

ACT Forests - Options for weed treatment adjacent to residential areas*

***A report by the Commissioner for the Environment, ACT, May 2002
(*based on a specific study at Narrabundah Hill, Stromlo Forest)***

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Overview

The justification for this investigation is derived from paragraph 12(1)(a) of the *Commissioner for the Environment Act 1993* (Attachment 1). It originated in early 2001 with requests from Weston Creek Residents Against Aerial Spraying (WCRAAS) and from Ms Kerrie Tucker, MLA, to investigate the proposed aerial spraying of weeds by ACT Forests, prior to replanting of *Pinus radiata*, in a specific locality (Narrabundah Hill, Stromlo Forest).

At a public meeting in November 2001, ACT Forests introduced several other options for weed control in that locality (see Attachment 2). The preferred option did not involve aerial spraying. We decided to continue with the investigation because of –

- (i) public concern at the proposed use of AgVet chemicals close to residential areas, and
- (ii) our agreement by that time with the Director of ACT Forests to consider whether this specific case at Narrabundah Hill would be sufficiently similar to situations to be faced in other parts of the ACT where plantation forests are close to residential suburbs, to yield some recommendations which could be adopted by ACT Forests in such similar situations.

We originally derived Terms of Reference for this investigation in meetings with the complainants and with the Director of ACT Forests. Those Terms of Reference have since been adjusted to take into account the change in proposed treatment, and now include both the efficacy of aerial spraying of AgVet chemicals, as well as the proposed alternative to aerial spraying, at Narrabundah Hill.

I understand that this current complaint was directed to me partly as a result of community awareness of my having conducted an earlier *Investigation into the ACT Government's Use of Chemicals for Pest Control* (May 1998).

That investigation covered all ACT agencies which use AgVet chemicals for pest control. My 1998 recommendations, in part, sought to have a co-ordinated approach across the ACT Government to encourage best practice pest control by ACT Government agencies.

The AgVet Chemicals Coordination Network (AVCCN) was created as a result of my 1998 Report. All ACT agencies which use AgVet chemicals are now members of that network, and are required to report on progress towards implementation of those recommendations through an annual AVCCN report, which is an annexure to the Department of Urban Services Annual Report. Under the *Commissioner for the Environment Act 1993*, the Commissioner for the Environment Annual Report also includes comments on Government actions in response to “special” reports (see Attachment 1).

I maintain a strong preference for application of the Precautionary Principle in all cases of AgVet chemicals use, and strongly support the Government’s commitment to Integrated Pest Management (IPM).

Those philosophies were expressed in my 1998 Report and have been carried into this investigation.

My related belief that ACT Government agencies should continue to carefully analyse the merits of use of specific products, even though those products may continue to be approved by the National Registration Authority (NRA), has led to detailed discussions with the ACT Environment Protection Authority (EPA) to clarify the role of the EPA in this regard, in practice. I note that the current role of the EPA (as is the case for all States and Territories) in relation to AgVet chemicals, is solely to ensure that end use and storage are in accordance with directions of the manufacturer, as approved by the NRA.

All of these issues have (re)arisen in the context of this current investigation that is specific to ACT Forests’ proposed operations at the Narrabundah Hill site, close to a residential area, but also raises matters that have wider implications. Recommendations have therefore been made for actions by ACT Forests and by the EPA.

As this Report does not require a Government response that is tabled in the Assembly, and in view of the role of the EPA in relation to the use of AgVet chemicals, I have structured certain recommendations so that the EPA may raise them with the AVCCN and have outcomes reported in the AVCCN annual report for 2001-02. I would then comment in my Annual Reports.

I have noted the functions that at times present conflicts for ACT Forests and its responsibility to have its commercial operations run profitably. These include the community requirement for continued recreational use of ACT Forest plantations and the Environment ACT requirement that woody environmental weeds, such as Blackberry, need to be controlled.

ACT Forests also needs to function sustainably, or at least to be progressing towards sustainable operations. The need to have a profitable operation therefore must include

the analysis of social, cultural and ecological factors, as well as the financial issues. Balancing the ostensible conflicting social, cultural, ecological and financial aspects of operating is effectively what I see as the business of sustainable management.

Environmental or sustainability issues may present specific challenges to be addressed and resolved, but they can not be overlooked or ignored.

In its contribution to the AVCCN annual report for 2000-01, ACT Forests indicated control activities of Blackberry, Broom, Serrated Tussock, Woody weeds, Willows and pine wildlings at a variety of sites. The report did not identify the method. There was no indication of ACT Forests' adoption of IPM practices. However, in discussions with ACT Forests of our draft report, we have been advised that there has been considerably more adoption of IPM by ACT Forests than indicated in the AVCCN Annual Report. ACT Forests has provided the following comments:

“ACT Forests has been actively minimising the amount of herbicide used over the past 12 years. Whilst not overtly described as such, ACT Forests' weed management strategy is part of an integrated pest management program. The strategy includes a range of activities aimed at reducing herbicide use. However, in cases where herbicides have been deemed the most appropriate form of weed control, compromises have been made to reduce potential impacts (of those chemicals).

“Several non-chemical weed control measures are also implemented as part of ACT Forests' weed management strategy including:

- cultivation;
- crusher rolling;
- biological control;
- increased stocking of commercial species; and
- mechanical removal, particularly of young pine wildlings.

“In areas where chemical application is considered the most prudent way to balance management objectives set for ACT Forests, site specific applications procedures are developed. ... “Points considered during the selection of an appropriate option include:

- the weed spectrum present on the site;
- the soil type;
- the structure of remnant natural vegetation on the site;
- the likely cost effectiveness of various treatment options;
- the ground surface/access conditions and the impact this will have on application techniques;
- the level and nature of public use; and
- the desired outcome following the treatment with regard to knockdown and residual control of weeds.”

This is the process that would have been applied to Narrabundah Hill compartment. ACT Forests is encouraged to report to the AVCCN according to the process used for selection of appropriate treatments.

Those actions will also make it easier for ACT Forests to accommodate specific aspects of my recommendations.

Weed treatment can be prior to planting (that is, during Autumn) or post-planting (during Spring). The option recommended in the November Options Paper is for post-planting. The active ingredients in that option are triazines (atrazine/hexazinone) which are often preferred for forestry use because they do not harm *Pinus radiata*. Once the seedlings are established for eight weeks, the immediate area around each seedling can be treated for weeds without harming the young *Pinus radiata*. Treatment is more likely to be required only once, rather than twice, with this post-planting method, which is therefore more efficient from a purely operational point of view. ACT Forests advises that it also uses hexazinone in the pre-planting mixture.

ACT Forests also advises that weed treatment of any one specific location to facilitate growth of *Pinus radiata* seedlings normally occurs only once in 30 years. A weed-free site for the first 12 months is critical to survival of the seedlings and to successful tree establishment. Once the tree reaches 2 metres (after about two years) it is generally considered that tree growth is not detrimentally affected by weed growth.

However, I am concerned at the reports from overseas studies of the adverse effects of substances of the class “triazines” which include the proposed substances atrazine and hexazinone.

In addition to the proximity of Narrabundah Hill to residential areas, this particular year presents a further complicating factor for ACT Forests. The extensive Christmas 2001 fires present ACT Forests with the necessity to replant a much larger area of *Pinus radiata* this year (something like 1,100 hectares), compared with their normal schedule of around 600 hectares. Programs for the year have had to be radically revised. Pressure to complete the replanting in the timeframe will lead ACT Forests towards the most efficient and cost-effective methods for control of weeds, without adversely affecting the young pine trees.

