A1 GOOD PRACTICE GUIDE FOR WILDING CONIFER CONTROL

NATIONAL WILDING CONIFER CONTROL PROGRAMME

AERIAL BASAL BARK APPLICATION (ABBA)

VERSION 3.1: MAY 2023

The ABBA method of wilding conifer control involves chemically ring-barking trees by using a wand to apply herbicide from a helicopter. Dead trees are left standing until they naturally break down. It is the most efficient way to control scattered wildings in difficult-to-access terrain or in areas with high value vegetation.

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Front cover image: ABBA method in action (credit: Dave Hansford)

ABOUT THIS DOCUMENT

Overall disclaimer:	The information in this publication represents the collective view of the National Wilding Conifer Control Programme (the 'National Programme'). We have made every effort to ensure the information is accurate. However, the National Programme does not accept any responsibility or liability for error of fact, omission, interpretation or opinion, nor for the consequences of any decisions based on this information. Good practice use by any reader is done so at their own risk, and the National Programme rejects all liability for any risk or loss as a result of applying this good practice information. This guide is not designed to provide exhaustive compliance information and is not a substitute for professional advice. It remains the full responsibility of the user to obtain the specific guidance, authorisations, consents and permits as required to meet regulatory requirements and complete the work.
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VERSION CONTROL

DATE	DETAILS	VERSION NO.	AMENDED BY
February 2014	Based on the 2014 DOC guideline "Woody Weed Control Using Bark Application Methods", published by DOC's Science and Capability Group.	Reference for the 2014 document: DOCDM-1364016.doc Draft	MPI via 2017 workshop
March 2019	Edited for readability and in response to EPA feedback comments	Version 1	MPI
1 July 2020	Herbicide mix updated to reflect programme ban on mineral fuel	Version 2	MPI
October 2022	Generic intro removed; PPE/RPE added; X-Tree recommended, other minor edits	Version 3	MPI
May 2023	- Respirator appendix added (Appendix 3) - Stock safety updated in pre-start briefing - Tethered wand information added - Updated reference to Hazardous Substances Amendment Regulations 2021	Version 3.1	MPI

1. ABBA PRE-CONTROL WORK

1.1 PRE-START BRIEFING

Before the operation begins hold a pre-start briefing, led by the Project Manager or equivalent, with key personnel. This shall be in a timely enough manner to allow for potentially affected parties to be notified of any changes.

Pre-start briefing to include, but not be limited to:

- Ensure consent from the landowner or nominated occupier (by email or recorded personal contact). A notification process shall be in place that shows adjoining landowner(s) are aware of the operation.
- Any stock in the control area shall be discussed with the owners or managers.
- If relevant, check the Safety Data Sheet for your operation's herbicide for any stock withholding period guidelines that need to be adhered to. In the absence of guidelines in the Safety Data Sheet, introduction of stock after spray operations should be cautionary.
- Introduction of stock to an area after spray operations should be cautionary.
- Seek information from occupiers and neighbours on all potential hazards that might be encountered (e.g. main grid power lines or hot wires that go from ridge to ridge on farmland). These hazards need to be entered as appropriate into the site safety hazard register, which needs to be available for inspection by everyone involved for the duration of the work.
- All applicable contractual matters must be completed.
- All cost sharing is agreed upon and confirmed so that everyone knows how the operation is funded and any conditions that need to be met. Any separate agreements and understandings regarding control of other plant pests encountered must be finalised before the operation begins.
- Brief the helicopter pilot and crew and any other contractor/team members, all adjacent neighbours, and the landowner(s) or occupier(s) on whose land the operation is being carried out. The briefing must explain where the operational area is. Show the area visually using a map and describe the outermost boundary of the operation. A map is to be supplied to each party.
- Ensure the flight path is not over open water; check any regional rules surrounding this.
- Work with occupiers and neighbours to identify all water takes that may be affected.
- Discuss steps that shall be taken in the event of an environmental or health and safety incident.
- Check weather conditions at time of programmed operation. Refer to product labels to determine suitability during wet weather. Affected parties must be notified in the event of a weather postponement.

2. ABBA MATERIALS

2.1 HERBICIDE

The recommended ABBA herbicide for wilding conifer species is X-Tree Wet & Dry (UPL), a ready-to-use herbicide containing triclopyr butoxyethyl ester (no mixing required).

