post-mitigation control risk (residual risk), after initiating the mitigation control measures within the ESRA.

Exposure	List of values	HHP Hazards ³ <ul style="list-style-type: none">Acute toxicity mammals and birds	Assessment of Other potential risks – Pre-controls ^{1,2}	Assessment of Other potential risks - Post mitigation controls ^{1,2}	Descriptor of why / why not a risk ³	Mitigation strategies defined to minimise risk
Environmental	Soil (erosion, degradation, biota, carbon storage)	2/2 = Low	2/2 = Low	2/2 = Low	Risks are site-dependent but likely to be low due to the application method. Fipronil's broader soil risks include: <ul style="list-style-type: none">Low mobility in soil (K_{oc} 427-1248ml/g, (K_{foc} range 427-1248 mL/g). It has low water solubility (20°C) (1.9-3.79 mg/L). Residues remain mainly in the upper 30cm of soil. Mobility is affected by physical properties of the soil, e.g. higher organic matter content reduces mobility.Moderately persistent in soil (DT50 (soil) (field) 32-366 days). Factors that affect persistence include application rate, pH, temperature, plant cover, and soil type.Not expected accumulate, to a 'threshold for concern' for bioaccumulation risk. Different source assessment of the same data (BCF 321, LogP = 3.75-4.01).Fipronil has three toxicologically important metabolites (Fipronil has about 9 known metabolites).<ul style="list-style-type: none">Fipronil amide: Persistent and moderately mobile, moderate acute toxicity on fish and moderate to high on aquatic invertebrates. Moderate acute toxicity to earthworms. Data deficient for most toxicity factors.Fipronil sulfone: Persistent and non- mobile, high acute toxicity on fish and high on aquatic invertebrates. Moderate acute toxicity to earthworms. Data deficient for most toxicity factors.Fipronil sulphide: Persistent and slightly mobile, moderate acute toxicity on fish and moderate to high on aquatic invertebrates. Moderate acute toxicity to earthworms. Data deficient for most toxicity factors.	Refer to Appendix 1: 'Generic Mitigation and Monitoring Measures for Herbicides, Fungicides, Vertebrate Toxins, and Insecticides'. The Appendix describes the mitigation requirements to minimise risk from the exposure variables. Although Appendix 1's mitigation measures should significantly reduce pre-control risks, not all risk can be eliminated as seen in the post-mitigation controls column. Depending on the residual risk, some sites may require more stringent versions of individual mitigation measures than those in Appendix 1. Also, in some situations, additional company mitigation measures may need to be included.
	Water (groundwater, surface water, water supplies)	2/2 = Low	2/2 = Low	2/2 = Low	Risks are site-dependent but likely to be low due to the application method. More broadly risks to water vary and include: <ul style="list-style-type: none">Entering water. There are three pathways to enter water: directly into waterways from the spray, overland flow from rain, and via the soil to groundwater.<ul style="list-style-type: none">Low to moderate risk of migration into water via all three routes due to low mobility in soil and moderate persistence.Low risk of entering groundwater.Risks when in water:<ul style="list-style-type: none">Hazard classed as very toxic to aquatic life with long-lasting effects.Moderately persistent in water and moderately fast breakdown in sediment tests (DT50 (water phase) 30-54 days, (water-sediment) 68 days). Fast breakdown in water by light (aqueous photolysis) (DT50 (pH7) 0.33 days, but stable in sterile water (DT50 (20°C, pH5-7)).	
	Atmosphere (air quality, greenhouse gases)	Na	1/1 = low	1/1 = low	Low risk to the atmosphere due to the baited caged traps application method.	
	Non-target species (vegetation, wildlife, bees and other pollinators, pets)	Birds 2/2 = Low	Fish 2/2 = Low Aquatic invertebrates 2/2 = Low Aquatic algae/plants 2/2 = Low Bees 3/3 = Medium Birds 2/2 = Low Vegetation 2/2 = Low	Fish 2/2 = Low Aquatic invertebrates 2/2 = Low Aquatic algae/plants 2/2 = Low Bees 2/2 = Low Birds 2/2 = Low Vegetation 2/2 = Low	Risks are site-dependent but likely to be low due to the application method. Broader aquatic and terrestrial risks vary depending on non-target species: <ul style="list-style-type: none">Aquatic:<ul style="list-style-type: none">Hazard classed as very toxic in the aquatic environment with lasting effects.High to very high acute toxicity to fish (LC50 (96hr) (rainbow trout) 0.248 mg/L, (bluegill) 0.085 mg/L, (European carp) 0.43 mg/L).High <i>chronic</i> toxicity to fish (rainbow trout) 0.015 mg/L).High to very high acute toxicity to aquatic invertebrates including crustaceans, depending on species (LC50 (48 hrs) (Daphnia) 0.19 mg/L, (Mysid Shrimp) 0.00014 mg/L).Data deficient for chronic toxicity for aquatic invertebrates.Data deficient for acute toxicity to sediment-dwelling organisms.High chronic toxicity to sediment-dwelling organisms (LC50 (96hr) (bloodworms) 0.0001 mg/L).High acute toxicity to aquatic algae (EC50 (72hr) (<i>Raphidocelis subcapitata</i>) 0.16 mg/L, (Scenedesmus subspicatus 0.068mg/L).Moderate acute toxicity to aquatic plants (EC50 (7 days) (common duckweed) 0.16 mg/L.Terrestrial:<ul style="list-style-type: none">No acute risks to terrestrial plants.High acute risks to mammalian species. For data on mammals see the health section below.Very high acute toxicity to insects both targeted and non-target species.Moderate acute toxicity for earthworms (LC50 (7 days) (earthworm) >500 mg/kg).Moderate <i>chronic</i> toxicity for earthworms (NOEC (earthworm) 2.5-19 mg/kg).Low to moderate acute toxicity to birds depending on species and source (LD50 (mallard duck) >5000 mg/kg, (bobwhite quail) 11-48 mg/kg).High acute toxicity to bees and other pollinators (LD50 (bee) (contact and oral acute) (worst case up to 72hr) 0.0059 & 0.004 ug/bee, (alfalfa leafcutting bee) 0.004 ug/bee).	

	List of values	HHP Hazards ³ • Acute toxicity mammals and birds	Assessment of Other potential risks – Pre-controls ^{1,2}	Assessment of Other potential risks - Post mitigation controls ^{1,2}	Descriptor of why / why not a risk ²	Mitigation strategies defined to minimise risk
Environmental	Non-timber forest products (as FSC-STD-01-001 V5-2 FSC principles and criteria, criterion 5.1)	Beekeeping 2/2 = Low	2/2 = Low Beekeeping 2/2 = Low	2/2 = Low Beekeeping 2/2 = Low	Risks to non-timber values are site-dependent but likely to be low due to the application method. Fipronil poses a high risk to bees and other pollinators. This has led to the banning of the pesticide in Europe and other countries. Although the bait is designed to attract wasps only, and not bees, consider lowering operational risk by notifying apiarists in the target area. Recommend they move their hives during the treatment period.	<p>Refer to Appendix 1: ‘Generic Mitigation and Monitoring Measures for Herbicides, Fungicides, Vertebrate Toxins, and Insecticides’.</p> <p>The Appendix describes the mitigation requirements to minimise risk from the exposure variables.</p> <p>Although Appendix 1's mitigation measures should significantly reduce pre-control risks, not all risk can be eliminated as seen in the post-mitigation controls column. Depending on the residual risk, some sites may require more stringent versions of individual mitigation measures than those in Appendix 1. Also, in some situations, additional company mitigation measures may need to be included.</p>
	High conservation values (particularly HCV 1-4)	1/1 = low	1/1 = low	1/1 = low	The risk of Fipronil to high conservation values due to the application method is likely low. There may have a positive impact by removing an aggressive, territorial, and introduced insect pest.	
	Landscape (aesthetics, cumulative impacts)	Na	1/1 = low	1/1 = low	Low risk to the landscape. Treatment method is low intensity and targeted to individual wasp nests and their insect ranges.	
	Ecosystem services (water, soil, carbon sequestration, tourism)	Na	1/1 = low	1/1 = low	Low risk to the landscape. Treatment method is low intensity and targeted to individual wasp nests and their insect ranges.	
Social	High conservation values (especially HCV 5-6)	Na	3/3 = Medium	2/2 = Low	Risks to high conservation values are site-dependent but likely to be low due to the application method. For HCV 5, the risk potentially involves community acceptance of insecticide as an appropriate tool. For HCV 6, Fipronil is highly unlikely to damage a cultural site.	
	Health (fertility, reproductive health, respiratory health, dermatologic, neurological and gastrointestinal problems, cancer and hormone imbalance)	2/2 = Low	3/3 = Medium	2/2 = Low	<p>Risks to human health from Fipronil are likely to be low when used according to label, SDS and good practice. Also, the purpose of the Fipronil application is to reduce the impact caused by wasps on health and safety. The broad health risks are:</p> <ul style="list-style-type: none"> The following are oral, dermal or inhalation toxicity risks: <ul style="list-style-type: none"> High acute oral toxicity depending on source (LD50 (rat) 50-300, often sourced as 92 mg/kg, (mouse) 91mg/kg). Classified in SDSs as H301 or H302, either toxic or harmful if swallowed. Moderate acute dermal toxicity (LD50 (rabbit) 354-1120 mg/Kg, (rat) >2000->5000 mg/kg). Some SDSs class as H311: Toxic in contact with skin or H315: Causes skin irritation. Most SDSs list as mild skin irritation. Moderate acute inhalation toxicity (LC50 (Rat) (4 hr) 0.36-42 mg/L). Classified as H331: Toxic if inhaled. Data variable on risk to eyes between SDSs. Serious eye damage/irritation rabbit: (OECD Guideline 405, or H320: Causes eye irritation. Carcinogenicity, mutagenicity, teratogenicity, reproduction, and endocrine risks: <ul style="list-style-type: none"> Carcinogenicity: Unlikely to be a carcinogen. It is not listed as carcinogenic by SWA, NTP, or IARC. In long-term studies in rats, exposed to high doses, Fipronil induced thyroid tumours. However, these results are thought to be due to a rodent-specific liver effect that is not relevant to humans. Mutagenicity: Unlikely to be a mutagen. Mutagenicity tests revealed no genotoxic potential. Teratogenicity: Unlikely to be teratogenic. Animal studies did not indicate a toxic developmental effect at doses that were not toxic to the parental animals. Reproduction or reproductive toxicity: Unlikely to be a reproductive risk. Endocrine disruption potential: Fipronil is on the EU endocrine disruption list. Specific Target Organ Systemic Toxicity (Single Exposure): <ul style="list-style-type: none"> Not classed as STOST (single exposure). Chronic toxicity: <ul style="list-style-type: none"> Classed as STOST (repeated exposure – category 1). H372: Causes damage to organs through prolonged or repeated exposure and NZ EPA 6.9A toxic to human target organs or systems Causes mortality and signs of neurotoxicity through prolonged or repeated exposure. The Australian Acceptable Daily Intake (ADI) for Fipronil for a human is 0.0002 mg/kg/day, set for the public for daily, lifetime exposure based on a NOEL of 0.2 mg/kg/day). 	
	Welfare	2/2 = Low	2/2 = Low	2/2 = Low	<p>Australian GHS hazardous substances classification codes on all reviewed SDSs for health and environmental hazards include:</p> <ul style="list-style-type: none"> Health: Acute Toxicity Oral Category 3, Acute Toxicity Oral Category 4, Acute Toxicity Dermal Category 3, Skin Corrosion /Irritation - Category 2, Serious Eye Damage/Eye Irritation - Category 2B Acute Toxicity Inhalation Category 3, Specific Target Organ toxicity - repeated exposure Category 1, H301: Toxic if swallowed, H302: Harmful if swallowed, H311: Toxic in contact with skin, H315: Causes skin irritation, H320: Causes eye irritation, H331: Toxic if inhaled, H372: Causes damage to organs through prolonged or repeated exposure. Environmental: Hazardous to aquatic environment Short term/Chronic Category 1, H410: Very toxic to aquatic life with long lasting effects. Note: Australian SDSs are often not consistent in their listing of hazard classifications. Refer to safe work Australia's summary tables https://www.safeworkaustralia.gov.au/system/files/documents/1702/classification_and_labelling_workplace_hazardous_chemicals_poster_-a4.pdf <p>NZ hazardous substances classification codes for health and environmental hazards taken from the NZ EPA CCID database:</p> <ul style="list-style-type: none"> Health: 6.1D (All), 6.4A, 6.9A (All), Environment: 9.1A (All), 9.3B, 9.4A <p>Refer to health and other social exposure elements as that can also influence welfare too.</p>	