I acknowledge that pressure and the reasons for it, but do not support any measures that may have adverse environmental effects.

I can not ignore what I see as my responsibilities as Commissioner for the Environment to use information in a precautionary way to avoid, as far as is practicable, mistakes such as have been made in the past because of the adoption of procedures or techniques that were not adequately evaluated prior to their adoption.

That interpretation of my responsibilities naturally exposes me to criticism by those who favour short-term economic considerations, rather than environmental sustainability (in the fullest sense of the ACT’s definition of the environment – see Attachment 3).

My recommendations take into account my stated responsibilities as Commissioner for the Environment, and also the circumstances of ACT Forests stated in this Overview.

Terms of Reference

1. Safety of proposed AgVet chemicals treatment in terms of
 - the chemicals to be used (individually and as a mixture) and
 - the physical form and method of application.
2. Adequacy of ACT Forests' consultation process
3. Adequacy of the procedures to be employed by ACT Forests to -
 - notify all residents, including, in particular, those with chemical sensitivity
 - reduce the risk of adverse side effects
4. Whether there are safer, realistic and economically viable alternatives for controlling weeds when planting pines
5. Evidence that native species using the region for habitat will not be adversely affected
6. Demonstration that the mixtures will not contaminate surface and ground water

Recommendations

I recommend that -

1. as a matter of course, ACT Forests demonstrate and record that it has investigated Integrated Pest Management (IPM) as the preferred method of pest control, and reports progress through the Agricultural and Veterinary Chemicals Coordination Network (AVCCN) annual report accordingly.
[A recommendation will be made in my 2001-02 Annual Report for the EPA to take this recommendation to the AVCCN for consideration of adoption by other members.]
2. ACT Forests does not authorise the use of any product containing the AgVet chemical atrazine, and ACT Forests adopts its best IPM endeavours to avoid or, otherwise, minimise the use of hexazinone in its practices.
[A recommendation will be made in my 2001-02 Annual Report for the EPA to take this recommendation to the AVCCN for consideration of adoption by other members.]
3. ACT Forests investigate modification of the "weed-a-metre" to enable application of granular AgVet chemicals, other than triazines, on weeds surrounding the seedling, without harming the seedling. (This recommendation is a corollary to Recommendation 2.)
4. in consultation with the EPA, ACT Forests develop a policy for public notification of proposed weed treatment, in areas that are adjacent to

residential areas, and/or are regularly used for recreational purposes, for all AgVet chemicals applications (see also Recommendation 12).

The policy must address at least the following points -

- the target people/residents to be notified, which must include people on the Chemically-Sensitive List,
- the types of notification to be undertaken (eg public meetings, letterbox drop, signage)
- an obligation to specify on all signage the type of danger if the product label carries the Signal Words DANGER – POISON (eg Signage for products containing hexazinone should show words like DANGER – POISON – MAY CAUSE SERIOUS AND IRREVERSIBLE EYE IRRITATION)
- the timing of public notification activities in relation to the proposed treatment and the duration for which signage should remain in place
- how members of the public may comment on the proposed actions

In the specific case of Narrabundah Hill, ACT Forests consult again with Weston Creek residents prior to weed treatment, to discuss the proposed method of weeds treatment in the Narrabundah Hill compartment, arising from the Options Paper consultation and this report.

[With the exception of (e), this recommendation will be made in my 2001-02 Annual Report for the EPA to take this recommendation to the AVCCN for consideration of adoption by other members.]

5. ACT Forests demonstrate to the EPA that any AgVet chemicals intended for mixing are compatible, in accordance with directions for use or with the product label, as approved by the National Registration Authority (NRA), or other authority acceptable to the EPA, and obtain approval from the EPA before using such mix. Such approved mixes should be reported in the AgVet Chemicals Coordination Network (AVCCN) annual reports each year as part of the list of AgVet chemicals and quantities used by ACT agencies during that year. (See also Recommendation 8)

[A recommendation will be made in my 2001-02 Annual Report for the EPA to take this recommendation to the AVCCN for consideration of adoption by other members.]

6. the EPA urge the NRA to investigate, as a matter of urgency, the effects (compatibility) of commonly mixed AgVet chemicals, and ensure that directions for use, labels and Material Safety Data Sheets for AgVet chemicals report the products/AgVet chemicals that can be mixed.
7. wherever practicable, as a way of reducing AgVet chemicals use, ACT Forests use a “cut and daub” method of application on woody environmental weeds, after investigation of IPM methods has identified that AgVet chemicals should be used.

[A recommendation will be made in my 2001-02 Annual Report for the EPA to take this recommendation to the AVCCN for consideration of adoption by other members.]

8. as a result of the Audit of ACT Forests' Aerial Spraying Operational Procedures at Compartment 419, Kowen Plantation (July 2001) ACT Forests take the following actions –
- (a) conduct new tests with an approved mix of chemicals (see Recommendation 5), and provide evidence to the EPA for approval, that a different mix would produce spray-drift of not more than 60 metres (see Recommendation 8(c), and notify the Commissioner for the Environment accordingly.
(The mix of AgVet chemicals used in the audit was not acceptable to the Environment Protection Authority (EPA). This basically invalidates the audit results.)
 - (b) address other anomalies in the audit report in consultation with the EPA, as noted below:
The claim that the audit complied with Environmental Authorisation 0011 is dubious on the grounds - that -
 - (i) there is no confirmation that the trial did not at any time apply herbicide within 150 metres of the dam;
 - (ii) the environmental authorisation requires that herbicides not be applied within 150 metres of any occupier such as dwelling or school, or of a water body. (That is, any water body not a water body used for domestic consumption.); and
 - (iii) results for water quality testing in the dam had not been completed at the time the report was released.
 - (c) use a mixture that is acceptable to the EPA to pursue the aerial spray audit recommendation to “employ laboratory studies, including the use of wind tunnels and computer models, to more accurately estimate droplet sizes and spread factors of the spray mixture under different meteorological conditions and operational parameters (noting that) the results of such studies may provide a more definitive set of conditions under which helicopter application of herbicides may be made adjacent to sensitive areas.”
 - (d) based on the audit results that spray-drift did not extend more than 60 metres beyond target boundaries, consider rotary blade aerial spraying as an option in forestry compartments that are adjacent to residential areas, subject to the following conditions, in addition to the usual compliance with Environmental Authorisation 0011 and all established procedures:
 - (i) appropriate follow-up of other parts of this and all recommendations in this report,
 - (ii) the use of “best practice” nozzles (at this point, micronaire nozzles), and
 - (iii) the leaving of a substantial buffer, that is, for preference, at least consistent with the EPA’s requirement in environmental

authorisations, currently, that herbicide should not be applied within 150 metres of any occupier, such as a dwelling, school or of a water body.

However, in terms of its multiple functions, and a very real need for community consultation about methods of weed treatment adjacent to residential areas, ACT Forests might be advised to adopt a less “provocative” method of treatment.

9. ACT Forests consult with Dr Will Osborne, University of Canberra, to identify whether there are any sites where particular care needs to be taken to preserve frog breeding sites, and to receive advice on ways to minimise negative impacts of AgVet chemicals spraying on frog breeding cycles.

[A recommendation will be made in my 2001-02 Annual Report for the EPA to take this recommendation to the AVCCN for consideration of adoption by other members.]