Alternatively, an equivalent mix is a 20% basal bark mixture, often referred to as a 20% volume to volume (v/v) solution:

- 200 mL of 600 g/L triclopyr butoxyethyl ester (triclopyr BEE) herbicide,
- 800 mL of 100% biodiesel (a methyl ester derived from vegetable oil or modified seed oils).

This herbicide mix gives 120 g of active ingredient per 1 L of herbicide mixture.

Note: the use of mineral based diesel (including JetA1), fuels and oils (including blends of mineral diesel and vegetable oil) as carriers in herbicide mixes is prohibited in the National Programme.

2.2 PERSONAL PROTECTIVE EQUIPMENT (PPE)

Exposing workers to X-Tree Wet and Dry or Triclopyr 600 + biodiesel may cause a range of issues including but not limited to:

- Eye irritation
- Allergic skin reaction and sensitisation by skin contact
- Damage to kidneys through prolonged or repeated exposure
- Harmful if swallowed

Care must be always taken to prevent exposure when handling these chemicals. This means wearing eye protection, nitrile gloves, coveralls, chemical resistant boots and a properly fitted mask when mixing, handling, and applying chemicals. Wand operators should not have any exposed skin.

Determining the correct Respiratory Protective Equipment (RPE)

The risk of chemical exposure to wand operators has not been assessed through exposure monitoring. Given this, the programme strongly recommends that P3 masks should be used. Properly fitted P2 masks with a carbon filter do provide some protection for operators and may be sufficient.

Information relatin to selection of RPE can be found in Appendix 3.

Link to WorkSafe guidance on RPE: Respiratory Protective Equipment (RPE) | WorkSafe

PPE and RPE requirements

Table 1. PPE and RPE specifications for set-up and delivery of ABBA operations.

TYPE OF PPE	SPECIFICATIONS/COMMENTS
Eye protection	Goggles or a helmet visor must be used when mixing, handling, and applying chemicals
Nitrile gloves	• Nitrile gloves must be used when mixing, handling, and applying chemicals. • Other chemical resistant gloves maybe used by the pilot to ensure they don't lose dexterity and compromise safety.
Chemical-resistant coveralls	Coveralls must be used when mixing, handling, and applying chemicals.
Footwear	Chemical resistant work boots must be used when mixing, handling, and applying chemicals.
Respirator	• Respirator must be used when mixing, handling, and applying chemicals. • We recommend the use of a P3 half face mask with appropriate agrichemical filters. A P2 mask with carbon filter may also be appropriate. • A verbal electronic communication system must be in place between the pilot and wand operator. The mask must be fit tested to ensure adequate protection.

2.3 DELIVERY EQUIPMENT AND SETUP

Helicopter set up

The decision of which helicopter type to be used will be based on safety and specific environmental conditions (e.g. altitude and manoeuvrability requirements) and will ultimately be made by the pilot. To allow for accurate record keeping and post control monitoring, a GPS system must record both the helicopter flight path and points where herbicide is applied to conifers. The GPS data shall be provided to the relevant Project Manager.

All equipment attached to the helicopter must have an approved modification listed in the aircraft flight manual.

- Operators using the wand must be restrained with an approved safety harness at all times.
- The pilot is responsible for installing a securing mechanism, such as a bracket or strap, to ensure the wand does not come in contact with the main or tail rotors. The wand operator must use it as directed by the pilot.
- Spare, oil-resistant (Viton rubber) O-rings for the handguns and diaphragms for the nozzles shall be carried on the helicopter.

Spray tanks

To ensure that the herbicide remains properly mixed, the spray tank must have an efficient agitation system. A mechanical agitation system is satisfactory. If using a 20% basal bark mixture (rather than the pre-mixed

X-tree wet & dry), it is best to pre-mix the herbicides before putting the formulation into the spray tank, but if there is a good agitator on the helicopter, putting products directly into the tanks also works.

The Civil Aviation Authority (CAA) requires that where tanks have a 'jettison system' fitted (to be able to jettison any unwanted liquids), it must be fully operational. Note: emergency "jettison" may trigger an environmental incident (see appendix 4).