	List of values	HHP Hazards ³ • Acute toxicity mammals and birds	Assessment of Other potential risks – Pre-controls ^{1,2}	Assessment of Other potential risks - Post mitigation controls ^{1,2}	Descriptor of why / why not a risk ²	Mitigation strategies defined to minimise risk
Social	Food and water	2/2 = Low	2/2 = Low	2/2 = Low	The risk to food and water is likely low from forestry treatments. The application method and the approximate 10mg/ha application rate for the targeted wasp nests limits risks to food and water. <ul style="list-style-type: none"> Fipronil is used on a wide variety of commercial crops including bananas, brassicas, cotton, wine grapevines, potatoes, mushrooms, pasture, potatoes, sorghum and sugarcane. Eliminate the potential risk of accidental or ongoing oral ingestion by pesticide workers with poor on-the-job personal hygiene around food and drink. 	<p>Refer to Appendix 1: ‘Generic Mitigation and Monitoring Measures for Herbicides, Fungicides, Vertebrate Toxins, and Insecticides’.</p> <p>The Appendix describes the mitigation requirements to minimise risk from the exposure variables.</p> <p>Although Appendix 1’s mitigation measures should significantly reduce pre-control risks, not all risk can be eliminated as seen in the post-mitigation controls column. Depending on the residual risk, some sites may require more stringent versions of individual mitigation measures than those in Appendix 1. Also, in some situations, additional company mitigation measures may need to be included.</p>
	Social infrastructure (schools and hospitals, recreational infrastructure, infrastructure adjacent to the management unit)	1/1 = Low	1/1 = Low	1/1 = Low	The risk to social infrastructure is likely low if the treatment area is well within the forest and away from in-forest or adjoining infrastructure. However, one of the purposes of applying Fipronil is to reduce wasp impact on health and safety, and general nuisance, in high visitor or tourism areas. <ul style="list-style-type: none"> A survey for the 2016 Fipronil derogation application highlighted respondents concerns over the insecticide. Survey respondents predominantly disagreed (56%) with the use of Fipronil as provided in the draft derogation applications, with 30% agreeing with its use. Also, stakeholders did not accept that there was a real need to use Fipronil to protect trees (53% disagreed), or to control European wasps and grasshoppers (56% disagreed). Stakeholders were highly concerned about the sufficiency of control measures given the potential impacts of the pesticide on non-target species, with 64% disagreeing that control measures detailed in the draft derogations were sufficient. 	
	Economic viability (agriculture, livestock, tourism)	1/1 = Low	1/1 = Low	1/1 = Low	Low risk to economic viability. Treatment method is low intensity, and bait housed within cages. There is low risk of the insecticide being applied outside of the treatment area. Fipronil will likely improve tourism. One of the purposes of applying Fipronil is to reduce wasp impact on health and safety, and general nuisance, in tourism areas.	
	Rights (legal and customary)	Na	1/1 = Low	1/1 = Low	Risks to rights are likely to be low. It is unlikely that additional restrictions will be placed in operational or high visitor/tourism areas post-application.	
	Other	----	----	----	----	
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1 = The risk profile is only for the pesticide listed in the table. Often other pesticides are added to improve treatment efficacy or solubility. Also, risk will vary between sites, methods and scale and intensity of the treatment.

2 = It is recommended to take a precautionous approach. New research may bring to light risks that were not identified in previous assessments. Current research is not exhaustive, is often agricultural-based from northern hemisphere studies, and the effects on some exposure variables are not known or fully understood. **Also, between SDS's there can be conflicting data, variation in both amount and quality of information, and differing judgements of risks. Some SDSs are more current than others. Therefore, consider reviewing SDS's of similar pesticide products.**

3 = Post mitigation risks

ESRA Glufosinate-ammonium (and surfactant 1-Methoxy-2-propanol)

This template follows a similar format to that of Annex 2 within the FSC Pesticides Policy FSC-POL-30-001 V3-0 EN. Therefore, it may be used by SDGs and Organisations in their Environmental and Social Risk Assessment (ESRA), and by certification bodies as a checklist to assess conformance with the minimum requirements for ESRA.

Date	May 2020
Proposed chemical pesticide	Products containing Glufosinate-ammonium
Pesticide type	Herbicide
CAS number(s)	77182-82-2 Glufosinate-ammonium 107-98-2: 1-Methoxy-2-propanol (Monopropylene glycol methyl ether), a surfactant/stabiliser
Common trade name(s) (Listed brand names may have different formulations including combinations with other chemical pesticides)	Numerous trade names. Available as a soluble concentrate (SC). Names include: <ul style="list-style-type: none"> • AGPRO Glufosinate 200 • Apparent Weedshot 200 • BASF Basta SL 200 • Bayer Finale (UK) • Farmalinx Commando 200 • FMC Glusta 200 • GENFARM GLUFOSINATE 200 • Imtrade Cease • Titan Glufosinate 200 • ThermoFisher Scientific 1-Methoxy-2-propanol (USA) <p>Refer to the APVMA PubCRIS database for the full list of registered products in Australia with this active ingredient.</p>
FSC pesticide classification (prohibited HHP, highly restricted HHP, restricted HHP, or other chemical pesticide)	Restricted HHP (Reproductive or probable reproductive toxicant)
Purpose of use (protection of vegetation, human health, native species, seeds or seedlings, weed control, others)	Pre-plant weed control. Used for pine wilding control (often southern pine species) in second or subsequent rotations and also used for firebreak maintenance in Western Australia. May also be used on Glyphosate-resistant weeds.
Location where used (forest, office, fire store, nursery)	Forest.
Application method (hand, ground machine, aerial)	All methods including aerial, ground based boom, handgun, and knapsack.
Scale and intensity of use	Variable. Dependent on the size of the operational area and method of application.
Alternatives considered (burning, mechanical land prep, hand, mechanical releasing, oversowing,	A wide range of alternatives has been considered consistent with Criterion 10.7 of FSC-STD-01-001 V5-2 FSC Principles and Criteria.

grazing, weed mats, biological control, alternative chemicals)	Further information on alternatives is within the IPM.
Pesticide used individually or in conjunction with other pesticide(s)	<ul style="list-style-type: none"> • Can be used in conjunction with Glyphosate and Metsulfuron methyl for broader weed control. • Always check the product label, and if there are other pesticide additives, consult their ESRA's too. • Risks will likely increase with additional herbicide products, especially those known to have effects on the soil, water, air and aquatic or terrestrial life. Little is known about potential compounding risks of mixes, as risk assessments are generally made on individual active ingredients.
Reference documents	<ul style="list-style-type: none"> • Integrated Pest Management document • FSC Pesticides Policy FSC-POL-30-001 V3-0 EN • FSC Lists of highly hazardous pesticides FSC-POL-30-001a V3-0 EN D2-0 • SDS AGPRO Glufosinate 200 • SDS Apparent Weedshot 200 • SDS BASF Basta SL 200 • SDS Bayer Finale (UK) • SDS Farmalinx Commando 200 • SDS FMC Glusta 200 • SDS GENFARM GLUFOSINATE 200 • SDS Imtrade Cease • SDS Titan Glufosinate 200 • SDS ThermoFisher Scientific 1-Methoxy-2-propanol (USA) • Pesticide properties database http://sitem.herts.ac.uk/ • APVMA website including the PubCRIS database https://portal.apvma.gov.au/pubcris • NZ EPA website including the Chemical Classification and Information Database (CCID) https://www.epa.govt.nz/database-search/chemical-classification-and-information-database-ccid/ • Herbiguide herbiguide.com.au/InformationHerbicides.aspx • US National Center for Biotechnology Information's website PubChem database https://pubchem.ncbi.nlm.nih.gov/compound/Glufosinate-ammonium • PAN Pesticides Database http://pesticideinformation.org/Search_Chemicals.jsp • Glufosinate application for a temporary derogation to use a 'highly hazardous' pesticide (undated) • G. Wolterink, C.M. Mahieu and L. Davies, JMPR report 'GLUFOSINATE-AMMONIUM 547–652 JMPR 2012'
Note	<ul style="list-style-type: none"> • Glufosinate-ammonium products generally use 1-Methoxy-2-propanol, a surfactant/stabiliser. Some SDSs list a 'secret' additive. • 1-Methoxy-2-propanol's properties are often data deficient but are also listed where available.

Risk profiling

The risk matrix below helps frame the level of risk for each ESRA exposure variable, and to also assist in comparing risk between the ESRAs of different chemical pesticides. A score assessed as 3/2 means the likelihood is 'possible' and the consequence of the event 'minor'.

		LIKELIHOOD					
		1 - Negligible	2 - Unlikely	3 - Possible	4 - Likely	5 - Almost Certain	6 - Certain
CONSEQUENCE	6 - Catastrophic	Medium	High	Extreme	Extreme	Extreme	Extreme
	5 - Extreme	Medium	Medium	High	High	Extreme	Extreme
	4 - Major	Low	Medium	Medium	High	High	Extreme
	3 - Moderate	Low	Low	Medium	Medium	High	High
	2 - Minor	Low	Low	Low	Low	Medium	Medium
	1 - Insignificant	Low	Low	Low	Low	Low	Medium

The risk for some attributes will change between pre-control assessment risk and post-mitigation control risk (residual risk), after initiating the mitigation control measures within the ESRA.