10. as an alternative to AgVet chemicals use, ACT Forests investigate the practicability of programs such as Work for the Dole or offenders on Community Service Orders, through ACT Corrective Services, for the manual removal of weeds, and/or mulching to suppress weed growth. If this action is not practicable this financial year because of the added pressure resulting from the Christmas 2001 fires, then I would urge that it be investigated in 2002-03 and results reported on in the AVCCN annual report.

[A recommendation will be made in my 2001-02 Annual Report for the EPA to take this recommendation to the AVCCN for consideration of adoption by other members.]

11. the EPA review use of the term “water body” in Environmental Authorisation 0011 (and other Environmental Authorisations, as relevant), in such a way as to maintain the original environmental protection, and also to ensure consistency with directions for use of the AgVet chemicals products, and to ensure that due care is taken by ACT Forests (and others, as relevant) to minimise the risk of environmental harm in intermittent watercourses if significant rain events occur following herbicide treatment.

12. as a consequence of a requirement in Environmental Authorisation 0011 that proposed application of only Schedule 7 poisons be publicly notified, the EPA adopt its best endeavours through the AVCCN that –

- a) all use of Schedule 7 poisons by or on behalf of ACT Government agencies -
 - (i) be only as a last resort
 - (ii) be such AgVet chemicals that can be applied by direct application methods on the target species, such as daubing, and not sprayed; and
- b) reasons for use of Schedule 7 poisons by AVCCN members be justified and documented, including that a less toxic substance was not effective, such documentation to be included in the AVCCN annual report

Background to the Investigation

On 2 February 2001 Mariann Lloyd-Smith, Coordinator of the National Toxics Network Inc, sent me a copy of a letter she had written to Tony Bartlett, Director, ACT Forests, about proposed aerial herbicide application in Narrabundah Hill in the Weston Creek area. On 20 February 2001 Kerrie Tucker, MLA wrote to this Office requesting that I investigate the matter. On 27 February 2001 I telephoned Tony Bartlett about the intentions of ACT Forests. In part, Tony Bartlett told me that ACT Forests intends to spray in Autumn 2002 and to replant in Winter 2002.

I have retained a particular interest in the ACT Government's use of chemicals for pest control since I conducted an investigation into that matter, the report being completed in May 1998 (*Investigation into the ACT Government's Use of Chemicals for Pest Control*). Since that time, members of the community have approached me on a number of occasions about aspects of chemicals use, and, since the release of my report, I coordinated a series of discussions between ACT Government agencies, industry members and members of the public about processes for public notification of intention to spray. I include an update in each Annual Report on progress of the Agricultural and Veterinary Chemicals Coordination Network (AVCCN), which was created as a result of my recommendations.

Other commitments to reports required under legislation, prevented any investigative activity on our part at the time of the original letter in January 2001. In early July 2001, I met with Kerrie Tucker MLA and members of the Weston Creek Residents Against Aerial Spraying who had also communicated with me about ACT Forests' proposals. After discussion, I informed the participants at that meeting that I would investigate the situation.

Under subsection 14(3) of the *Commissioner for the Environment Act 1993*,

Where—

(a) a person who—

(i) has made a complaint to the commissioner with respect to action taken by an agency; and

(ii) has complained to the agency with respect to that action; and

(iii) informs the commissioner that the agency has not responded or has not responded adequately; and

(b) the commissioner is of the opinion—

(i) if the agency has not responded—that, since the complainant complained to the agency, a reasonable period has elapsed in which the agency could have responded; or

(ii) if the agency has responded—that the response was not adequate;

the commissioner shall, subject to this section, investigate the action.

In this case, while ACT Forests remained willing, and did continue to communicate with the community group about its intentions, I perceived the continuation of the proposal to aerially spray the forest compartment prior to replanting as warranting some investigation.

The following Draft Terms of Reference (TsoR) were identified at that meeting:

1. Safety of aerial spraying in terms of
 - the chemicals to be used (individually and as a mixture)
 - the potential for spray drift
2. Adequacy of ACT Forests' consultation processes
3. Adequacy of the procedures to be employed by ACT Forests to -
 - notify all residents, including, in particular, those with chemical sensitivity
 - reduce the risk of adverse side effects
4. Whether there are safer alternatives to controlling weeds when planting pines
5. Evidence that native species using the region for habitat will not be adversely affected
6. Demonstration that the mixtures will not contaminate surface and ground water

In accordance with the requirements of subsection 15(1) the *Commissioner for the Environment Act 1993*, I subsequently notified the Chief Executive of the Department of Urban Services, to whom the Director of ACT Forests reports, of my decision to investigate the ACT Forests' proposals before any aerial herbicide application was conducted. The draft TsoR were communicated to the Chief Executive with an invitation to discuss the efficacy and aptness of those Terms of Reference.

Since that time, we have met formally with Tony Bartlett Director of ACT Forests (hereafter, 'Tony Bartlett') and have attended at least two public meetings at which he has spoken to members of the Weston Creek community about ACT Forests' proposals.

On 5 October 2001 we discussed the draft Terms of Reference with Tony Bartlett and agreed that TsoR, numbers 4 and 5 required a slight adjustment. Specifically, we recognised that there are obviously safer alternatives than AgVet chemical use. We have therefore addressed the fourth ToR as "Whether there are safer, realistic and economically viable alternatives for controlling weeds when planting pines".

With regard to the fifth ToR, the original letter to Tony Bartlett from the National Toxics Network referred to "vulnerable" native species, specifically a report on the toxicity of glyphosate and glyphosate-based formulations to frogs and tadpoles. I would not normally use the term "vulnerable" in this context, because of its specific meaning for native species under the *Nature Conservation Act 1980* (as amended). However, the implication of dropping the qualifier altogether extends consideration to all native species, which is not practicable. While I leave the wording as is, I propose to discuss the fifth ToR in terms of the original concerns expressed by the National Toxics Network.

At our meeting of 5 October 2001, Tony Bartlett asked whether our investigation would be specific to Narrabundah Hill and whether further investigations may occur if he proposed to spray in other areas abutting residential development. We agreed that our investigation should be applicable to all areas where ACT Forests abut or are adjacent to residential development.

At the same time, Tony Bartlett also advised that the report of the Audit of ACT Forests' Aerial Spraying Operational Procedures had still not been finalised. The trial was conducted in Compartment 419, Kowen Plantation on 2 July 2001. Although the report had been expected around September, we did not receive a copy until 21 November 2001, and even then, results of water quality testing were not available.

The report was received just seven days before the Weston Creek Community Council meeting at which ACT Forests circulated an Options Paper, which indicated a shift away from the aerial spraying proposal. The recommendation in that paper was for manual spot spraying of planted seedlings in Spring 2002, using Forest Mix® Granular Herbicide (containing active ingredients 50g/kg hexazinone and 150g/kg atrazine) in a "weed-a-metre" – a conical applicator through which granules are dropped in a metre-wide circle. The process controls weeds to a one-metre diameter circle around the planted tree for up to a year. Because that process would not address all weeds in the compartment, ACT Forests also proposes to "control any significant infestations of weeds away from the planted trees with herbicide at the appropriate time". To quote further from the recommendations of the Options Paper:

This is ACT Forests' preferred weed control option on this site based on the following factors –

- it effectively reduces the weeds around the base of the planted seedlings;
- it is relatively economical
- it takes into account public concerns
- it maintains the remnant mature eucalypts within the compartment
- it is practical; and
- contractors have the necessary equipment to do the operation."