Spray pumps

The type of pump system used is at the discretion of the helicopter pilot. Internal or external (electric) driven pumps are used to deliver the herbicide to the wand, although some operators prefer external tanks with petrol drive pumps. The pressure of the spray pump shall be operated between 3-5 bar to minimise misting of the herbicide.

Herbicide wands

The shape and length of the wand is optional and at the discretion of the pilot and/or wand operator. However, wands are generally between 1.5 m and 4 m long, and straight. Sometimes wands with a 45° bend at the tip are used. However, the 'bent' wand makes it harder to treat trees directly below the helicopter, which is the preferred option as it reduces rotor-wash.

The operator should have a risk management assessment in place for wand use, so the operator isn't able to raise it into the rotor disk. Similarly, a system needs to be established for wand positioning for landing (e.g. wand pointing to the rear of the helicopter) so that it doesn't hit the ground as the helicopter lands.

The use of an extendable carbon fibre rod that can reach outside the rotor wash zone is an option for treating trees in difficult locations. A carbon fibre wand is also recommended for all ABBA work, for health and safety reasons, as it is much safer than a steel wand, in the unlikely event of it coming in contact with the rotor or ground.

The nozzle size is important, as this needs to produce a solid stream. Nozzles that produce 'fine' or 'very fine' droplets are not recommended because the small droplets are prone to drift (Akesson & Yates, 1984).

3. ABBA METHOD

3.1 FLIGHT PATH

To ensure wilding conifers are not missed, it is important that an operational area is flown in a consistent and logical pattern that is agreed upon during the pre-flight briefing. Typical search methods used for ABBA operations include working along at the same contour heights, moving ridgeline to ridgeline or gully to ridgeline and vice versa, depending on the nature of the topography, density and locations of the wilding conifers.

The flight path and locations of controlled wilding conifers must be recorded using GPS to allow for identification of unsearched areas and accurate relocation of controlled trees for post-control auditing.

3.2 CORRECT SPECIES IDENTIFICATION

All wilding trees to be treated must be positively identified before treatment occurs to ensure only wilding conifer species are treated (unless other woody weeds are also agreed to be included).

3.3 HELICOPTER OPERATION

The ideal flying/hovering height to treat a wilding conifer using ABBA is to have the wand within 1 m of the top of the tree. This will minimise chemical drift and facilitate the accurate and precise placement of the herbicide onto the correct areas of the trunk (and upper branches if appropriate). However, wilding conifers occurring within deep fissures or other inaccessible areas may require treatment from a greater height, to ensure aircraft safety.

The pilot must fly a tight circular motion so that the wand operator can effectively direct the herbicide down and into the main stem area. Larger trees that are judged to be suitable to treat using ABBA usually cannot be treated adequately from directly above and require circular treatment, from one side then moving around to the 'topside' to complete the basal treatment. Similar circular movements may also be needed for smaller trees.

The positioning of the wand operator relative to the pilot is optional. An operator positioned in the rear of the machine on the same side as the pilot allows the pilot to see the tree that is being sprayed, which means less communication between the pilot and crew member is required. If the operator works from the front passenger seat alongside the pilot, the pilot may not be able to see the target tree, so more communication is required. Planned techniques may need to be modified depending on what is seen during flights.

3.4 REDUCING ROTORWASH

Wilding conifers should be treated directly below the helicopter whenever possible. This approach removes the temptation to over-extend the wand into the rotor wash zone. The pilot shall turn off the pump immediately if they see rotor wash of the herbicide occurring.

The minimum amount of air disturbance and rotor wash occurs when the helicopter is moving in a forward direction, but application can only occur when in a hover. Therefore, where possible, trees should be treated after allowing the air disturbance to subside. Aiming the wand directly down or arcing a little towards the back of the helicopter are the optimum positions to treat a tree and will result in minimal rotor wash bounce of herbicide off the ground.

3.5 HERBICIDE APPLICATION

Operating the wand requires diligence at all times as good coverage around the entire basal stem area (known as 'chemical ring-barking') is essential for effective control. Operators should use discretion when applying herbicide, taking into account the size and complex nature of the tree to be treated and whether another method may be more effective. During initial control operations it is better to apply more herbicide into a tree than not enough and risk having to revisit an area where trees have only been partially controlled.