Exposure	List of values	HHP Hazards ³ (Reproductive or probable reproductive toxicant) ⁴	Assessment of Other potential risks – Pre-controls ^{1, 2}	Assessment of Other potential risks - Post mitigation controls ^{1, 2}	Descriptor of why / why not a risk ^{2,3}	Mitigation strategies defined to minimise risk
Environmental	Soil (erosion, degradation, biota, carbon storage)	Na	3/3 = Medium	3/2 = Low	<p>Risk levels to soil vary. Risks include:</p> <ul style="list-style-type: none"> Slightly mobile to high mobility in soil (K_{oc} 2.3-600 ml/g). It has high water solubility (500000-1370000 mg/L). Methoxy-2-propanol: Likely mobile due to its water solubility. Non-persistent in soil (DT50 6-20 days). Half-life aerobic and anaerobic in the soil is typically 8-20. Anaerobic soil half-life is 37 days. Degradation is mostly by rapid microbial action to its metabolites then ultimately to carbon dioxide. Factors affecting these include temperature, rainfall, and soil type. Glufosinate-ammonium rarely migrates below 10-15 cm but will migrate through the soil with low biological activity, especially in a high rainfall environment. Methoxy-2-propanol: Data deficient. Bioaccumulation potential is low based on LogP (PPDB) and an estimated BCF (PubChem) (BCF 3.2, LogP = -4.01 (low). Some SDSs state 'Does not accumulate.' Methoxy-2-propanol: Data deficient. Two major metabolites, 3-methyl-phosphinico-propionic acid (MPP) and 2-methylphosphinico-acetic acid (MPA): <ul style="list-style-type: none"> MPP (no CAS#): Data deficient, however, it is non-persistent in soil but degrades slowly in water and is stable in water-sediment (DT50 150 days for both). It has low aquatic toxicity for fish, invertebrates and plants. Data are deficient on mammalian toxicity. MPA (no CAS#): Data deficient, however, it is non-persistent in soil. Data are deficient on the breakdown in water. It has low - moderate aquatic toxicity for fish (moderate), invertebrates and plants (low). It has moderate acute toxicity to earthworms. Data are deficient on mammalian toxicity. Potential increased erosion due to vegetation dieback. Risk increases with scale and intensity, especially in the erosion-prone hill country where infrastructure and slopes near waterways are prone to surface erosion. However, the risks reduce if oversown or hydro seeded cut/fill batters are not sprayed. 	<p>Refer to Appendix 1: 'Generic Mitigation and Monitoring Measures for Herbicides, Fungicides, Vertebrate Toxins, and Insecticides'.</p> <p>The Appendix describes the mitigation requirements to minimise risk from the exposure variables.</p> <p>Although Appendix 1's mitigation measures should significantly reduce pre-control risks, not all risk can be eliminated as seen in the post-mitigation controls column. Depending on the residual risk, some sites may require more stringent versions of individual mitigation measures than those in Appendix 1. Also, in some situations, additional company mitigation measures may need to be included.</p> <p>The Appendix also describes mitigation measures for other pesticides that may be used in conjunction with the product to improve the efficacy of the treatment.</p>
	Water (groundwater, surface water, water supplies)	Na	3/3 = Medium	2/2 = Low	<p>Risk levels to water vary and include:</p> <ul style="list-style-type: none"> Entering water. There are three pathways to enter water: directly into waterways from the spray, overland flow from rain, and via the soil to groundwater. <ul style="list-style-type: none"> Low to high risk of migration into water sources via all three routes. This depends on its mobility within a specific soil as these are widely variable. Methoxy-2-propanol: Data deficient but likely a risk due to its water solubility. Low leachability (GUS leaching potential index, 1.03) to potential leachability (PAN). This is due to the variation in mobility. However, field tests indicate that it seldom migrates below 10-15cm depth. Risks when in water: <ul style="list-style-type: none"> Hazard classed as very ecotoxic to aquatic life (NZ). Low persistence in water and sediment tests (DT50 vary significantly (water-sediment) 24.5 days, (DT50 (water phase) 7 days). Rapidly degraded in surface levels of water because it is biodegradable. In hydrolysis tests, it is persistent in water (DT50 (pH 7) (sterile water, no light) >386 days) and stable in light (sterile water). Glufosinate-ammonium is expected to have low to high adsorption to suspended solids and sediment based upon the Koc. The risk profile to water increases with: <ul style="list-style-type: none"> Site factors that increase the potential for surface runoff, e.g. steep slopes, poorly draining soils and soils with shallow groundwater. Site factors that increase the potential of leaching to groundwater, e.g. sites with permeable soils with shallow water tables. Poor product application, e.g. spraying before heavy rain, direct spray or drift over water, or locating storage or load zones that increase the risk to water from accidental spillage. 	
	Atmosphere (air quality, greenhouse gases)	Na	1/1 = Low	1/1 = Low	The risk to the atmosphere is low. Risks vary and include the application method, scale and intensity, location relative to adjoining properties, and weather conditions. Aerial spraying has a potentially higher risk as it will result in having pesticide in the air over the application area until the spray settles.	
	Non-target species (vegetation, wildlife, bees and other pollinators, pets)	<p>Fish 3/3 = Medium Aquatic organisms 3/3 = Medium Bees 2/2 = Low Birds 2/2 = Low Vegetation 4/4 = High Soil organisms 3/2 = low</p>	<p>Fish 3/3 = Medium Aquatic organisms 3/3 = Medium Bees 2/2 = Low Birds 2/2 = Low Vegetation 4/4 = High Soil organisms 3/2 = low</p>	<p>Fish 2/2 = Low Aquatic organisms 2/2 = Low Bees 2/2 = Low Birds 2/2 = Low Vegetation 2/2 = Low Soil organisms 3/2 = low</p>	<p>Aquatic and terrestrial risks vary depending on non-target species:</p> <ul style="list-style-type: none"> Aquatic: <ul style="list-style-type: none"> Hazard classed as 9.1B (A) and 9.1C (C): Very ecotoxic in the aquatic environment and harmful in the aquatic environment (NZ). NZ EPA used daphnia (15mg/L), and flathead minnow (13.1 mg/L) and common duckweed (1.47), all moderate, for its hazard classifications. Low acute toxicity to fish (LC50 (96hr) (rainbow trout) 34-710 mg/L, (carp) >1000 mg/L, LC50 (96hr) (Bluegill sunfish) >1000 mg/L). 1-Methoxy-2-propanol: Low to moderate acute toxicity (LC50 (96hr) (Orfe) 4600-10000 mg/L, (fathead minnow) 13-21 mg/L)). Low <i>chronic</i> toxicity for fish (NOEC (rainbow trout) (21 days) 100 mg/L). Low to moderate acute toxicity to aquatic invertebrates depending on the source (LC50 (48 hrs) (Daphnia) 15 - 560 - 1000 mg/L). Moderate acute toxicity to aquatic crustaceans (LC50 (96 hrs) (opossum shrimp) 7.5 mg/kg). Low <i>chronic</i> toxicity for aquatic invertebrates (NOEC (Daphnia) (21 days) 18 mg/L)). No risk assessment data for sediment-dwelling organisms Low acute toxicity to aquatic algae (EC50 (72hr) (<i>Scenedesmus quadricauda</i>) 46.5 mg/L, (<i>Desmodesmus subspicatus</i>) 36 mg/L, (<i>Scenedesmus subspicatus</i>) >1000 mg/L). Moderate acute toxicity to aquatic plants (EC50 (96 hrs) (common duckweed) 1.47 mg/L). 	

	List of values	HHP Hazards (Reproductive or probable reproductive toxicant)*	Assessment of Other potential risks – Pre-controls ^{1, 2}	Assessment of Other potential risks - Post mitigation controls ^{1, 2}	Descriptor of why / why not a risk ^{2,3}	Mitigation strategies defined to minimise risk
Environmental	Non-target species (vegetation, wildlife, bees and other pollinators, pets)	See above	See above	See above	<ul style="list-style-type: none"> Terrestrial: <ul style="list-style-type: none"> Will severely affects non-target vegetation. Potential risks to mammals, see the health section. Low acute toxicity for earthworms (LC50 (7 day) (earthworm) >1000 mg/kg). Low acute toxicity to birds (LD50 (mallard duck) >2000 mg/kg, (Japanese quail) >2000 mg/kg). Non-toxic to low acute toxicity to bees (LD50 (contact and oral acute) (worst case up to 72hr) >345ug/bee). 	Refer to Appendix 1: 'Generic Mitigation and Monitoring Measures for Herbicides, Fungicides, Vertebrate Toxins, and Insecticides'.
	Non-timber forest products (as FSC-STD-01-001 V5-2 FSC principles and criteria, criterion 5.1)	Na	2/2 = Low	2/2 = Low	Glufosinate-ammonium is applied to bare land so risks to under the canopy, non-timber products aren't applicable. Other non-timber risks are covered in economic viability and food and water sections.	
	High conservation values (particularly HCV 1-4)	1/1 = Low to 2/2 = Low	1/1 = Low to 4/5 = High	1/1 = Low to 2/2 = Low	The risk of Glufosinate-ammonium to high conservation values in some situations could be extreme. Poor application adjoining or near a high conservation value area will compound the risk. Glufosinate is a non-selective herbicide.	
	Landscape (aesthetics, cumulative impacts)	Na	Small scale 1/1 = low Large aerial 6/3 = High	Small scale 1/1 = low Large aerial 4/3 = Medium	The risk to landscape increases with scale and intensity. Large operational areas may significantly impact aesthetics. This could depend on the location of the treatment area and public sentiment. For example, treatment size, visibility, proximity to and type/sensitivity of neighbours, impact on public recreation, perceived impact on nearby parks, forest, or spray sensitive land users like orchards or organic farming.	
	Ecosystem services (water, soil, carbon sequestration, tourism)	Na	2/2 = Low	2/2 = Low	Risks to ecosystem services are likely low after mitigation measures are in place. Refer to the water, soil, atmosphere and non-target species exposure variable assessments. However, specific circumstances may raise the risk profile. For example, if the treatment area was part of a municipal water catchment zone.	
Social	High conservation values (especially HCV 5-6)	2/2 = Low	2/2 = Low	2/2 = Low	The risk is likely to be low in most situations.	<p>The Appendix describes the mitigation requirements to minimise risk from the exposure variables.</p> <p>Although Appendix 1's mitigation measures should significantly reduce pre-control risks, not all risk can be eliminated as seen in the post-mitigation controls column. Depending on the residual risk, some sites may require more stringent versions of individual mitigation measures than those in Appendix 1. Also, in some situations, additional company mitigation measures may need to be included.</p> <p>The Appendix also describes mitigation measures for other pesticides that may be used in conjunction with the product to improve the efficacy of the treatment.</p>
	Health (fertility, reproductive health, respiratory health, dermatologic, neurological and gastrointestinal problems, cancer and hormone imbalance)	2/2 = Low	3/3 = Medium	2/2 = Low	<p>Risks to human health from Glufosinate-ammonium are likely to be low when used according to label, SDS and good practice:</p> <ul style="list-style-type: none"> The following are oral, dermal or inhalation toxicity risks: <ul style="list-style-type: none"> Classed as 9.3B: Ecotoxic to terrestrial vertebrates (NZ). Low to moderate acute oral toxicity (LD50 (rat) 1910-2170 mg/kg, (LD50 (mouse) 416 mg/kg). High toxicity based on Short term dietary studies (NOEL) (rat) 64 mg/kg). Classed as H302: Harmful if swallowed (Aust) and 6.1D: acutely toxic (oral) (NZ). If ingested in large enough volume it will kill humans as evidenced in suicides. The fatality rate in reported poisonings is about 18%. Symptoms include vomiting, diarrhoea, abdominal cramps, tremors, hypotension (low blood pressure), muscular spasms, unconsciousness, coma, convulsions, respiratory failure, nausea, Symptoms may be delayed for several hours. It is not clear whether the toxicity is due to the active ingredient, to the surfactant contained in relatively high amounts in the formulation or to the combination of both. 1-Methoxy-2-propanol: Low acute risk (LD50 (rat) 5710 mg/kg). Low acute dermally toxicity for Glufosinate-ammonium (LD50 (rat) 1400 mg/Kg, LC50 (rabbit) >2000 mg/kg). Classed as H312: Harmful in contact with skin (Aust) and 6.1D: acutely toxic (dermal)(NZ). Data deficient for health effects associated with long term skin exposure. 1-Methoxy-2-propanol: Low acute risk (LD50 (rat) 5660 mg/kg). Low acute inhalation toxicity (LC50 (Rat) (4 hr) (nose only) 1.26 – 4.4 mg/L). H332: Harmful if inhaled (Aust) and 6.1D: acutely toxic (inhalation) (NZ). Data deficient for health effects associated with long term inhalation. 1-Methoxy-2-propanol: Data deficient. Classed as H319: Causes serious eye irritation (Aust) and 6.4A: irritating to eyes. Carcinogenicity, mutagenicity, teratogenicity, reproduction, and endocrine risks: <ul style="list-style-type: none"> Carcinogenicity: Not listed as an IARC, NTP or SWA carcinogen. Glufosinate-ammonium was not carcinogenic in lifetime feeding studies in rats and mice. No evidence for genotoxicity was observed in any test (JMPR). 1-Methoxy-2-propanol: Not listed in databases. Mutagenicity: Glufosinate-ammonium was not mutagenic or genotoxic in a battery of in vitro and in vivo tests. Teratogenicity: Likely to cause teratogenicity. In animal studies, Glufosinate-ammonium caused malformations/developmental toxicity typically at doses that were toxic to the parental animals. In some studies, sub-lethal doses of Glufosinate-ammonium was found to cause abnormalities mammal embryos development both in vitro and in vivo. Data are deficient. 1-Methoxy-2-propanol: Data deficient. Reproduction or reproductive toxicity: Possibly, to likely, be a reproductive toxin, depending on the source. FSC restricted HHP classification is based on EU GHS classification as a reproductive toxicant and a probable reproductive toxicant (1A and 1B). Classed in Australia as Reproductive Toxicity - Category 1 or 1B (fertility and unborn child), H360: May damage fertility or the unborn child. Classed in NZ as 6.8B: Suspected human reproductive or developmental toxicants based on rat studies. However, Glufosinate-ammonium is not listed on the US TRI reproductive toxin database. Glufosinate-ammonium impaired fertility in laboratory animals. Implantation loss occurred in a rat multigeneration study. There were no effects on male fertility. Deformities in the brain were also found. In a mouse study, embryos exposed to Glufosinate-ammonium in vitro developed apoptosis (fragmentation of the cells leading to cell death) in the neuroepithelium of the brain. An earlier study found that all the embryos in the treated groups had specific defects including overall growth retardation, increased death of embryos, hypoplasia (incomplete development) of the forebrain at 10 mg/mL, and cleft lips at 20 mg/L. In a rat study, the results suggested that Glufosinate-ammonium exposure at a crucial stage in pregnancy causes a decrease in the number of glutamate receptors in offspring. 1-Methoxy-2-propanol: Contains ingredients that are suspected reproductive hazard. Data are deficient in developmental effects. 	