Comments on the Options Paper were sought by ACT Forests by 21 December 2001. Because of the time of year, ACT Forests granted the Weston Creek Residents Against Aerial Spraying an extension to 11 January 2002.

At that point, we reviewed the purpose of our investigation, given that the investigation and the draft TsoR had arisen as a result of a proposal to aerially spray at Narrabundah Hill.

We decided not to comment separately on the Options Paper, but to still report on the broader issue of AgVet chemical treatment of weeds on ACT Forests lands that abut/are adjacent to residential areas. To do this I will consider the TsoR from a perspective of both aerial spraying and the recommendations in the ACT Forests Options Paper of November 2001.

The Terms of Reference were therefore modified to be more general, instead of concentrating only on aerial spraying.

Discussion of the Terms of Reference

***1. Safety of proposed AgVet chemicals treatment in terms of
- the chemicals to be used (individually and as a mixture) and
- the physical form and method of application.***

Residents of Weston Creek were/are particularly concerned with the safety of any aerial spraying herbicide treatment processes to be used by ACT Forests in such close proximity to a residential area, and in an area that is regularly used by the public. A survey on 14 July 2001 by Katy Gallagher (now MLA) of approximately 120 houses in Jemalong Street, Eucumbene Drive and Tullaroop Street, Duffy revealed the main concerns were

Concern	% (of total number)
Health	35.7%
Aerial Drift	28.5%
More Info needed	16.6%
Pets	12%
Birds and bird food	12%
Garden damage	12%
Kids safety (other than health)	4.8%
Environment	4.8%
Pregnancy risk	2%
Not confident of guarantees	2%
Lack of consultation	2%
Want to get out when it's done	2%
Is it necessary?	2%
Want direct spraying	2%

Safety in terms of chemicals to be used –

This section specifically addresses the AgVet chemicals used in the aerial spray audit and the AgVet chemicals in the recommended option in the Options Paper of November 2001 (recommended November option). These were –

- For the aerial spray audit - Roundup Dry® (containing 680g/kg glyphosate as the monoammonium salt), Velpar DF® (containing 750 g/kg hexazinone) and Brush-Off® (containing 600 g/kg metsulfuron methyl). The organosilicone surfactant Pulse® and emulsified canola oil were included at a rate of 100 mL/ha and 600 mL/ha respectively as spray adjuvants (additives) to enhance the activity of applied herbicides. This mix was originally intended for pre-planting application in the Narrabundah Hill compartment in Autumn 2002.
- For the recommended November option - Forest Mix® Granular Herbicide (containing active ingredients 50g/kg hexazinone and 150g/kg atrazine). Application would be by manual spot spraying of planted seedlings in Spring 2002 using a “weed-a-metre” – a conical applicator through which granules are dropped in a metre-wide circle.

Other herbicides would be used as necessary for both options.

Our investigation has revealed the following points about the AgVet chemicals used in the aerial spraying trial or intended to be used in the recommended November option:

- a) With the exception of metsulfuron methyl, all AgVet chemicals involved in the aerial spraying proposal and the “weed-a-metre” proposal are classified as Schedule 5 poisons, in the Guidelines for Classification of Drugs and Poisons for the National Drugs and Poisons Schedule Committee, under the *Therapeutic Goods Act 1989*. Schedule 5 poisons in those Guidelines are described as having low toxicity or a low concentration; a low to moderate hazard; are capable of causing only minor adverse effects to human beings in normal use and require caution in handling, storage or use. Nevertheless hexazinone can cause serious and irreversible eye irritation (see (e) below).
- b) Since the audit trial, the EPA has revealed that the documentation held by ACT Forests on the mix of Roundup Dry®, Velpar DF® and Brush-Off® was not adequate. The EPA has advised ACT Forests that any mixing of AgVet chemicals must be approved, that is, in accordance with directions for use, of the AgVet chemicals involved, or product labels, as approved by the NRA.
- c) By contrast, the NRA appears unconcerned. An officer of the NRA, informed this Office that there is no problem with mixing Velpar, Glyphosate and Brush-off – that it is “standard practice” and there are no unintended effects that the NRA officer was aware of. He also indicated that mixing them together does not change how they act when they get into the environment, that is, how they break down (see also para (k) of this section).
- d) Atrazine (one of the active ingredients in the recommended November option, Forest Mix®) was first registered in Australia in 1960-61 for the control of annual weeds and seedling grasses in broadacre crops and along fence lines, and irrigation channels.

In 1977, its use was extended to include the control of weeds in pine plantations. By the mid 1990s, atrazine was recognised as one of the most commonly detected pesticides in surface and groundwater around Australia (eg central and north west

Tasmania, South Australia).

Atrazine has been banned in Germany, Italy, Norway, Sweden (and most recently France), due to its high mobility in soil and to its potential to contaminate water.

It is classified as a Schedule 5 poison.

Atrazine has been classified as a Restricted Use Pesticide in the USA, due to its potential for groundwater contamination. As a Restricted Use Pesticide, only certified applicators may purchase and use it. Atrazine was one of the first five pesticides selected for review by the National Registration Authority's Existing Chemicals Review Program. An Interim Report in 1997 resulted in conditions being placed on its use, particularly around open waterways and drains, and changes to the directions for use. The final report in draft form was released for comment by the NRA in March 2002. That report does not recommend that atrazine be banned in Australia.

Atrazine is also a known endocrine function disruptor, inhibiting the functioning of testosterone, progesterone and estrogen. Lloyd-Smith (2001) reports that the National Registration Authority review of atrazine dismissed concerns regarding the endocrine function and carcinogenic potential of atrazine, but that aspect has been given more credence again in the US from recent biological research indicating that "the most commonly used herbicide in the United States appears to disrupt the sexual development of frogs at extremely low levels, raising new questions about its safety..." (*Canberra Times*, 18 April 2002, *Washington Post*, 22 April 2002)

- e) Hexazinone is the other active ingredient in Forest Mix® and is also in Velpar DF®. It has been used by ACT Forests for some time. As stated above, as a Schedule 5 poison, it is considered a slightly toxic compound. However, effects due to acute exposure may include irritation of the eyes, nose and throat, as well as nausea and vomiting. It has the ability to cause serious and irreversible eye irritation (Kamrin, 1997).
- f) Both hexazinone and metsulfuron methyl have the potential to contaminate groundwater at very low levels. Hexazinone, one of the triazines, is very poorly absorbed to soil particles, very soluble in water, and slowly degraded, so it is likely to be mobile in most soils and has the potential to contaminate groundwater. In 1999, the chief of national forests in California declared a moratorium on aerial application of hexazinone after its "off target" impacts on waterways (National Toxics Network January 2001)
- g) In terms of mixing AgVet chemicals, the National Toxics Network letter also raised: (i) the lack of information about solvents and surfactants included in formulations which are not disclosed under commercial confidentiality arrangements. This was raised in my earlier investigation and, I believe, is still an issue for chemically sensitive people. (ii) unknown health and environmental impacts of low level pesticide mixtures in groundwater.

- h) Recent research by Kate Langdon (2001) in NSW for Dr Michael Warne, Senior Research Ecotoxicologist with the NSW EPA has demonstrated that not enough is known about effects of mixing of chemicals¹.