Single or multi-stemmed trees, generally less than 60 cm diameter, should be treated by applying the herbicide into the tree and onto the bark of the trunk as low down as possible. The herbicide should encircle the trunk from ground level upwards for a minimum of three times the diameter of the trunk in sufficient quantity that it covers the trunk to the ground. The herbicide should be applied until it runs down the stem.

Larger trees with many upper branches and thick rough bark require more herbicide to be applied. The principle to be followed is to treat each large branch in the crown as a single tree and to apply enough herbicide so that it encircles the branch and runs down each branch onto the intersecting trunk and, from there, to the ground.

4. ABBA POST CONTROL

4.1 POST-CONTROL AUDITING

Post-control auditing for ABBA operations currently relies on visual inspections. This is best carried out once treated trees are showing visible effects of the treatment. In most cases it is recommended that post-control surveys are undertaken between 4 and 5 weeks following control in summer when the effects of the herbicide will be seen (if control takes place outside the growing season, it can take longer for the effects to be seen). It is good practice to do a final audit after 2 years (for small trees) or 3 years (for big trees), when the overall effectiveness of the control treatment can be evaluated.

The results of post-control auditing can be cross-checked against the GPS flight paths submitted from the control operation. Operators' spray diaries can also be used to verify the exact dates and times when control was undertaken. It is essential that all recording of information is valid and kept up-to-date.

4.2 PROGRAM QUALITY CONTROL

Quality control checks should be conducted to ensure operations are being carried out in accordance with agreed plans and good practice. These are also helpful in post-control auditing.

Inspections may cover a wide variety of aspects, such as:

- checking daily briefing forms;
- evidence of daily equipment checks and annual checks;
- air operational observations (from a ground position);
- observation of ground operation procedures (refuelling, chemical handling, helicopter landing/take off procedures);
- an inspection of the ABBA wand to ensure it is functioning correctly;
- inspection of tanks on helicopters to ensure they are mounted safely and are in good working condition (carried out by a qualified Licensed Aircraft Maintenance Engineer);
- tree inspections (if applicable) to confirm that herbicide has been applied correctly;
- inspection of waypoints, track logs (flight lines), spray diaries and flow rate data to confirm which areas have been treated – track logs may show an area that has not been controlled; and
- where appropriate, actual volume of herbicide used compared with both the size and number of trees treated.[3]

3 The usefulness of this information may be variable. A rule of thumb often used is to apply as much herbicide as is necessary to kill a tree, to prevent any survivors needing to be treated, as the cost of aerial re-treatment well exceeds the cost of extra herbicide used.

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Wilding Pine Network

Information for community groups: https://wildingpinenetwork.org.nz/community-groups/

Choosing the right control method: https://wildingpinenetwork.org.nz/control-guidelines-now-available/

APPENDIX 1: TERMS AND DEFINITIONS

TERM	DEFINITION
Calibration	The process of determining, checking or rectifying the graduation of any instrument that gives quantitative measurements. In this case, checking that the equipment, when operated to the specifications, delivers the required amount of chemical mixture per unit area over the bout (or effective swath) width.
Carrier	The substance that carries the herbicide formulation and any adjuvants. The formulation will specify the carrier – often water, sometimes an oil.
Chemical Safety Data Sheet (SDS)	Safety data sheets provide important information about hazardous substances, including how the substance should be safely used, stored, transported and disposed of. It provides first aid information, information about the personal protective equipment that the person handling the substance should wear and what to do in the event of an emergency, such as a spill or fire. It is mandatory to have a current, accessible safety data sheet for each of the hazardous substances in your workplace regardless of the quantity you hold.
GROWSAFE	The brand name used by the industry training organisation known as New Zealand Agrichemical Education Trust (NZAET). The role of NZAET is to ensure independent trainers train to national industry standards. NZAET appraises, accredits and reviews specialist trainers to ensure quality. It also publishes the GROWSAFE manual, a training aid for teaching NZS 8409:2004 *Management of Agrichemicals* (Standards New Zealand, 2004).
New Zealand Standard for Management of Agrichemicals (NZS 8409:2021)	The New Zealand Code of Practice approved by the Environmental Protection Authority (EPA) under the Hazardous Substances and New Organisms Act 1996. It sets out how to manage agrichemicals to comply with the relevant hazardous substance regulations. Knowledge of this industry Code of Practice is an essential part of GROWSAFE certification and Qualified Person certification.
NZTM projection	New Zealand Transverse Mercator (NZTM2000) is the projection used for New Zealand's Topo50 1:50,000 and other small-scale mapping. Spatial data users should use NZTM2000 where a projection is required within mainland New Zealand. You can convert co-ordinates between NZTM and WGS84 using the Land Information New Zealand (LINZ) online co-ordinate converter.[4]
Project Manager	Where the operation is being carried out under the National Wilding Conifer Control Programme, there will be a Project Manager – who acts on behalf of the Programme to ensure the operation is conducted appropriately and aligned to the Programme's good practice guidelines, or in the absence of such, the relevant industry codes of practice. The role includes ensuring all equipment is applicable to the task, staff or contractors are suitably trained and competent to undertake the work, relevant health and safety considerations and practices are employed and accurate data is collected and reported. The Project Manager is deemed to have the duties of a PCBU under the Health and Safety at Work Act 2015 and other applicable regulations.
Qualified person	The qualification requirements for handling a class 9 substance are defined in the Hazardous Substances (Hazardous Property Controls) Notice 2017 (EPA, 2017, Part 4 subpart C). This replaces the former Approved Handler Test Certificate process.