	List of values	HHP Hazards (Reproductive or probable reproductive toxicant) ⁴	Assessment of Other potential risks – Pre-controls ^{1, 2}	Assessment of Other potential risks - Post mitigation controls ^{1, 2}	Descriptor of why / why not a risk ^{2,3}	Mitigation strategies defined to minimise risk
Social	Health (fertility, reproductive health, respiratory health, dermatologic, neurological and gastrointestinal problems, cancer and hormone imbalance)	See above	See above	See above	<ul style="list-style-type: none"> Endocrine disruption potential: Not listed on the EU list. Data are deficient. 1-Methoxy-2-propanol: Data deficient. Specific Target Organ Systemic Toxicity (Single Exposure): <ul style="list-style-type: none"> Data are deficient. 1-Methoxy-2-propanol: Data toxicity to the central nervous system (CNS) and respiratory system. Chronic toxicity: <ul style="list-style-type: none"> Classed as 6.9A: Toxic to human target organs or systems (NZ). Prolonged or repeated exposure may cause neurological disturbances. Glufosinate-ammonium caused neurobehavioral effects or neuropathological changes in animal studies. Glufosinate-ammonium was well tolerated in rats and mice but less well tolerated in the dog in sub chronic studies. NZ EPA classification was for kidney toxicity. A rat study found an increase in absolute and relative kidney weights in males. <p>The Australian Acceptable Daily Intake (ADI) for Glufosinate for a human is 0.02 mg/kg/day, (some SDSs are different) set for the public for daily, lifetime exposure (based on the NOEL of 2.1 mg/kg/day).</p>	<p>Refer to Appendix 1: 'Generic Mitigation and Monitoring Measures for Herbicides, Fungicides, Vertebrate Toxins, and Insecticides'.</p> <p>The Appendix describes the mitigation requirements to minimise risk from the exposure variables.</p> <p>Although Appendix 1's mitigation measures should significantly reduce pre-control risks, not all risk can be eliminated as seen in the post-mitigation controls column. Depending on the residual risk, some sites may require more stringent versions of individual mitigation measures than those in Appendix 1. Also, in some situations, additional company mitigation measures may need to be included.</p> <p>The Appendix also describes mitigation measures for other pesticides that may be used in conjunction with the product to improve the efficacy of the treatment.</p>
	Welfare	2/2 = Low	3/3 = Medium	2/2 = Low	<p>Australian GHS hazardous substances classification codes on all reviewed SDSs for health and environmental hazards include:</p> <ul style="list-style-type: none"> Acute Toxicity Oral - Category 4, Acute Toxicity Dermal - Category 4, Serious Eye irritation - Category 2/2A, Acute Toxicity Inhalation - Category 4, Reproductive Toxicity - Category 1 or 1B (fertility and unborn child) or 2, Specific Target Organ Toxicity - Repeated Exposure - Category 2, H302: Harmful if swallowed, H312: Harmful in contact with skin, H319: Causes serious eye irritation, H332: Harmful if inhaled, H360/361: May (suspected) damage fertility or the unborn child, H373: May cause damage to organs through prolonged or repeated exposure. Note: Australian SDSs are not consistent in their listing of hazard classifications. <ul style="list-style-type: none"> Refer to safe work Australia's summary tables https://www.safeworkaustralia.gov.au/system/files/documents/1702/classification_and_labelling_workplace_hazardous_chemicals_poster_a4.pdf <p>NZ hazardous substances classification codes for health and environmental hazards taken from the NZ EPA CCID database:</p> <ul style="list-style-type: none"> Health: 6.1D (All), 6.1D (O), 6.1D (D), 6.1D (I), 6.4A, 6.8B, 6.9A (All), 6.9A (O). 1-Methoxy-2-propanol: 3.1C, 6.1E: may be harmful, aspirational hazard, 6.3B: mildly irritating to the skin, 6.4A: irritating to the eyes. Environment: 9.1B (All), 9.1B (A), 9.1C (F), 9.1C (C), 9.2A, 9.3B. 1-Methoxy-2-propanol: none. Note: NZ SDSs may have some, all, or additional hazard classifications. Refer to NZ EPA for definitions of hazardous substances classification codes https://www.epa.govt.nz/industry-areas/hazardous-substances/rules-for-hazardous-substances/hazardous-substances-classification-codes/ <p>Refer to health and other social exposure elements as that can also influence welfare.</p>	
	Food and water	2/2 = Low	3/3 = Medium	2/2 = Low	The risk to food and water is likely low. In forestry applications, it is unlikely to impact community water supplies. Glufosinate-ammonium is widely used in food-producing primary sectors like cropping, orchards (bananas, kiwis, mango, pineapple, citrus, olives, stonefruits), vineyards and berry crops (strawberries, cane berries), tomatoes, sugarcane. It is also used to maintain fallow land and in agriculture. Eliminate the potential risk of accidental or ongoing oral ingestion of Glufosinate-ammonium by pesticide workers with poor on-the-job personal hygiene around food and drink.	
	Social infrastructure (schools and hospitals, recreational infrastructure, infrastructure adjacent to the management unit)	3/2 = Low	1/1 = Low to 3/5 = High	1/1 = Low to 3/2 = Low	The risk to social infrastructure is likely low if the treatment area is well within the forest and away from in-forest or adjoining infrastructure. Risks increase with scale and intensity. For example, if the operation is on a boundary close to infrastructure or where there are in-forest rights. However, access and recreation would likely be restricted only during the operation.	
	Economic viability (agriculture, livestock, tourism)	1/1 = Low to 3/3 = Medium	1/1 = Low to 3/5 = High	1/1 = Low to 3/3 = Medium	The risk to economic viability is likely low if the treatment area is well within the forest. Risk increases with scale, intensity and operational complexity, especially if the operation is on a boundary. For example, an aerial overspray or leaching could have an economic impact on adjoining agriculture, aquaculture or horticulture, leading to costly compensation or legal action. Organics are especially vulnerable.	
	Rights (legal and customary)	Na	2/2 = Low	2/2 = Low	Risks to rights are likely to be low. Also, operational areas will likely be closed off to those with rights only during the operation, e.g. utility companies or those with road access easements.	
	Other	----	----	----	----	
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1 = The risk profile is only for the chemicals listed in the table. Often other pesticides are added to improve treatment efficacy or solubility. Also, risk will vary between sites, methods and scale and intensity of the treatment.

2 = It is recommended to take a precautionous approach. New research may bring to light risks that were not identified in previous assessments. Current research is not exhaustive, is often agricultural-based from northern hemisphere studies, and the effects on some exposure variables are not known or fully understood. **Also, between SDS's there can be conflicting data, variation in both amount and quality of information, and differing judgements of risks. Some SDSs are more current than others. Therefore, consider reviewing SDS's of similar pesticide products.**

3 = The product has not been tested. The properties of Glufosinate-ammonium are listed above. The surfactant's properties are often data deficient. Where they are known they have been listed.

4= Post control generic risks.

Environmental and Social Risk Assessment (ESRA) for Glyphosate

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FSC's 2019 Pesticide Policy – A Change in Approach

The FSC in August 2019 introduced a new pesticide policy. It incorporates a risk-based approach that considers not only the hazard of the active ingredient but also how the chemical pesticide is used. The new method requires companies to complete an Environmental and Social Risk Assessment (ESRA) rather than apply for a derogation. This is explained fully in the pesticide policy and the annexe.

Risk-based assessment is a significant shift from the previous pesticide policy that followed a hazard approach which identified chemical pesticides with high toxicity and prohibited their use unless the FSC Board of Directors granted a temporary derogation for their use. Derogations were for up to 5 years, and the FSC determined the conditions of their use.

If our company wants to use an HHP pesticide and it does not have an existing derogation, or the derogation is no longer valid, then we need to do an Environmental and Social Risk assessment (ESRA).

What is an ESRA?

FSC describes an ESRA as 'a process to predict, assess and review the likely or actual environmental and social effects of a well-defined action, evaluate alternatives, and design appropriate mitigation, management and monitoring measures. In the context of the FSC Pesticide Policy, it relates to chemical pesticide use.'

An ESRA contains these main steps:

- Identify the lowest risk option to control a pest, weed or disease, the conditions for its use and the generic mitigation and monitoring measures to minimise the risks
- Consider the approved list of hazards, exposure elements and exposure variables

- Select the option that demonstrates the least social and environmental damages, more effectiveness and equal or greater social and environmental benefits
- Before applying any chemical pesticide, incorporate the results of the ESRA to site operational plans, to identify site-specific risks
- Use of HHP according to approved methods
- Make the ESRAs and incorporation to the operational plans available to affected stakeholders upon request.

An ESRA has significant advantages over a derogation because the outcome of the process is determined locally and not at FSC in Germany, and once completed and approved by the auditors and the FSC National Standards Development Group it doesn't have an expiry date. However, our effort still needs to be directed at finding non-chemical methods or those that are better for the environment.

FSC's transition from Derogations to Environmental and Social Risk Assessments (ESRAs)

Many commonly used forestry pesticides currently have derogations. The new policy means that no new derogations applications will be processed. Existing approved derogations and their conditions will remain valid until their expiry date or until national HHP indicators become effective and replace the derogations.

This means that if companies need to use an FSC restricted HHP that there isn't a valid derogation for its use, companies will need to meet the new policy and conduct an environmental and social risk assessment (ESRA).

Glyphosate is Now One of FSC's Highly Hazardous Pesticides

FSC has revised the list of Highly Hazardous Pesticides (HHP). Glyphosate wasn't previously on the list, but now it is. FSC classified it as a probable carcinogen. Although not all experts agree with this rating, it is wise to be cautious about any chemical used, and besides FSC requires us to follow their rules.

ESRA Part A: Hazards and Exposure Elements Table

The first step is to understand how glyphosate creates hazards to the environment or to our lives. These are called exposure elements. The following table helps determine the type and level of risk so we use the correct mitigation measures.

Table 1: Identification and Assessment of Risk With Mitigation Strategies

Exposure elements	List of values	Hazard groups and types of hazards ^{1,2}									Descriptor of why / why not a risk ³	Mitigation strategies dzefined to minimise risk ⁴
		Acute toxicity		Chronic toxicity				Environmental toxicity				
		Toxic by contact or ingestion	Toxic by inhalation	Carcinogenicity	Mutagenicity to mammals	Developmental and reproductive toxicity	Endocrine disruptor	Acute toxicity to aquatic organisms	Persistence in soil and water	Biomagnification - bioaccumulation		
Environmental	Soil erosion and degradation	Na	Na	Na	Na	Na	Na	Low	Low	Na	Weight of evidence indicates there is a low risk of glyphosate affecting erosion if used according to the label and good practice standards. An area of risk is where road cuts and fills are sprayed and re-vegetation measures established at construction are killed off, especially those on recently constructed roads and landings in the erosion-prone hill country. Until glyphosate salts break down, rain-triggered erosion could elevate levels of glyphosate bound sediment if it got into water bodies.	Meet the requirements of the generic mitigation and monitoring measures section of the ESRA. Pay attention to the timing of the operation. Evaluate both short term weather to ensure the pesticide is absorbed in the vegetation and not washed off by rain or dew and that the longer-term forecast does not identify events that could lead to erosion and sediment from the application site. Generic mitigation strategies are within the mitigation section of the ESRA.
	Soil carbon storage	Na	Na	Na	Na	Na	Na	Na	Na	Na	There are no foreseen risks associated with soil carbon. Studies have generally reported minimal impacts on litter decomposition, soil microbial communities and soil microbial processes, factors that could impact soil carbon, from glyphosate applied under typical application rates in forests.	Weight of evidence indicates that there are no foreseen risks, so no mitigation strategies are anticipated.
	Soil biota	Low	Low	Unlikely	Unlikely	Unlikely	Unlikely	Low	Low	Unlikely	There is a low risk of glyphosate affecting soil biota. Studies have generally reported minimal impacts from glyphosate applied under typical application rates in forests, on litter decomposition, soil microbial communities and soil microbial processes. However, it is solely noted on the Australia/NZ SDS that ‘Microbial degradation is the major cause of loss from soil with the liberation of carbon dioxide.’ This may be the case in agricultural soils where the product is used seasonally and not once or twice in a rotation.	Meet the requirements of the generic mitigation and monitoring measures section of the ESRA. Focus on practice standards that help keep application rates at, or below, manufacturers label rates like timing for optimum pesticide effectiveness. Generic mitigation strategies are within the mitigation section of the ESRA.
	Water (groundwater, surface water, water supplies)	Na	Na	Unlikely	Unlikely	Unlikely	Unlikely	Low	Low	Unlikely	Weight of evidence indicates there is a low risk of glyphosate affecting water if used according to the label and good practice standards. The breakdown of glyphosate in forest floor litter and soils is generally rapid (litter: DT50 8 to 19 days; soil: DT50 5 to 40 days) and glyphosate is rarely detected below the upper 15 cm level of soils indicating that it is very unlikely to percolate down through forest soils and into groundwater. However, glyphosate can potentially enter freshwater either from direct spray or spray-drift or accidental spillage if storage or load zone is poorly located.	Many practice standards are involved around precision spraying around water. Some are listed below. Refer to the generic mitigation strategies within the mitigation section of the ESRA for additional ones. For example, ensure the pesticide gets applied solely to the application area and that run-off or sedimentation from rain is eliminated. Also, use operators with proven track records and methods that help keep application rates at, or below, manufacturers label. Also refer to the health and welfare, social and infrastructure sections below for additional mitigation.
	Atmosphere (air quality, greenhouse gases)	Na	Na	Na	Na	Na	Na	Na	Na	Na	Na	Glyphosate has no foreseen risks to the atmosphere. Aerial spraying will result in application area having pesticide in the air until the spray settles.