The results of the experiment have indicated an antagonistic reaction – that is, the toxicity of the AgVet chemical mix is less effective than the individual herbicides, if used separately. Results were not conclusive as to which combination is actually causing the antagonistic response, as three AgVet chemicals were combined. However, Langdon notes Tomlin (2000) and Baylis (2000) who have found that the toxicity of glyphosate (the active ingredient of Roundup Dry®) has been found to be reduced when mixed with other herbicides. Such information is supported by directions for use of Roundup provided by Monsanto Australia Limited in the statement “The addition of crystalline ammonium sulfate to Roundup, when used to control ANNUAL weeds MAY ... assist in minimising the antagonism in tank mixes of Roundup and flowable triazine herbicides.” There is no such corollary on the directions of use for Velpar® DF.

- i) While glyphosate (Roundup) is often considered to be not residual (as indicated above), at least one report notes an estimated average half-life of 47 days. Reported field half-lives range from 1 to 174 days. Its half-life in pond water ranges from 12 days to 10 weeks. It is strongly absorbed to most soils, but does not leach appreciably (<http://www.hancock.forests.org.au/docs/herbicides.htm> #Glyphosate). The safety directions do not report toxicological effects, ecological effects or environmental fate.
- j) National Toxics Network’s letter of 23 January 2001 also reports that a study of contamination of forest ponds found glyphosate residues in sediment 400 days after application. The half-life in pond sediments in a Missouri study was 120 days and persistence was over a year in pond sediments in Michigan and Oregon.
- k) The following comments about the AgVet chemicals used in the aerial spraying audit were obtained from EPAs around Australia and New Zealand:
- Hexazinone (Velpar) has a relatively high potential to leach to groundwater. Predetermining factors for concern would be: a sandy soil; low water-holding capacity and low organic carbon content (PT Holland and others, 1998)

¹ The research was designed to determine the type of toxicant interaction of a mixture of herbicides that has been used under field conditions in NSW. Specifically, the research was to ascertain whether the result of mixing Oust®, Roundup Dry® and Gesatop® would be additive, antagonistic or synergistic when applied to oats *Avena sativa*. “Additivity occurs when the toxicity of a combination of compounds is exactly what would be expected by adding together the toxic effects of each compound when administered separately (Calabrese 1991). Antagonism occurs when the toxicity of the mixture is less than would be expected by adding together the toxic effects of each compound when administered separately (Landis & Yu, 1995)... Synergism refers to instances where the toxicity of the mixture is actually greater than what would be expected by simply adding together the toxic effects of each compound when administered separately (Landis & Yu, 1995). In general, chemicals with the same modes of action should be additive, whereas, chemicals with different modes of action are unlikely to be simply additive (Calabrese, 1991)”. Sulfometuron-methyl is the active ingredient of Oust®, which is in the same group of herbicides as sulfometuron methyl, but we have not been able to identify the extent of similarity for this report.

- The use of hexazinone seems excessive – from the human health point of view. Roundup and Brush-off would seem to be better choices (Jim Frith, WA farmer with more than 40 years' experience as a farmer, user of herbicides "because he can find no other alternative" and member of Friends of the Forest (referred by the WA EPA) (pers.comm, November 2001)

- The herbicides themselves are reported as not of high toxicity to humans/animals, but all are quite toxic to most plant species.... The combination of the three herbicides listed would be unusual, particularly the inclusion of hexazinone, because the glyphosate would kill everything (and more) than the hexazinone would. Presumably the job is designed to rid the site of wilding pines (and other woody plants), so the inclusion of hexazinone of which pines are tolerant, is unexpected. In terms of environmental effects, a lot depends on the application rate. Hexazinone is very residual and Eucalypts are quite sensitive to it. It can be washed off sprayed areas in heavy rain, and end up killing off-site plants, if the job isn't done well. Roundup is not residual at all, and Brush-off is somewhat residual (Peter Fagg, Forestry Victoria, pers.comm, November 2001).

- 1) The ACT Forests' Options Paper points out that the Narrabundah Hill area is scattered with numerous mature remnant Red Gum *Eucalyptus blakelyi* which ACT Forests' seeks to preserve. Hexazinone becomes activated by rainfall or irrigation water. We note from the comments above that Eucalypts are quite sensitive to hexazinone and that it can be washed off sprayed areas in heavy rain, and end up killing off-site plants.

Safety of proposed physical form and method of application

Aerial spraying –

The purpose of the audit at Kowen plantation on 2 July 2001 was to "assess ACT Forests' compliance with legislative obligations and other procedures covering the aerial application of herbicides and to monitor any movement of herbicide beyond the treated area", as a way of allaying residents' concerns about health and spray drift arising from this sort of herbicide application.

The audit report concluded that –

- There was no detectable drift beyond 60 metres of the target area;
- ACT Forests' aerial spraying operation complied with its current environmental authorisation issued by the ACT Environmental Protection Authority;
- ACT Forests complied with the "Code of Practice for the Safe Use of Agricultural Chemicals by Aerial Application";
- ACT Forests complied with its Standard Operating Procedure for Application of Herbicide by Helicopter; and
- ACT Forests complied with its Prescription for the Application of Herbicide by Helicopter and its Code of Forest Practices.

The audit report was deficient in several ways:

- Under the subheading ‘spraying conditions’ in the audit report, it is noted that the average distance from the target areas to the dam is approximately 180 metres. There is no confirmation that the trial did not at any time apply herbicide within 150 metres of the dam.
- The audit report claimed compliance with the condition in Environmental Authorisation 0011 that herbicide not be applied within 150 metres of a body of water used for domestic consumption. The environmental authorisation actually requires that herbicides not be applied within 150 metres of any occupier such as dwelling or school, or of a water body. (That is, any water body not a water body used for domestic consumption.)
- Water quality testing (of the dam in the target area) had still not been completed at the time the report was released.

Concern was expressed in the National Toxics Network letter of January 2001 that drift from aerial application, both by helicopter and fixed plane, have measured glyphosate up to 800 metres from application (the maximum distance tested).

ACT Forests conducts aerial spraying by way of helicopter, and the intention until November 2001 was to aerially spray the cleared compartment at Narrabundah Hill in Autumn 2002. For the audit which was conducted at Kowen in July 2001, hydraulic nozzles with an application rate of 100 litres per hectare were used. This is reported as the standard practice in Australia. However, it is acknowledged that these nozzles are not ideal as they produce a variety of droplet sizes. (Large droplets are more likely to drop onto the target area. Fine droplets are more likely to drift beyond the target area.) We are advised by Tony Bartlett that the hydraulic nozzles were deliberately used for this audit, to test the “worst case scenario”.

A more precise alternative in the form of micronaire nozzles exists, which produces droplets of a consistent size. ACT Forests has subsequently advised that it uses this technology for aerial spraying as a matter of course (although the wording of the Audit Report implied that it did not).

“Standard practice” in Australia does not appear to be “best practice” as far as the nozzle types used in aerial applications of herbicides are concerned. It is encouraging to note that ACT Forests employs “best practice” nozzles.

During the audit, the wind speed and direction varied, though remaining within the allowable parameters. This variation also increased the risk of drift, adding to the “worst case scenario”.

Suitable weather conditions for helicopter application of herbicides have been prescribed by ACT Forests to minimise the drift of fine droplets. Droplet size is also contingent upon the particular chemical/s used.

Of the three AgVet chemicals in the mixture, hexazinone was the only chemical tested for drift, and drift was contained within 60 metres of target boundaries. One must assume that the drift of glyphosate and metsulfuron methyl would be similarly

contained, if the mixture is homogeneous and has not separated into different phases, but I maintain that a different mix would need to be tested for drift.

The audit report recommended that ACT Forests “employ laboratory studies, including the use of wind tunnels and computer models, to more accurately estimate droplet sizes and spread factors of the spray mixture under different meteorological conditions and operational parameters.... [in order to] provide a more definitive set of conditions under which helicopter application of herbicides may be made adjacent to sensitive areas.” I support this as a recommendation, using a mix of AgVet chemicals that is approved by the EPA.

See also the section on Safety in terms of chemicals to be used.

Manual application of granular herbicide with a conical “weed-a-metre” –

ACT Forests has assessed that this method meets a number of requirements, including that it is relatively economical, practical, effective and takes into account public concerns about spray drift and remnant mature Eucalypts within the compartment. Obviously the manual application of granular herbicide (the November option) obviates the risk of spray drift.

The recommended product Forest Mix® is not yet registered in the ACT, although I am advised that the NRA can issue an “off-label” permit for use in the ACT of AgVet chemicals that are registered in NSW, pending registration in the ACT. Forest Mix® is apparently scheduled for registration in the ACT in July 2002, and if this registration goes ahead at that time, its use in September should not require a specific permit.

As a document for public comment, I have found the Options Paper wanting. In terms of describing the processes for each option, for example, both options 3 (strip spray rows with dry flowable herbicide by a boomspray) and 6 (rough heaping along with low intensity autumn burn followed by ground based spraying) appear to include the need for ground preparation prior to planting. However, as I understand the process, such preparation is necessary regardless of the method of weed treatment used.

In addition, the AgVet chemicals associated with each option are not identified except as “granular herbicide”, “dry flowable herbicide” “boom-spray” and “ground-based spraying”. It therefore does not provide the necessary detailed information for full consideration to be given to the options. Members of the WCRAAS clearly have direct knowledge of AgVet chemicals, or have access to such knowledge. The Options Paper did not identify specific products or active ingredients which would provide the sort of information that such a group would be seeking. That said, at the public meeting when the Options Paper was released, the AgVet chemicals associated with the recommended option were stated verbally and some brochures made available.

The Options Paper did include mechanical methods and did provide indications of the amount of AgVet chemicals that would be used by each option, relative to what would be used in an aerial application.

It is noted that treatment for any one given forestry compartment is reported by ACT Forests as normally being only once in every 30 years.

Because of the characteristics of both hexazinone and atrazine, which are discussed below, I remain unconvinced about the recommended option, although I believe the weed-a-metre application to have considerable advantages over other applications in terms of no spray-drift and reduced chemicals usage.

Related Comments and Conclusions

The audit report is deficient in several ways, but it would appear probable that at least some of these deficiencies are in the way the report was written, rather than in the actual procedures adopted. This situation is far from ideal, given that the report has become a public document, but for this report, I have taken on board feedback provided by officers of ACT Forests.

Of more significance, the mix of AgVet chemicals used has not been verified. The recent Langdon research on mixing AgVet chemicals suggests that there is a need to have confirmation of the compatibility of an intended mix. This is confirmed by the EPA's direction to ACT Forests to not use the Roundup Dry® (containing 680g/kg glyphosate as the monoammonium salt), Velpar DF® (containing 750 g/kg hexazinone) and Brush-Off® (containing 600 g/kg metsulfuron methyl) unless the mix is supported by NRA approved directions for use or labelling of the products.

I believe the results of the audit can not therefore be used as verification of the safety of the process at this stage. In addition, the ACT should be urging the NRA to investigate, as a matter of urgency, the effects of commonly mixed AgVet chemicals, and to require that such information be included on directions of use and in Material Safety Data Sheets for AgVet chemicals.

Nevertheless, the key codes of practice and operating procedures relating to the concerns about spray-drift appear to have been adhered to. The audit of ACT Forests' aerial spraying procedures with a spray-drift of not more than 60 metres from target (even using "worst case" scenario nozzles) does not support the National Toxics Network concerns about herbicide spray drifting up to 800 metres from the target site.

On that basis, I am reluctant to recommend a total ban of aerial spraying in areas adjacent to residential development. However, any proposal for aerial spraying close to residential development would have to have a number of riders. For example, in my view, any such spraying would have to be undertaken only after ACT Forests has dealt with the shortcomings in the audit and/or report, and a substantial buffer would be necessary. Depending on the proximity of the target area to sensitive (residential) areas, ACT Forests might consider the comments of Peter Fagg of Forestry Victoria, who suggested "If areas closer than 500 metres need to be treated, consideration should be given to using ground-based methods, eg spot spraying." In terms of its multiple functions, and a very real need for community consultation about methods of weed treatment adjacent to residential/recreational areas, ACT Forests might be advised to adopt this less "provocative" method of treatment in those (sensitive) areas.

As to the recommended November option, the greatest concerns about the triazines - atrazine and hexazinone are –

- potential for groundwater contamination,
- their persistence in soil,
- the field half-life and
- the poor absorption into soil particles, being very soluble in water and degrading slowly.

The last three characteristics are the very attributes which make the AgVet chemicals attractive to forestry practice, providing a longer-term effect, and therefore being more efficient/cost-effective. And the triazines lend themselves to post-planting weed treatment because they do not negatively affect the pine seedlings.

ACT Forests has advised that it stopped using atrazine in the 1980s. (As I understand it, the atrazine product at that time was dry flowable, and not reliably consistent in solution. The granular product of today (for both atrazine and hexazinone) is apparently easier to use, in terms of predictability (consistency) of application and of occupational health and safety. However, because of atrazine's track record, I believe its reintroduction in the ACT should be actively discouraged. There is no obligation to use an AgVet chemical simply because it is registered, and I have always maintained that the ACT should be setting the highest environmental standards. If the area to be treated at Narrabundah Hill is likely to be accessible to walkers, runners, children and their dogs (and for a variety of other activities/uses as noted in the submission to the ACT Forests Options Paper by WRAACS), I believe it would be inadvisable to spread Forest Mix® granules in the area. I would prefer that ACT Forests invoke the Precautionary Principle and find an alternative to the triazine herbicides that does not have the associated risks of triazines.

That leaves the manual application of granular herbicides in specific locations (eg via a weed-a-metre) as a preferred method of AgVet chemical treatment for areas adjacent to residential development, but I have rejected the use of triazines. The most efficient application is post-planting, so if a less risky alternative to the triazine products were to be used, the weed-a-metre design would need to be modified to allow the AgVet chemicals to be applied without harming the seedlings. I believe this is something worth investigating to minimise environmental risk and maximise efficiency.

2. Adequacy of ACT Forests' consultation process

ACT Forests has responded positively to requests from both the Weston Creek Residents Against Aerial Spraying and the Weston Creek Community Council, and it would appear, has consulted openly with members of the community in relation to the proposal to treat the weeds in the Narrabundah Hill compartment. I do believe, however, that some of that consultation has been as a result of the effective organisation of the community. The experience in Weston Creek, and the positive attitude of Tony Bartlett may well result in proactive approaches by ACT Forests from now on.

Correspondence from Weston Creek Residents Against Aerial Spraying of 1 May 2001 to the then Minister for Urban Services, Brendan Smyth, MLA stated in part “We were surprised at paragraph four in your letter relating to the consultation process – the clear impression given is that the Government has carried out an effective consultation process. On the contrary, it must be acknowledged that the publicity and media interest generated over this issue has been stimulated almost wholly by the group of concerned residents we represent; through letters to the Editor and the provision of briefing for, and discussions with, journalists both from the Chronicle and Canberra Times and by publicising the matter locally through letter boxing and the Duffy Primary School P&C. Much of this media interest has derived from the fact the ACT Government appears intent on spraying forests adjacent to residential areas on the basis of a totally inadequate consultation process. The interest generated at the meeting of the Weston Creek Community Council on 28 March (2001) attended by between 90 and 100 residents indicates quite clearly that this matter will continue to engage a growing group of concerned and somewhat annoyed residents in the coming months.”

A survey of approximately 120 houses door-knocked in Jemalong Street, Eucumbene Drive and Tullaroop Street on July 14th 2001 produced the following results about awareness of the proposal:

Q1 – Are you aware of plans by the ACT Government (Forest ACT) to use a combination of three herbicides to control weeds in nearby Stromlo Forest?

% Yes	% No
81%	19%

Q2 – Are you aware that aerial spraying may be involved in the weed control program?

% Yes	% No
74%	26%

Q3 - Would you like more local consultation on the weed control program before it goes ahead?

% Yes	% No
81%	19%

**3. Adequacy of the procedures to be employed by ACT Forests to -
- notify all residents, including, in particular, those with chemical sensitivity
- reduce the risk of adverse side effects**

ACT Forests has informed this Office that it has the list of chemically sensitive people, though very few are on that list in the vicinity of Narrabundah Hill. Tony Bartlett also indicated at the November 2001 meeting of the Weston Creek Community Council, that ACT Forests would go back to Weston Creek residents through the Community Council before action would be taken to treat the weeds in

the Narrabundah Hill compartment. I believe that in the circumstances, this latter action is imperative.

Environmental Authorisation 0011 requires public notification only when ACT Forests intends to spray AgVeg chemicals that contain Schedule 7 poisons. As indicated earlier in this report, most, if not all, products used by ACT Forests for weed treatment contain Schedule 5 poisons. I am keen to ensure that some sort of notification of residents occurs when ACT Forests intends to treat weeds in compartments that are adjacent to residential areas, using AgVeg chemicals other than only Schedule 7 poisons.

Indeed, I would like to see all environmental authorisations for AgVet chemical treatment in public places contain a requirement to publicly notify nearby residents/users and to provide conspicuous signage, with telephone numbers/e-mail contacts to facilitate enquiries or objections. However, I am advised by the EPA that such a requirement in an environmental authorisation would be outside the authority of the EPA.

I addressed this matter of public notification in detail in my 1998 Report and still believe it is an important part of procedures associated with the use of AgVet chemicals for the treatment of weeds. I am therefore recommending that ACT Forests develop a policy for public notification of its intention to use AgVet chemicals. I have outlined in the recommendation the sorts of things that I believe should be included as a minimum in such a policy. Ideally, the EPA would assist development of that policy through the AVCCN and I will be making that recommendation in my 2001-02 Annual Report.

If my recommendations about hexazinone and atrazine are not adopted and ACT Forests were to proceed with the Forest Mix® Granular Herbicide, I believe that given the risk of (severe) eye irritation, notification and signage would have to advise of the risks associated with eye irritation, as notified in the Signal Words on the product labels. While I acknowledge that granules are safer to use than dry flowable product, the granules label still contains a warning due to the risk of eye irritation. I would really prefer that the treated area be fenced off for over a year in such a way that entry could not be gained, or that a less substantial fence would have to have warning signs posted at frequent intervals.

In addition, the list of chemically-sensitive people must be common to all ACT Government agencies to ensure that each person on that list is notified, to allow them to make any necessary precautionary arrangements at the time of the spraying. I believe those chemically-sensitive people must be personally notified of the intention to use herbicides within a certain timeframe, and then, because of the weather/condition constraints surrounding specific timing of chemical treatment, the people on that list should be personally notified of the specific time of treatment.

4. Whether there are safer, realistic and economically viable alternatives for controlling weeds when planting pines

The location of commercial forestry in an essentially urban area, that is used increasingly for recreational purposes, adds a complexity that does not exist to the

same extent for foresters in more remote areas. Since the ACT *Pinus radiata* forests were established, there has been a vast increase in population and in the residential area of Canberra. There has also been a vast increase in the range and reported effectiveness of available AgVet chemicals/herbicides, as well as a vast increase in the knowledge of risks and unintended impacts of herbicides, after a particular AgVet chemical has been approved for use.

The most recent proposal to use granules post-planting obviates the risk of spray drift, and obviates the need to treat the area again for up to/over a year. Even with my criticisms of how the Options Paper was put together, and with the preferred fencing of the area treated, this option appears to be at least comparatively cost effective. However, I have already indicated disapproval of the reintroduction of atrazine to the ACT, and of the use of the granules of any of the triazines, in areas used frequently by people and their pets. There is also the risk to wildlife (frogs) (see the discussion under Term of Reference 5 below).

Safer, economically viable options that ACT Forests might investigate include –

- exploring the modification of the weed-a-metre design, as already noted, to allow the use of an alternative less risky AgVeg product in the post-planting phase
- a ‘cut and daub’ method of application chosen over spraying wherever practicable, and
- the manual removal of weeds and/or mulching to suppress weed growth, using programs such as Work for the Dole or offenders on community service, through ACT Corrective Services.

5. Evidence that native species using the region for habitat will not be adversely affected

In the absence of the resources to undertake a complete fauna survey, our comments are limited to possible impacts on frogs, as the National Toxics Network letter of January 2001 specifically referred to a report “Acute toxicity of a herbicide to selected frog species” which found that both glyphosate and glyphosate formulations can be acutely toxic to adult frogs and tadpoles, and that tadpoles are many times more sensitive to the herbicide formulation tested than adult frogs.

I have referred earlier in this report to the concerns expressed in the National Toxics Network letter of January 2001 about the lack of information that is available about solvents and surfactants included in formulations, which are not disclosed under commercial confidentiality arrangements. Research by Dr Michael J Tyler, Department of Zoology, University of Adelaide, South Australia has supported that concern, while at the same time, calling into question the conclusions of research noted above that has reported the toxicity of glyphosate to frogs.

Dr Tyler’s research has revealed that “there is agreement that it is not the glyphosate that is the principal problem but a detergent additive termed a dispersant or wetting agent. The function of the dispersant is to break down the surface tension at the leaf surface, so that the individual spray droplets disperse to completely cover the leaf.

Unfortunately all detergent compounds interfere with cutaneous respiration in frogs and particularly gill respiration in tadpoles. Impact may vary with water temperature because oxygen saturation decreases with temperature. To date there have been no tests at 40°C or above – conditions when oxygen availability is very low. Although the herbicide is claimed to be ‘environmentally friendly’, it is clear that users have been lulled into a false sense of security. The use of these herbicides near water is already banned in the UK and the USA. It is to be hoped other countries join Australia in following suit” (FROGLOG Number 21, March 1997 - see www2.open.ac.uk/biology/froglog/FROG-LOG-21-5.html).

As discussed previously in this report, Environmental Authorisation 0011 excludes the use of AgVet chemicals within 150 metres of a “water body”.

Research has also shown that the hormone systems of amphibians are disrupted by atrazine... (see Cox C, 2001, “Atrazine: Environmental Contamination and Ecological Effects”, Journal of Pesticide Reform/Fall 2001, Vol. 21, No.3 - www.pesticide.org/atrazineEnv.pdf).

More recently, in laboratory tests at the University of California, Berkeley, Associate Professor Tyrone Hayes and colleagues (2002) exposed larvae of the African clawed frog to the herbicide atrazine. Sexually mature males showed a 10-fold decrease in testosterone levels, bringing them below levels found in normal females, which could explain the smaller vocal organs and abnormal sex organs. As many as 16 per cent of the animals had more than the normal number of gonads.

This is the first study to investigate the effect of atrazine on the tadpole stage of frogs, and to look at low levels of atrazine (ranging from 0.1 to 200 parts per billion, much lower than those permitted by the US EPA regulations and considered safe to humans). To date, atrazine's effects on mammals and amphibians have been tested only at large doses.

We have consulted with Dr Will Osborne, reptiles and amphibians adviser to the 1994 and 1995 State of the Environment Reports, and currently to the ACT Flora and Fauna Committee, and with Mr Ross Bennett, author of *Reptiles and Amphibians of the ACT* (1997) and currently proprietor of the Australian Reptile Centre in Canberra, about the frog habitation of Narrabundah Hill. While pine forests typically do not host a wide variety of native species, both Mr Bennett and Dr Osborne referred to the number of frog species that occur in pine forests in the ACT. Dr Osborne has commented also on the abundance of frogs around the pine forests and his interpretation was that whatever management practices have been carried out have had little deleterious long-term effect overall.

Dr Osborne indicated that in autumn there will be few tadpoles in the water and adult and juvenile frogs will be scattered through the forest, particularly in damp grassy areas. His view is that it is unlikely they would be directly hit by spray, as they would be in litter or in the cracks in the soil. However, he did not know how granules, or transport of the herbicides through the soil would affect the frogs. Dr Osborne referred us to Rainer Mann at the School of Environmental Biology, Curtin University

of Technology for this information, who has recently completed a PhD on the effects of herbicides/pesticides on frogs. We were unable to contact him.

Dr Osborne stated that the frogs found on Narrabundah Hill are widespread and common in much of the northern ACT and region, and he expects would very quickly repopulate areas they have disappeared from, as long as suitable breeding sites are present. He did express concerns about situations where Blackberry is spreading over frog breeding sites, as this presents a long-term threat to those local populations by loss of their breeding sites.

ACT Forests should consult with Dr Osborne about timing of any spraying or spreading of triazines during Spring that might be undertaken to minimise impacts on breeding cycles and to identify whether there are any sites where particular care needs to be taken to preserve breeding sites.

The table below shows the frog species known to exist in the area to be treated, along with relative abundance both in the ACT and on Narrabundah Hill.

Common name	Scientific name	Abundance (ACT)	Distribution (ACT)	Abundance (Narrabundah Hill)
Banjo Frog	<i>Limnodynastes dumerilii</i>	Common	W	Common
Common Eastern Froglet	<i>Crinia insignifera</i>	Common	W	Very common
Peron's Tree Frog	<i>Litoria peronii</i>	Common	W	Common
Plains Froglet	<i>Crinia parinsignifera</i>	Common	W	Very common
Smooth Toadlet	<i>Uperoleia laevigata</i>	Common	?	Common
Spotted Burrowing Frog	<i>Neobatrachus sudelli</i>	Common	IK	Uncommon
Spotted Grass Frog	<i>Limnodynastes tasmaniensis</i>	Common	W	Very common
Whistling Tree Frog	<i>Litoria verreauxii</i>	Uncommon	??	Only one record to date

L = localised; IK = Insufficiently known; W - widespread
 ACT Abundance/Distribution - *ACT State of the Environment Report 1994 & 1997*
 Narrabundah Hill Abundance – Dr Will Osborne, University of Canberra

6. Demonstration that the mixtures will not contaminate surface and ground water

Information for this ToR is covered under the first ToR.

If ACT Forests proceeds with the Forest Mix® Granular Herbicide, with the active ingredients of hexazinone and atrazine, such a demonstration would be improbable, given the risks of leaching and non-target effects in certain conditions that are contained in the directions for use.

6. References

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Relevant extracts from the Commissioner for the Environment Act 1993

Section 12 (1) of the Commissioner for the Environment Act states:

The Commissioner has the following functions:

- (a) investigating complaints regarding the management of the environment by the Territory or a Territory authority;*
- (b) conducting such investigations as may be directed by the Minister;*
- (c) conducting, of his or her own motion, investigations into actions of an agency where those actions would have a substantial impact on the environment of the Territory.*

The Commissioner functions as an environmental ombudsman under 12(1)(a).

‘Special annual reporting requirements’ arising from investigations conducted under 12(1)(b) and 12(1)(c) apply under section 20.

Section 20 of the *Commissioner for the Environment Act 1993* reads:

A report presented, or information provided, by the Commissioner under section 8 of the Annual Reports (Government Agencies) Act 1995 in respect of a period shall include particulars of—

- (a) any special factor which the Commissioner believes had a significant impact on the environment during the period;*
- (b) any measures taken during the period by or on behalf of the Territory in relation to the implementation of any recommendation in a State of the Environment Report under section 19 or a special report under section 21; and*
- (c) any recommendation in such a report which the Commissioner believes is still to be implemented or fully implemented.*

(Under section 21 ‘special’ reports resulting from investigations conducted under paragraphs 12(1)(b) and 12(1)(c) must be tabled in the Legislative Assembly.)

ACT Forests' Assessment of Weed Control Options for Narrabundah Hill, Stromlo Forest, (November 2001)

1. *Aerial spraying using dry flowable herbicides*
This option is not practical due to the weed distribution in relation to the significant number of large remnant trees on the site
2. *Aerial spraying using granular herbicides*
This option is not recommended, as the reduced spectrum of weeds killed by granular herbicides does not justify the use of an aerial operation
3. *Strip spraying rows with ground based boom spray*
This option is not practical due to the limited equipment available to commence this operation on a second rotation site. It is also not economical
4. *Spot spray planted trees manually with a weed-a-metre*
This option requires the least amount of herbicides, but it will not result in complete elimination of weeds on the site
5. *Manual cutting out of weeds with loppers/chainsaws*
This option is not commercially viable, as the planted seedlings would suffer significantly from competition, leading to poor survival rates. It would also require a higher amount of time and labour.
6. *Rough heap logging debris, low intensity burn and ground-based spraying*
This is not a reasonable option due to the high amount of labour required and the issue of smoke management. This option does not remove competition from around the base of the planted trees, which would result in low survival rates, making it non-commercial.
7. *No weed control*
This option is not environmentally or economically viable and the planted seedlings would suffer significantly from competition, leading to poor survival rates.

ACT Definition of the Environment

ACT Environment Protection Act 1997, "environment" (in the Interpretation section) means each of the following:

- (a) the components of the earth, including soil, the atmosphere and water;
- (b) any organic or inorganic matter and any living organism;
- (c) human made or modified structures and areas;
- (d) ecosystems and their constituent parts, including people and communities;
- (e) the qualities and characteristics of places and areas that contribute to their biological diversity and ecological integrity, scientific value and amenity;
- (f) the interactions and interdependencies within and between the things mentioned in subparagraphs (a) to (e) (inclusive);
- (g) the social, aesthetic, cultural and economic conditions that affect, or are affected by, the things mentioned in subparagraphs (a) to (e) (inclusive).