4 http://apps.linz.govt.nz/coordinate-conversion/

TERM	DEFINITION
Regional Air Plans	Each regional council/territorial authority has a regional plan to protect air, land and water quality. Rules in these plans contain conditions regarding the discharge of agrichemicals. While there is some national commonality between rules around the use of agrichemicals for wilding conifer management, project managers and operational controllers should be aware at all times of the specific rules and conditions in place for the regions they are working in.
Shapefile	A shapefile is a common geospatial file type compatible with ESRI and other Geographical Information System (GIS) software. It spatially describes data in the shape of points, lines or polygons (areas).
Spray drift	Spray drift is the unintentional diffusion of a pesticide outside the application area, with a possible risk to human health, the environment, or property.
Operator	A person who is involved with the control work.
Pilot	A person who operates the flying controls of an aircraft.

APPENDIX 2: LEGAL REQUIREMENTS

The key legal requirements for operators using the ABBA method to be aware of are summarised here.

- **Health and Safety at Work Act 2015** – administered by WorkSafe New Zealand, covering matters outlined in section 3.1 of this document.
  - The Health and Safety at Work Act also includes **Health and Safety at Work (Hazardous Substances) Amendment Regulations 2021,** covering hazardous substances regulations (amended November 2021)[5] around the use of agrichemicals in the workplace.
  - An MU operation-specific health and safety plan must be developed and kept on site at all times.
  - WorkSafe New Zealand has approved codes of practice (ACOPs) for various activities, such as the ACOP for Safety and Health in Forestry Operations, which is relevant for wilding conifer control.[6]
- **Hazardous Substances and New Organisms Act 1996 (HSNO Act)** – administered by the Environmental Protection Authority (EPA). The EPA approves all herbicides for use in New Zealand and places conditions such as upper limits on the active ingredient that can be applied. The upper level of active ingredient that can be applied may be higher than is shown on company label claims. The herbicides used for wilding conifers do not exceed the EPA stated upper limits and the EPA does not specify nor approve manufacturer label rates. Regulations under the HSNO Act are largely replaced by the Health and Safety at Work (Hazardous Substances) Regulations 2017, and HSNO controls have been replaced with EPA notices, such as the Hazardous Substances (Hazardous Property Controls) Notice 2017 (EPA, 2017).
- **New Zealand Standard for Management of Agrichemicals (NZS8409:2021)** – a New Zealand Code of Practice approved by the EPA that provides practical and specific guidelines on the safe, responsible and effective use of agrichemicals. The standard is available to agrichemical users through the GROWSAFE training programme. Off-label use of herbicides is permitted. See section C3.2 of the current New Zealand Standard NZS 8409:2021 (Standards New Zealand, 2021).
- **Civil Aviation Authority rules and regulations** – address the shared responsibility for safety and security of all aircraft users and participants involved with aircraft, with numerous standards to meet and maintain.
- **Biosecurity Act 1993** – among many matters, sets out which organisms are declared pests in each region, and allows for authorised persons to be appointed, with a resulting wide range of powers (including entry to places to undertake pest inspections and control, and numerous other powers). Wilding conifers are declared pests in many regions of New Zealand.
- **Resource Management Act 1993** – addresses many environmental management matters (e.g. discharging agrichemicals to air or land) and responsibilities, including the provision of regional water plans and regional air plans developed by regional councils. However, which activities are permitted or non-