	List of values	Hazard groups and types of hazards ^{1,2}									Descriptor of why / why not a risk ³	Mitigation strategies defined to minimise risk ⁴
		Acute toxicity		Chronic toxicity				Environmental toxicity				
		Toxic by contact or ingestion	Toxic by inhalation	Carcinogenicity	Mutagenicity to mammals	Developmental and reproductive toxicity	Endocrine disruptor	Acute toxicity to aquatic organisms	Persistence in soil and water	Biomagnification - bioaccumulation		
	Non-target vegetation	High	Na	Na	Na	Unlikely	Na	Na	Na	Unlikely	Glyphosate is a non-target herbicide. Spray contact with non-target vegetation could be severely affected. This will depend on the amount of drift and the sensitivity of the species to glyphosate.	Meet the requirements of the generic mitigation and monitoring measures section of the ESRA. Non-target application of glyphosate is one of the largest potential risks when working next to neighbouring properties. Be particularly vigilant when aerially spraying especially around communication and timing of application. It is preferred practice to offset boundary spraying with a ground application if aerial spraying is intended for the block.
	Non-target terrestrial wildlife, bees and the other pollinators, pets	Low	Low	Unlikely	Unlikely	Unlikely	Unlikely	Na	Low	Unlikely	There is little information available on forest terrestrial fauna. However, they are potentially at risk through a direct spray, spray drift or wash-off following rainfall events, and uptake via inhalation and absorption. Amphibians are particularly vulnerable. Secondary exposure is also possible through the ingestion of flora and fauna food sources containing glyphosate residues. However, the indicators for toxicity are listed as ‘non-toxic’: honeybees (arthropods), duck and quail (birds), earthworms (soil organisms). Where there are hives in the forests, care will need to be taken especially in roadside spraying operations where clover or other flowering plants have been used in the oversowing blend.	Meet the requirements of the generic mitigation and monitoring measures section of the ESRA. Focus on practice standards that help keep application rates at, or below, manufacturers label rates like timing for optimum pesticide effectiveness.
	Non-target aquatic wildlife	Low	Na	Unlikely	Unlikely	Unlikely	Unlikely	Low	Low	Unlikely	Glyphosate is toxic to aquatic life with long-lasting effects. However, forest field studies indicate that the concentrations and duration of glyphosate typically measured, except for direct over-spraying of wetlands, were well below the standard toxicity endpoints for fish and other aquatic organisms. Some studies indicate that the surfactant added to glyphosate to improve efficacy could have significant impact to aquatic wildlife like frogs and tadpoles. Avoid or be highly selective of the surfactant.	Meet the requirements of the generic mitigation and monitoring measures section of the ESRA. The risk of glyphosate over-sprayed on waterways will significantly where there are incised gullies with low-order streams that are difficult to detect or avoid during aerial spray applications. Mitigation strategies include ensuring that the map and GPS coverage identifies all waterways and use droplet size that reduces drift.
	Non-timber forest products (as FSC-STD-01-001 V5-2 FSC principles and criteria, criterion 5.1)	Low	Na	Unlikely	Unlikely	Unlikely	Unlikely	Low	Low	Unlikely	Low risk as glyphosate is used regularly and extensively in food production. For specifics, if the non-timber product is a plant crop, refer to the risks within the non-target vegetation. If the non-timber product is aquatic, refer to the risks within non-target aquatic mitigation. If the non-timber product is terrestrial, refer to the non-target terrestrial risk section above.	If the non-timber product is a plant crop, refer to the requirements within the non-target vegetation. If the non-timber product is aquatic, refer to the non-target aquatic mitigation. If the non-timber product is terrestrial, refer to the non-target terrestrial section above.

	List of values	Hazard groups and types of hazards ^{1,2}									Descriptor of why / why not a risk ³	Mitigation strategies defined to minimise risk ⁴
		Acute toxicity		Chronic toxicity				Environmental toxicity				
		Toxic by contact or ingestion	Toxic by inhalation	Carcinogenicity	Mutagenicity to mammals	Developmental and reproductive toxicity	Endocrine disruptor	Acute toxicity to aquatic organisms	Persistence in soil and water	Biomagnification - bioaccumulation		
	Landscape (aesthetics, cumulative impacts)	Low	Low	Unlikely	Unlikely	Unlikely	Unlikely	Low	Low	Unlikely	The risk to landscape is low. However, the risk increases with scale and intensity. For example, large aerial sprayed areas could increase the hazard, especially if bordering neighbouring properties that could include state or national forest or parks.	Meet the requirements of the generic mitigation and monitoring measures section of the ESRA. Non-target application of glyphosate is one of the largest potential risks when working next to neighbouring properties. Be particularly vigilant when aerially spraying especially around communication and timing of application. It is preferred practice to offset boundary spraying with a ground application if aerial spraying is intended for the block.
	Ecosystem services (water, soil, carbon sequestration, tourism)	Na	Na	Unlikely	Unlikely	Unlikely	Unlikely	Low	Low	Unlikely	The risk is low; however, specific circumstances could increase risk. Refer to the individual risk sections for water, soil, carbon sequestration, and tourism.	Meet the requirements of the generic mitigation and monitoring measures section of the ESRA. Refer to the individual mitigation sections for water, soil, carbon sequestration, and tourism.

Exposure elements	List of values	Hazard groups and types of hazards ^{1,2}									Descriptor of why / why not a risk ³	Mitigation strategies defined to minimise risk ⁴
		Acute toxicity		Chronic toxicity				Environmental toxicity				
		Toxic by contact or ingestion	Toxic by inhalation	Carcinogenicity	Mutagenicity to mammals	Developmental and reproductive toxicity	Endocrine disruptor	Acute toxicity to aquatic organisms	Persistence in soil and water	Biomagnification - bioaccumulation		
Social	High conservation values (especially HCV 5-6)	Na	Na	Na	Na	Na	Na	Na	Na	Na	The risk is likely to be Not Applicable mitigation in an Australian/NZ context unless in a specific individual company situation. These will need to be addressed in the application-specific ESRA.	There is no need for mitigation in an Australian/NZ context unless in a specific individual company situation. These will need to be addressed in the application-specific ESRA.
	Health (fertility, reproductive health, respiratory health, dermatologic, neurological and gastrointestinal problems, cancer and hormone imbalance)	Low	Low	Unlikely	Unlikely	Unlikely	Unlikely	Low	Low	Unlikely	FSC categorises glyphosate as highly hazardous due to its potential as a carcinogen. However, the weight of evidence indicates that there are unlikely to be any health-related hazards if used according to the label and good practice standards. Most studies report that there is no, or unlikely carcinogenic or genotoxic risk to humans at anticipated exposures. Views aren’t consistent, for example, those of PAN.	Meet the requirements of the generic mitigation and monitoring measures section of the ESRA. Meeting high personal care, material handling and pesticide application standards and health check requirements are essential. Generic mitigation strategies are within the mitigation section of the ESRA. These include health-specific mitigations like ensuring the contractor has read and fully understood how to apply glyphosate and the Personal Protective Equipment (PPE) requirements for it, the health and safety and environmental emergency procedures are well understood, and all PPE is on-site, in good condition, and correctly used*
	Welfare	Low	Low	Unlikely	Unlikely	Unlikely	Unlikely	Low	Low	Unlikely	Welfare has been assessed the same as health since health (and happiness) are key components of welfare. Weight of evidence indicates that there is unlikely to be any health-related hazards if used according to the label and good practice standards. Most studies report that there is no, or unlikely carcinogenic or genotoxic risk to humans at anticipated exposures. Views aren’t consistent, for example, those of PAN.	Meet the requirements of the generic mitigation and monitoring measures section of the ESRA. Meeting high personal care, material handling and pesticide application standards and health check requirements are essential.
	Food and water	Low	Low	Unlikely	Unlikely	Unlikely	Unlikely	Low	Low	Unlikely	Weight of evidence indicates there is a low risk of glyphosate affecting food and water if used according to the label and good practice standards. An area of risk is through accidental or ongoing oral ingestion by pesticide workers on-the-job poor personal hygiene around food and drink. Also, poor application timing before heavy rain or direct spray over water may increase the likelihood of broader risk to water. Forest products have a much lower risk profile compared with normal food crops. Glyphosate in Aust/NZ has not been recorded in drinking water and food other than at factors of levels below what is considered unsafe.	Meet the requirements of the generic mitigation and monitoring measures section of the ESRA. Meeting high personal care, material handling and pesticide application standards and health check requirements are essential. Generic mitigation strategies are within the mitigation section of the ESRA.
	Social infrastructure (schools and hospitals, recreational infrastructure, infrastructure adjacent to the management unit)	Low	Low	Unlikely	Unlikely	Unlikely	Unlikely	Low	Low	Unlikely	Poor practice can lead to significant risks like spray drift killing crops and contaminating water contamination. Recreation could be impacted, see rights section below.	Meet the requirements of the generic mitigation and monitoring measures section of the ESRA which includes managing operations around adjacent properties and communication with potentially affected parties will mitigate risks. Take particular care and initiate additional operational conditions, if necessary, around water reservoirs, neighbours water intakes within the forest boundary, or around public forest recreational activities e.g. mountain bike tracks, or other potentially riskier sites.

	List of values	Hazard groups and types of hazards ^{1,2}								Descriptor of why / why not a risk ³	Mitigation strategies defined to minimise risk ⁴	
		Acute toxicity		Chronic toxicity			Environmental toxicity					
		Toxic by contact or ingestion	Toxic by inhalation	Carcinogenicity	Mutagenicity to mammals	Developmental and reproductive toxicity	Endocrine disruptor	Acute toxicity to aquatic organisms	Persistence in soil and water			Biomagnification - bioaccumulation
	Economic viability – other primary sector	Low - High	Low	Unlikely	Unlikely	Unlikely	Unlikely	Low	Low	Unlikely	There is always a potentially significant risk when aerial spraying next to boundaries. Glyphosate overspray could have an economic impact to adjoining horticulture leading to costly compensation or legal action. Glyphosate is a non-target pesticide so sensitive crops can easily be killed or browned off. Organics are especially vulnerable.	Meet the requirements of the generic mitigation and monitoring measures section of the ESRA which includes managing operations around adjacent properties including communication with potentially affected parties will mitigate risks. However, it is essential to discuss the operation thoroughly in-house between the different management teams that may be involved. It is also critical to discuss the pesticide application with neighbours. It is preferred practice to offset boundary spraying with a ground application if aerial spraying is intended for the block.
	Economic viability - tourism	Low	Low	Unlikely	Unlikely	Unlikely	Unlikely	Low	Low	Unlikely	The risk to tourism can be both internal and external. Internal tourism would include in-forest mountain bike riding, horse trekking, and hunting. External would include adjoining state or national forest land or national parks. Glyphosate is a non-target pesticide so will kill or brown-off all species that are sensitive to it.	Meet the requirements of the generic mitigation and monitoring measures section of the ESRA which includes managing operations around adjacent properties including communication with potentially affected parties will mitigate risks. It is essential to discuss the operation thoroughly in-house between the different management teams that may be involved. It is also critical to discuss the pesticide application with neighbours. It is preferred practice to offset boundary spraying with a ground application if aerial spraying is intended for the block.
	Other											
<p>1 = Weight of evidence base. ‘Unlikely’ means there is not a unanimous agreement between assessment organisations but a general agreement. For example, almost all international government agencies disagree with the WHO’s IARC 2015 categorisation of glyphosate as a “probable carcinogen”. Evidence based means that "Unlikely" has been entered in the carcinogenicity column even though the FSC has categorised glyphosate as highly hazardous due to carcinogenicity.</p> <p>2 = The risk associated with the hazard is based off using glyphosate under the label and regulatory requirements.</p> <p>3= The appendices provide additional information.</p> <p>4 = Refer to 4.12 (2) section of this ESRA for general mitigation requirements</p>												

ESRA Part B: Scale, Intensity and Risk

Scale	A measure of the extent to which a management activity or event affects an environmental value or a management unit, in time or space. An activity with a small or low spatial scale affects only a small proportion of the forest each year, an activity with a small or low temporal scale occurs only at long intervals (Source: FSC 2011).
Intensity	A measure of the force, severity or strength of a management activity or other occurrence affecting the nature of the activity's impacts (Source: FSC 2011).
Risk	The probability of an unacceptable negative impact arising from any activity in the Management Unit combined with its seriousness in terms of consequences (Source: FSC 2011).

Source: FSC-STD- 01-001 V5-2 EN

Scale, Intensity and Risk (SIR) is mentioned extensively within FSC's Principles and Criteria, and it is also an essential component of an ESRA.

Glyphosate is used for many forestry operations across a wide range of scales, with different intensities and risk profiles. The risk profile will change depending on how we apply it, the size of the treatment area and the risks within, and external, to the site.

- Scale: Our operations range from small ones comprising of a fraction of a hectare like road edge spraying to large ones covering hundreds of hectares as with after clearfell land preparation.
- Intensity: Glyphosate is applied by hand with a backpack spray unit, by small vehicles with a tank, reel and handheld spray nozzle, vehicles with spray booms, or broadscale helicopter application
- Risk: Spot spraying over small areas has limited risk; however, risk across all exposure variables will likely increase significantly for large scale aerial applications in the steep hill country with rapidly changeable weather.

We can apply glyphosate in the following operations:

- Pre-plant and post-plant (with shield) spot spray
- Pre-plant desiccation (aerial and or ground-based machine)
- Weed control around infrastructures like buildings, roadsides, Fire dams and other sites
- Wilding or pest tree control (drill/cut-stump and paste)
- General noxious weed control (by hand or ground vehicle)

We need to apply the following generic mitigation requirements across all scale, intensity and risk. The following section details this mitigation. Some conditions are solely for aerial applications and generally are identified as such, but most are across all SIR.

The level of detail to assess a small spot spray job or a roadside weed spray will be minor compared to a broadcast extensive aerial treatment. Some of the generic mitigation or monitoring requirements are not necessary for some jobs. Rather than have a series of mitigation requirements by operational type, intensity and risk profile, it is simpler to go through a standard generic checklist.

ESRA Part C: Generic Mitigation and Monitoring Measures to Minimize the Risks

Pre-operational Planning

Develop an operational plan*

- Decide on the scale of treatment area*
- Complete both an office and field-based planning process to assess site hazard and risks, and provide ground-truthing
- Assess the sensitivity of the off-target vegetation
- Determine the application method*
- The field map must show spray/no spray areas and include information on potentially at-risk adjoining property, or environmental features Identify no-fly zones
- Create the plan to ensure the glyphosate stays within the target area and not contaminate other land, water supplies, streams or water bodies
- Determine minimum buffers by application method and buffer type
- Buffer zones will be left to protect water quality, non-target plants and non-target land. Buffer widths will be commensurate with the potential risk and consequences.

Meet legal requirements

- Comply with regulatory requirements, both state and national, and meet FSC requirements for chemical use.

Select formula and rates*

- Use non-pesticide methods of weed control in preference to glyphosate where effective, practical and financially prudent, as consistent with the company pesticide use policy (a requirement of the ESRA).
- Aim for pesticide applications to coincide with optimal plant uptake
- Follow approved product label instructions
- Use application rates below the manufacturers label rates, where still effective and legally possible
- Target pesticide only on required areas
- Consider soil properties and erosion in the treatment area
- Decide on the type and rate of application method, including the:
 - Formulation (type and components)*
 - Concentration of the active ingredient(s)*
 - Dose of the active ingredient(s)*
 - Mixture of active ingredients (composition and mixing process)*
 - Metabolites of the active ingredient*
 - Frequency and interval of application*
 - Note if there have been other pesticide applications*

- Consult the online FSC database for information exchange on alternatives and monitoring procedures*
- The results of the ESRA must be incorporated into planning and development of the prescription and operational maps*

Training, competencies, and job responsibilities requirements*

- Staff involved with planning, managing and undertaking the operation need to be trained and have the appropriate certificates or approvals
- Staff must understand the ESRA of the job
- Use only experienced contractors with suitable qualifications, current licenses, and demonstrated competency
- Individual staff, contractors and their employees understand their responsibilities in the operation.

Undertake pre-operation consultation with neighbours and community (if treatment area adjoins property boundary or operation could impact)

- Engage with stakeholders in conformance with the requirements in the applicable National Forest Stewardship Standard or Interim National Standard when conducting ESRA*
- Make the ESRAs and incorporation to the operational plans available to affected stakeholders upon request*
- Send written notification to neighbours adjacent to the operation and potentially affected stakeholders before any operation starts
- Inform the affected community if non-timber products like blackberries have been sprayed in publicly accessible forest areas
- Consider a no aerial spray buffer when a residential structure/yard, water intake or water well is immediately adjacent to the treatment area. Instead, treat with ground application methods.

During Operations

Operational briefing and sign-off plan

- Complete a pre-operational briefing and induction to confirm the operational area and operational requirements
- Ensure the site operational plan and map (prescription) is agreed and understood by all and signed off by the contractor and the company.

Health and safety and hazard identification*

- Work cannot start until the contractor has signed-off the prescription
- Ensure contractors have read and fully understood how to apply glyphosate and the PPE requirements for it
- Involve the contractor with site hazard identification and mitigation
- Ensure the health and safety and environmental emergency procedures are well understood
- Ensure all Personal Protective Equipment (PPE) is on-site, in good condition, and correctly used*
- Follow the product label and SDS
- Current SDS must be on-site, accompanying pesticides transported, and also kept at chemical storage locations
- Decide on signage needed and install for the operation

- Shut down the operation immediately if it breaches the requirement of the prescription
- Have handwashing facilities and separate drinking water available on-site
- Ensure a first aid kit is available at transport, storage and application sites
- Explain first aid measures the glyphosate SDS requires (from Aust/NZ SDS):
 - Inhalation: If inhaled, move the person to fresh air. Keep at rest in a position comfortable for breathing until recovered. Get medical advice if symptoms persist. If the person is not breathing, seek immediate medical assistance and give artificial respiration.
 - Ingestion: Do not induce vomiting. Rinse mouth with water. Get immediate medical advice.
 - Skin: Wash affected area with plenty of soap and water. If irritation persists or develops, get medical advice.
 - Eye contact: Hold eyelids apart and flush continuously with water several minutes. Remove contact lenses if present, continue rinsing for more than 5 minutes. If irritation persists or symptoms develop, seek immediate medical attention
 - The health of workers exposed to glyphosate will be monitored.

Clear operational areas of non-authorised people

- Ensure that the operational area is clear of non-authorised people, especially in aerial operations. This could include:
 - Installing signs or notices at suitable locations on roads and tracks leading to the target areas to warn the public of aerial operations
 - Creating road blocks
 - Carry out a reconnaissance flight over the target areas if aerial treating.

Transport and storage

- Park or store chemicals safely away from ditches, water bodies and riparian zones to avoid contamination of waterbodies
- Secure and safely transport pesticide to the operational area
- Transport, handle and store chemicals according to label instructions, SDS and other regulatory requirements
- Store pesticides in a chemical shed or secure, weatherproof location that meets regulatory requirements
- Don't leave pesticides unattended on-site unless locked, secured and in a safe area.

Mixing and loading sites

- Mix to specification
- Measure accurately and without spillage
- Use clean water free of contaminants. Contaminants like dirt or rust will affect calibration by reducing nozzle flow or droplet size
- Select mixing sites where spills can be contained, and will not directly enter a ditch, waterbody, riparian zone or reserves
- Don't load or mix herbicide at tank refilling locations
- Ensure when filling a tank that back-siphoning from the tank cannot occur
- Dispose of wastewater from cleaning storage tanks, equipment and containers safely away from ditches, water bodies and riparian zones.

- Never dump a load or a tank mix
- Containers must be disposed of appropriately off-site. The preferred method is to recycle via the chemical suppliers, drum-muster or agri-recovery sites.
- Ensure materials are on site to clean up or contain a spill.

Calibration of equipment

- Calibrate application equipment before starting work and during operations to ensure uniform and accurate distribution over the area
- Check regularly that usage matches hectares treated.

Weather and climatic conditions*

- Do not begin treatment unless conditions are within operational parameters
- Suspend all, or part of the program, if weather conditions or other factors are not optimal
- Undertake regular monitoring of weather conditions. These must meet application parameters or else the operation needs to be immediately shut down
- Continue treatment only if weather conditions are within the application parameters for maximum wind speed, wind direction, no rainfall, no inversion layer (surface or other), no cold air drainage, soil moisture, air temperature and relative humidity
- If aerial spraying, include additional specific application requirements - monitoring airspeed, release height and flight direction.

Apply Pesticide only to the treatment area*

- Treat all areas identified for treatment within the operational boundary
- Ensure an even distribution over the treatment area or as specified
- Ensure complete coverage of the treated area. Consider using effective marking systems (e.g. dye or foam) or electronic guidance systems
- Additional aerial spraying specific application requirements include:
 - Carry out the aerial application only by helicopter
 - Use only helicopters equipped with an on-board computer to monitor the chemical flow rate and give precise in-flight management of the application system.
 - Use only application system must have precise cut-off and no-drip nozzles.

Prevent leaching and spray drift *

- Ensure conditions are optimal for the job to start and within specification limits
- Ensure there is no risk of off-site damage by leaching or spray drift outside of the target area
 - Don't treat restricted areas or buffers
 - Don't contaminate any water supply, permanent or temporary stream, wetlands or other water bodies.
- Stop treatment or increase buffers where there is a downwind spray drift risk
- Use appropriate nozzles and pressures to reduce the risk of off-site impacts.
- Pesticide must not contaminate water supplies, or water bodies like streams, lakes or dams.

Social responsibility and care during operations (neighbours and community)*

- Notify neighbours adjacent to the operation, or potentially affected parties that need to be contacted on the day of operation
- Locate mixing sites and helipads away from neighbouring properties
- Don't fly loaded helicopters over adjacent ownership
- No aerial application if target areas are near a school, public playground, council/state/national park, or municipal water reservoir. Prudently use ground applications along the adjoining boundary.
- No glyphosate application within a Streamside Management Zone or a Riparian Management Zone unless to control exotic-invasive species and only if the treatment doesn't impact erosion or water quality.

Contain spills*

- Have an emergency spill kit or spill containment system available suitable for the quantity and type of chemical being stored and used
- Dispose of contaminated material responsibly and legally (location determined by spill size) well away from any ditch, waterbody, riparian or reserve.

Keep operational records*

- Keep the following records that FSC requires for the ESRA:
 - Product trade name*
 - The application rate of the product*
 - Date & time product was used*
 - Name and address of the applicator/supervisor*
 - Crop or situation that was treated*
 - Location where the product was used*
 - Area of land treated*
 - Weather details (previously listed)*.

Post Operational Monitoring

- Assess coverage of the operation, e.g. through visual checking for dye or through comparing electronic tracking performance against operational boundaries
- Check coverage to identify any areas of overspray or spraying outside boundaries
- Measure indicators of success including spray efficacy and no off-target adverse effects
- Undertake water sampling and analysis for chemical residues on high-risk sites to monitor the effectiveness of buffers & other protection measures
- Establish and monitor pesticide applicators health.

Improving Operational Effectiveness

- Have programmes in place, according to SIR, to research, identify and test alternatives to replace FSC highly restricted HHPs and restricted HHPs with less hazardous alternatives*
- Programmes shall have clear actions, timelines, targets and resources allocated*
- Programmes will usually be collaborative with other companies or research organisations.

ESRA Picloram

This template follows a similar format to that of Annex 2 within the FSC Pesticides Policy FSC-POL-30-001 V3-0 EN. Therefore, it may be used by SDGs and Organisations in their Environmental and Social Risk Assessment (ESRA), and by certification bodies as a checklist to assess conformance with the minimum requirements for ESRA.

Date	April 2020
Proposed chemical pesticide	Products containing Picloram
Pesticide type	Herbicide
CAS number(s)	<ul style="list-style-type: none"> • 1918-02-1 (Picloram hexyloxypropylamine salt) • 82683-78-1 (Picloram triethanolamine salt) • 2545-60-0 (Picloram potassium salt) • 026952-94-5 (Picloram Isooctyl Ester) • 6753-47-5 (Picloram triisopropanolamine)
Common trade name(s) (Listed brand names may have different formulations including combinations with other chemical pesticides)	<p>Only a few suppliers provide products with just Picloram. Available in water-dispersible granules or soluble liquid. Products include:</p> <ul style="list-style-type: none"> • Adama Picoflex (2545-60-0) • AGPRO Picloram 20G (82683-78-1) • AGPRO Picloram 200 (1918-02-1) • Farmerlinx Stuka Flexi (2545-60-0) • Corteva Tordon™ Granules Weed & Brush (82683-78-1) <p>Refer to the APVMA PubCRIS database for the full list of registered products in Australia with this active ingredient.</p>
FSC pesticide classification (prohibited HHP, highly restricted HHP, restricted HHP, or other chemical pesticide)	<p>Restricted HHP</p> <ul style="list-style-type: none"> • 1918-02-1 Picloram <p>Other chemical</p> <ul style="list-style-type: none"> • 82683-78-1 Picloram triethanolamine salt • 2545-60-0 Picloram potassium salt • 026952-94-5 Picloram Isooctyl Ester • 6753-47-5 Picloram triisopropanolamine salt
Purpose of use (protection of vegetation, human health, native species, seeds or seedlings, weed control, others)	Weed control. Used for pre and post-emergent control, nearly always with other herbicides, on a range of annual and perennial grasses and broad-leaved weeds, and scrub including difficult to kill perennial weeds.
Location where used (forest, office, fire store, nursery)	Forest.
Application method (hand, ground machine, aerial)	All methods applied either as a liquid or granules. Often aerial application but also boom spraying, spot gun, knapsack, and basal bark treatment.
Scale and intensity of use	Variable. Dependent on the size of the operational area and method of application.
Alternatives considered (burning, mechanical land prep, hand, mechanical releasing, oversowing,	A wide range of alternatives have been considered consistent with Criterion 10.7 of FSC-STD-01-001 V5-2 FSC Principles and Criteria.

grazing, weed mats, biological control, alternative chemicals)	Further information on alternatives is within the IPM.
Pesticide used individually or in conjunction with other pesticide(s)	<ul style="list-style-type: none"> Picloram is almost always used in conjunction with other herbicides to improve efficacy, including multiple combinations. Other herbicides include 2,4-D, Aminopyralid, Clopyralid, MCPA, and Triclopyr. Always check the product label, and if there are other pesticide additives, consult their ESRA's too. Risks will likely increase with additional herbicide products, especially those known to have effects on the soil, water, air, and aquatic or terrestrial life. Little is known about potential compounding risks of mixes, as risk assessments are generally made on individual active ingredients.
Reference documents	<ul style="list-style-type: none"> Integrated Pest Management document FSC Pesticides Policy FSC-POL-30-001 V3-0 EN FSC Lists of highly hazardous pesticides FSC-POL-30-001a V3-0 EN D2-0 SDS Adama Picoflex SDS AGPRO Picloram 20G & AGPRO Picloram 200 SDS Farmerlinx Stuka Flexi SDS TordonTM Granules Weed & Brush Pesticide properties database http://sitem.herts.ac.uk/ European Food Safety Authority 2009, 'Conclusion on the peer review of the pesticide risk assessment of the active substance Picloram' https://www.efsa.europa.eu/en/efsajournal/pub/1390 New Zealand Journal of Forestry Science (2015) 45:6 'Relative persistence of commonly used forestry herbicides for preventing the establishment of broom (Cytisus scoparius) seedlings in New Zealand plantations'. APVMA website including the PubCRIS database https://portal.apvma.gov.au/pubcris NZ EPA website including the Chemical Classification and Information Database (CCID) https://www.epa.govt.nz/database-search/chemical-classification-and-information-database-ccid/ Herbiguide herbiguide.com.au/InformationHerbicides.aspx PAN Pesticides Database http://pesticideinformation.org/Search_Chemicals.jsp US National Center For Biotechnology Information (NCBI) https://pubchem.ncbi.nlm.nih.gov/
Note	<ul style="list-style-type: none"> The ESRA solely used data for Picloram CAS 1918-02-1 as most studies were conducted on this. However, the toxicological and ecological information within the SDSs for all Picloram CAS variants almost always match CAS 1918-02-1. Many Picloram products do not use the HHP version CAS 1918-02-1. However, commonly used products with Picloram/Triclopyr do.

Risk profiling

The risk matrix below helps frame the level of risk for each ESRA exposure variable, and to also assist in comparing risk between the ESRAs of different chemical pesticides. A score assessed as 3/2 means the likelihood is 'possible' and the consequence of the event 'minor'.

		LIKELIHOOD					
		1 - Negligible	2 - Unlikely	3 - Possible	4 - Likely	5 - Almost Certain	6 - Certain
CONSEQUENCE	6 - Catastrophic	Medium	High	Extreme	Extreme	Extreme	Extreme
	5 - Extreme	Medium	Medium	High	High	Extreme	Extreme
	4 - Major	Low	Medium	Medium	High	High	Extreme
	3 - Moderate	Low	Low	Medium	Medium	High	High
	2 - Minor	Low	Low	Low	Low	Medium	Medium
	1 - Insignificant	Low	Low	Low	Low	Low	Medium

Risk for some attributes will change between pre-control assessment risk and post-mitigation control risk (residual risk), after initiating the mitigation control measures within the ESRA.

Chemical pesticide: Picloram

FSC pesticide classification: FSC restricted HHP

Exposure	List of values	HHP Hazards Suspected and Endocrine Disruptor	Assessment of Other potential risks – Pre-controls ^{1, 2}	Assessment of Other potential risks - Post mitigation controls ^{1, 2}	Descriptor of why / why not a risk ³	Mitigation strategies defined to minimise risk
Environmental	Soil (erosion, degradation, biota, carbon storage)	Na	3/3 = Medium	3/2 = Low	Risk levels to soil vary and include: <ul style="list-style-type: none"> Picloram is not classed as a risk to the soil environment. Very mobile in soil (K_{oc} 13-60 mL/g, K_{foc} 0.31-20.3 mL/g). Picloram is more mobile in soils with a pH>5. Moderate water solubility (430 mg/L). Low to highly persistence in soil depending on application concentration, temperature, soil type, and rainfall (DT50 (soil field studies) 20-300 days with avg 90 days, DT90 (soil field studies) 67-163 days). Picloram is degraded by photodegradation and microbial action. Low potential for bioaccumulation (BCF (L/kg) 74, LogP -1.92-0.3 (low). Potential increase in erosion due to vegetation dieback. Risk increases with scale and intensity, especially in the erosion-prone hill country where infrastructure and slopes near waterways are prone to surface erosion. The risks reduce if oversown or hydro seeded cut/fill batters are not sprayed. 	<p>Refer to Appendix 1: 'Generic Mitigation and Monitoring Measures for Herbicides, Fungicides, Vertebrate Toxins, and Insecticides'.</p> <p>The Appendix describes the mitigation requirements to minimise risk from the exposure variables.</p> <p>Although Appendix 1's mitigation measures should significantly reduce pre-control risks, not all risk can be eliminated as seen in the post-mitigation controls column. Depending on the residual risk, some sites may require more stringent versions of individual mitigation measures than those in Appendix 1. Also, in some situations, additional company mitigation measures may need to be included.</p> <p>The Appendix also describes mitigation measures for other pesticides that may be used in conjunction with Picloram to improve the efficacy of the treatment.</p>
	Water (groundwater, surface water, water supplies)	Na	3/3 = Medium	3/2 = Low	Risk levels to water vary and include: <ul style="list-style-type: none"> Entering water. There are three pathways to enter water: directly into waterways from the spray, overland flow from rain, and via the soil to groundwater. <ul style="list-style-type: none"> High risk of migration into surface water as Picloram is persistent and very mobile in soil. Sources say it is unlikely to contaminate groundwater. Risks when in water: <ul style="list-style-type: none"> Hazard classed as very toxic to aquatic life (acute and chronic). Not readily biodegradable. Degradation is slow in water sediment and stable in sterile and dark water conditions (DT50 (water-sediment) 196 days, (DT50 (water phase) 81 days). Breakdown in light (aqueous photolysis) is moderately fast (DT50 (days) at pH 7 is 2. The risk profile to water increases with: <ul style="list-style-type: none"> Site factors that increase the potential for surface runoff, e.g. steep slopes, poorly draining soils and soils with shallow groundwater. Site factors that increase the potential of leaching to groundwater, e.g. sites with permeable soils with shallow water tables. Poor product application, e.g. spraying before heavy rain, direct spray or drift over water, or locating storage or load zones that increase the risk to water from accidental spillage. 	
	Atmosphere (air quality, greenhouse gases)	Na	1/1 = Low	1/1 = Low	The risk to the atmosphere is low. Risks vary and include the application method, scale and intensity, location relative to adjoining properties, and weather conditions. Aerial spraying has a potentially higher risk as it will result in having pesticide in the air over the application area until the spray settles. Picloram is very slightly volatile, so minimal risk.	
	Non-target species (vegetation, wildlife, bees and other pollinators, pets)	2/2 = Low	Fish 3/2 = Low Aquatic organisms 3/2 = Low Bees 2/2 = Low Birds 2/2 = Low Vegetation 4/4 = High Soil organisms 3/2 = low	Fish 3/2 = Low Aquatic organisms 3/2 = Low Bees 2/2 = Low Birds 2/2 = Low Vegetation 2/2 = Low Soil organisms 3/2 = low	Picloram risks vary depending on non-target species: <ul style="list-style-type: none"> Aquatic: <ul style="list-style-type: none"> Toxic to aquatic life with long-lasting effects (NZ EPA 9.1 B, Aust H410) <ul style="list-style-type: none"> Low to moderate toxicity to fish depending on the source (LC50 (96hr) (rainbow trout) 8.8 mg/L, LC50 (96 hrs) (bluegill sunfish) 19.4 mg/L). Picloram isoctyl ester may be highly toxic to fish. Low to moderate acute toxicity to aquatic invertebrates (EC50 (48 hrs) Daphnia (water flea) 44.2-50 mg/L). Data deficient on acute toxicity to aquatic crustaceans. Low acute toxicity to aquatic sediment-dwelling organisms (NOEC (28days) (blood worm) 100 mg/L, Low acute toxicity to aquatic algae (EC50 (7 day) (biomass) (common duckweed) 102 mg/L, EC50 (72hrs) (growth) (Raphidocelis subcapitata) 36.9-60.2 mg/L). Terrestrial: <ul style="list-style-type: none"> Will severely affects non-target vegetation sensitive to Picloram. Low acute toxicity for earthworms (LC50 (7 days) (earthworm) 4475 mg/kg). Low to moderate acute toxicity to birds depending on the source (LD50 (mallard duck) 1944 mg/kg). Low to moderate acute toxicity to bees depending on whether contact or oral (LD50 (worst case up to 72hr) (contact) >100ug/bee), (LD50 (worst case up to 72hr) (oral) >74ug/bee). 	
	Non-timber forest products (as FSC-STD-01-001 V5-2 FSC principles and criteria, criterion 5.1)	2/2 = Low	2/2 = Low Aquaculture 3/4 = Medium	2/2 = Low Aquaculture 2/2 = Low	Picloram is applied to bare land or newly established trees so risks to under the canopy, non-timber products aren't applicable. However, risks will occur where aquaculture because of Picloram's mobility in soil and potential to get into the waterway, e.g. koura ponds, as koura can be highly sensitive to some pesticides.	
	High conservation values (particularly HCV 1-4)	2/2 = Low	4/5 = High	2/2 = Low	The risk of Picloram to high conservation values in some situations could be extreme. Poor application adjoining or near a high conservation value area will compound the risk. Picloram is a selective herbicide that will kill some plant species or cause dieback in others.	
	Landscape (aesthetics, cumulative impacts)	2/2 = Low	Small scale 1/1 = low to Large aerial 6/3 = High	Small scale 1/1 = low to Large aerial 4/3 = Medium	The risk to landscape increases with scale and intensity. Large operational areas may significantly impact aesthetics especially aerial application. This could depend on the location of the treatment area, application method and product type (SC or WG) and public sentiment. For example, treatment size, visibility, proximity to and type/sensitivity of neighbours, impact on public recreation, perceived impact on nearby parks, forest, or spray sensitive land users like orchards or organic farming.	

	List of values	HHP Hazards Suspected and Endocrine Disruptor	Assessment of Other potential risks – Pre-controls ^{1,2}	Assessment of Other potential risks - Post mitigation controls ^{1,2}	Descriptor of why / why not a risk ²	Mitigation strategies defined to minimise risk
Environ	Ecosystem services (water, soil, carbon sequestration, tourism)	2/2 = Low	2/2 = Low	2/2 = Low	Pre-control risks to ecosystem services are likely moderate, especially on heavily bisected hill country. Picloram can be highly persistent and is classed as very toxic to aquatic life (acute and chronic). Although it has a low risk of bioaccumulation, it is suspected of being a weak carcinogen and endocrine disruptor. However, specific circumstances may raise the risk profile. For example, if the treatment area was part of a municipal water catchment zone.	
	High conservation values (especially HCV 5-6)	Na	2/2 = Low	2/2 = Low	The risk is likely low.	<p>Refer to Appendix 1: 'Generic Mitigation and Monitoring Measures for Herbicides, Fungicides, Vertebrate Toxins, and Insecticides'.</p> <p>The Appendix describes the mitigation requirements to minimise risk from the exposure variables.</p> <p>Although Appendix 1's mitigation measures should significantly reduce pre-control risks, not all risk can be eliminated as seen in the post-mitigation controls column. Depending on the residual risk, some sites may require more stringent versions of individual mitigation measures than those in Appendix 1. Also, in some situations, additional company mitigation measures may need to be included.</p> <p>The Appendix also describes mitigation measures for other pesticides that may be used in conjunction with Picloram to improve the efficacy of the treatment.</p>
	Health (fertility, reproductive health, respiratory health, dermatologic, neurological and gastrointestinal problems, cancer and hormone imbalance)	3/3 = Medium	3/3 = Medium	2/2 = Low	<p>The risks to human health of Picloram are likely to be low when used according to label, SDS and good practice:</p> <ul style="list-style-type: none"> The following are oral, dermal or inhalation toxicity risks: <ul style="list-style-type: none"> Acute oral toxicity: Low toxicity (LD₅₀ (rat) 4012->8200 mg/kg), LD50 (Mice) >2000 mg/kg). Acute dermal toxicity: Prolonged skin contact is unlikely to result in absorption of harmful amounts. (LD50 (rat) >2000 mg/Kg), LD50 (rabbit) > 4000mg/kg). May cause an allergic skin reaction. Has caused allergic skin reactions when tested in guinea pigs. Acute inhalation toxicity: A respiratory tract irritant (LC50 (Rat) (4 hr) >0.035 mg/L). May cause slight temporary eye irritation. Corneal injury is unlikely. Chronic toxicological effects: Dogs, sheep, and beef cattle fed low levels of Picloram for a month experienced no toxic effects. The Australian Acceptable Daily Intake (ADI) is 0.07 mg/kg/day (EU ADI is 0.3), for daily, lifetime exposure based on a no-observed-adverse-effect level (NOEL) of 7 mg/kg/day Carcinogenicity, mutagenicity, teratogenicity, reproduction, and endocrine risks: <ul style="list-style-type: none"> Carcinogenicity: Suspected to be a carcinogen. Data suggests that Picloram could be weakly carcinogenic. Mutagenicity: Unlikely to be a mutagen. Teratogenicity: Unlikely. In animals, it did not cause birth defects or other effects in the foetus even at doses which caused toxic effects in the mother. Reproduction or reproductive toxicity: In animal studies, Picloram did not interfere with reproduction or fertility. In a two-generation rat study, no evidence of reproductive or offspring toxicity was seen. The parental toxicity was only observed at the high dose level (1000 mg/kg bw /day) and consisted of reduced weight gain in males and renal toxicity. Endocrine disruption potential: Picloram is suspected to be an endocrine disruptor. Specific Target Organ Systemic Toxicity risks: <ul style="list-style-type: none"> Specific Target Organ Systemic Toxicity (Single Exposure): Likely not a STOT-SE toxicant. Specific Target Organ Systemic Toxicity (Repeated Exposure): May cause damage to organs through repeated or prolonged exposure. In animals, effects have been reported in the liver, kidneys, and gastrointestinal tract. In human volunteers, there was a rapid oral absorption (Tmax = 30 min) with extensive urinary excretion (>80% within 72 hours). No potential for bioaccumulation was demonstrated, and no metabolites were detected in urine or faecal extracts indicating that Picloram is excreted unchanged. The Australian Acceptable Daily Intake (ADI) for Picloram for a human is 0.07 mg/kg/day, (some SDSs are different) set for the public for daily, lifetime exposure (based on the NOEL of 7 mg/kg/day in a 6mth dog study). 	
	Welfare	3/3 = Medium	3/3 = Medium	2/2 = Low	<p>Australian GHS hazardous substances classification codes on all reviewed SDSs for health and environmental hazards include:</p> <ul style="list-style-type: none"> Skin sensitisation - Category 1, Short-term (acute) aquatic hazard - Category 2, Long-term (chronic) aquatic hazard - Category 1, H317: May cause an allergic skin reaction, H400 Toxic to aquatic life, H410 Very toxic to aquatic life with long-lasting effects. Note: Australian SDSs are not consistent in their listing of hazard classifications. Refer to safe work Australia's summary tables https://www.safeworkaustralia.gov.au/system/files/documents/1702/classification_and_labelling_workplace_hazardous_chemicals_poster_a4.pdf <p>NZ hazardous substances classification codes for health and environmental hazards taken from the NZ EPA CCID database:</p> <ul style="list-style-type: none"> Health: 6.1D (All), 6.1D (O), 6.4A, 6.9B (All), 6.9B (O). Environment: 9.1B (All), 9.1B (F), 9.1C (A), 9.1D (C), 9.2A, 9.3C, 9.4C. Note: NZ SDSs may have some, all, or additional hazard classifications. Refer to NZ EPA for definitions of hazardous substances classification codes https://www.epa.govt.nz/industry-areas/hazardous-substances/rules-for-hazardous-substances/hazardous-substances-classification-codes/ <p>Refer to health and other social exposure elements as that can also influence welfare too.</p>	
	Food and water	2/2 = Low	2/2 = Low	2/2 = Low	<p>The risk to food and water is likely low:</p> <ul style="list-style-type: none"> Picloram is used in food-producing primary sectors. For example, in pasture management, and crops like barley, oats, and chickpeas. Eliminate the potential risk of accidental or ongoing oral ingestion of Picloram by pesticide workers with poor on-the-job personal hygiene around food and drink. 	
	Social infrastructure (schools and hospitals, recreation infrastruc, infrastructure adjacent to the mgmt. unit)	3/3 = Medium	1/1 = Low to 3/5 = High	1/1 = Low to 3/2 = Low	The risk to social infrastructure is likely low if the treatment area is well within the forest and away from in-forest or adjoining infrastructure. Picloram's persistence in soil and its high mobility are factors needing consideration. For example, risks would likely increase if there are water takes that are within, or drain from, the treatment area. Also, the risk is likely to increase with scale and intensity. For example, if the operation required aerial application, or there was a heavy weed infestation requiring multiple applications with a high dose rate, on an in-forest public accessway or easement.	

	List of values	HHP Hazards Suspected carcinogen and Endocrine Disruptor	Assessment of Other potential risks – Pre-controls ^{1, 2}	Assessment of Other potential risks - Post mitigation controls ^{1, 2}	Descriptor of why / why not a risk ²	Mitigation strategies defined to minimise risk
Social	Economic viability (agriculture, livestock, tourism)	Na	1/1 = Low to 3/5 = High	1/1 = Low to 3/3 = Medium	The risk to economic viability is likely low if the treatment area is well within the forest. Risk increases with scale, intensity and operational complexity, especially if the operation is on a boundary. For example, an aerial overspray or leaching could have an economic impact on adjoining agriculture, aquaculture or horticulture, leading to costly compensation or legal action. Organics are especially vulnerable.	Refer above.
	Rights (legal and customary)	Na	2/2 = Low	2/2 = Low	Risks to rights are likely to be low unless in specific situations like easements for water extraction or grazing. Also, operational areas will likely be closed off to those with rights only during the operation, e.g. utility companies or those with road access easements.	
	Other	Na	----	----	-----	
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1 = The risk profile is only for the pesticide listed in the table. Often other pesticides are added to improve treatment efficacy or solubility. Also, risk will vary between sites, methods, and the scale and intensity of the treatment.

2 = It is recommended to take a precautionous approach. New research may bring to light risks that were not identified in previous assessments. Current research is not exhaustive, is often agriculturally based from northern hemisphere studies, and the effects on some exposure variables are not known or fully understood. **Also, between SDS's there can be conflicting data, variation in both amount and quality of information, and differing judgements of risks. Some SDSs are more current than others. Therefore, consider reviewing SDS's of similar pesticide products.**

Select formula and rates		Herbicides							Fungicide	Vertebrate Toxin	Insecticides	
		2,4-D	Amitrole	Atrazine	Glyphosate	Glufosinate	Haloxyp**	Picloram**	Copper compounds**	Sodium Fluroacetate	Alpha Cypermethrin	Fipronil
	1. Use non-pesticide methods in preference to pesticides, consistent with company IPM, e.g. where effective, practical, and financially prudent	•	•	•	•	•	•	•	•	•	•	•
	2. Aim for pesticide applications to coincide with optimal target species uptake	•	•	•	•	•	•	•	•	•	•	•
	3. Follow manufacturer's product label instructions	•	•	•	•	•	•	•	•	•	•	•
	4. Use application rates below the manufacturers label rates, where still effective and legally possible	•	•	•	•	•	•	•	•	•	•	•
	5. Target pesticide only on required areas	•	•	•	•	•	•	•	•	•	•	•
	6. Consider soil properties, topography, rainfall and erosion in the treatment area	•	•	•	•	•	•	•	•	•	•	•
	7. Decide on the type and rate of application, including the:											
	<ul style="list-style-type: none"> Formulation (type and components)* Concentration of the active ingredient(s)* Dose of the active ingredient(s)* Mixture of active ingredients (composition and mixing process)* Metabolites of the active ingredient* Frequency and interval of application* Record if there have been other pesticide applications* 	•	•	•	•	•	•	•	•	•	•	•
	8. Consult the online FSC database for information exchange on alternatives and monitoring procedures*	•	•	•	•	•	•	•	•	•	•	•
	9. Incorporated the ESRA into planning and development of the prescription and operational maps*	•	•	•	•	•	•	•	•	•	•	•

Key: Asterix* indicates an FSC requirement (FSCPOL 30-001a V3) .** Indicates where not all pesticides by these names are listed HHP - check the CAS Number. **Black dot** = needs to be considered or done. **Orange dot** = additional care. **Red dot** = high care needed when considering or undertaking the attribute.

[illegible]

	<div>Key: Asterix* indicates an FSC requirement (FSCPOL 30-001a V3) .** Indicates where not all pesticides by these names are listed HHP - check the CAS Number. Black dot = needs to be considered or done. Orange dot = additional care. Red dot = high care needed when considering or undertaking the attribute.</div>	Herbicides						Fungicide	Vertebrate Toxin	Insecticides		
		2,4-D	Amitrole	Atrazine	Glyphosate	Glufosinate	Haloxyp**	Picloram**	Copper compounds**	Sodium Fluoroacetate	Alpha Cypermethrin	Fipronil
Weather and climatic conditions*	1. Do not begin treatment unless conditions are within operational parameters	•	•	•	•	•	•	•	•	•	•	•
	2. Suspend all, or part of the program, if weather conditions or other factors are not optimal	•	•	•	•	•	•	•	•	•	•	•
	3. Undertake regular monitoring of weather conditions. These must meet application parameters or else the operation needs to be immediately shut down	•	•	•	•	•	•	•	•	•	•	
	4. Continue treatment only if weather conditions are within the application parameters for maximum wind speed, wind direction, no rainfall, no inversion layer (surface or other), no cold air drainage, soil moisture, air temperature and relative humidity	•	•	•	•	•	•	•	•	•	•	
	5. If aerial application, include additional specific application requirements - monitoring airspeed, release height and flight direction.	•	•	•	•	•	•	•	•	•	•	
Apply Pesticide only to the treatment area*	1. Treat all areas identified for treatment within the operational boundary	•	•	•	•	•	•	•	•	•	•	•
	2. Ensure an even distribution over the treatment area or as specified	•	•	•	•	•	•	•	•	•	•	•
	3. Use bait boxes or stations, where product require their use											•
	4. Ensure complete coverage of the treated area. Use effective marking systems, e.g. GPS or electronic guidance systems	•	•	•	•	•	•	•	•	•	•	•
	5. Additional aerial spraying specific application requirements include: <div><div>• Carry out the aerial application only by helicopter/UAV (not fixed wing)</div><div>• Use only helicopters equipped with an on-board computer to monitor the chemical flow rate and give precise in-flight management of the application system and location (DGPS).</div><div>• Use only application system must have precise cut-off and no-drip nozzles.</div></div>	•	•	•	•	•	•	•		•		

		Herbicides							Fungicide	Vertebrate Toxin	Insecticides	
		2,4-D	Amitrole	Atrazine	Glyphosate	Glufosinate	Haloxifop**	Picloram**	Copper compounds**	Sodium Fluroacetate	Alpha Cypermethrin	Fipronil
	Improving operational effectiveness	1. Have programmes in place, according to SIR, to research, identify and test alternatives to replace FSC highly restricted HHPs and restricted HHPs with less hazardous alternatives*	●	●	●	●	●	●	●	●	●	●
		2. Programmes shall have clear actions, timelines, targets and resources allocated*	●	●	●	●	●	●	●	●	●	●
		3. Programmes will usually be collaborative with other companies or research organisations.	●	●	●	●	●	●	●	●	●	●

Key: Asterix* indicates an FSC requirement (FSCPOL 30-001a V3) .** Indicates where not all pesticides by these names are listed HHP - check the CAS Number. **Black dot** = needs to be considered or done. **Orange dot** = additional care. **Red dot** = high care needed when considering or undertaking the attribute.