5 Health and Safety at Work (Hazardous Substances) Amendment Regulations 2021: https://legislation.govt.nz/regulation/public/2021/0372/21.0/LMS576399.html

6 https://worksafe.govt.nz/topic-and-industry/forestry/safety-and-health-in-forest-operations/

APPENDIX 3: CLARIFICATION ON USE OF RESPIRATOR MASKS

Selecting Respiratory Protection Equipment (RPE)

The decision of a PCBU on the appropriate level of Respiratory Protection Equipment (RPE), in this case P3 vs. P2 with a carbon filter, must consider the following:

- What type of RPE will protect against the substance hazardous to health?
- Is the RPE suitable for the form of the contaminant (for example, mist, gas or solid)?
- Is the RPE suitable for the work (light or heavy work, short or long duration, confined space, ventilation)?
- The needs of each worker. For example, is the RPE the right size? Is it compatible with other PPE that workers need to wear? If the RPE needs to be worn for extended periods, what are the reasonably comfortable options?
- What control measures does the Safety Data Sheet (SDS) for the substance you are working with recommend?
- What type of respirator does the SDS recommend?

While P3 masks are preferable, they may not be appropriate based on the above considerations. Any PCBU can do their own analysis and determine that P3 masks are suitable for their work and make this a requirement of their contractors. This analysis would usually require expert help from occupational hygienists and suppliers of RPE. This is not practical in a helicopter.

Therefore each PCBU should follow WorkSafe guidance before selecting RPE for their task.

APPENDIX 4: ENVIRONMENTAL INCIDENT RESPONSE AND REPORTING PROCEDURE

Should an environmental incident occur in relation to the National Wilding Conifer Control program operations, the following response and reporting procedure is to be enacted.

An Environmental Incident within the National Wilding Conifer Control Program is considered to have occurred where one or more of the following is observed:

- A single event where over 1 Litre of chemical concentrate or mixed equivalent has been accidently discharged (i.e. distributed outside of control polygon or onto non-target species) into the environment.
- A loss of a threatened species or harm (dieback) to a threatened ecosystem that can be related to control operations is identified.

All environmental incidents observed during control operations are to be notified and assessed within a 48 hour period of being noticed. An environmental incident report is to be complied for each separate incident and these are to be reported in the monthly reporting.

However, where action could be immediately and safely be taken to prevent immediate danger or further harm to people and/or the environment you should ensure that action is being taken to avoid or minimise immediate danger or further harm in conjunction with reporting the situation.

ENVIROMENTAL INCIDENT REPORT CARD

1. Incident Reported by:

2. When did the incident occur? **Day:** **Time:**

3. Where did the incident occur?

4. Type of incident:

- Chemical spill to land,
- Chemical contamination of water,
- Near miss,
- Other? E.g. Cumulative effects i.e. chronic chemical build-up in areas where refuelling often takes place.

5. Cause of incident:

6. The value of any receiving environment:

- Very High (threatened species or ecosystem),
- High (native or productive land),
- Medium (intermixed native or productive species /exotic),
- Low (unproductive exotic).

7. The magnitude (severity) of the incident:

- Severe (large area, or large legacy effect)
- Moderate (partial loss of a population or ecosystem).
- Low (small area or very short temporary effect).

8. Using answers to 6 and 7 above, what is the (actual or potential) environmental impact of the incident (circle):

ENVIRONMENTAL IMPACT	VALUE OF RECEIVING ENVIRONMENT			
	LOW	MEDIUM	HIGH	VERY HIGH
LOW	Very low	Minor	Moderate	High
MODERATE	Minor	Moderate	High	Very High
SEVERE	Moderate	High	Very High	Very High

9. Actions taken to remedy the impact of environmental incident:

Contain:

Clean up:

Restore:

Prevent:

10. Any further actions needing to be taken: