DIFFUSION FUMIGATION OF RABBIT WARRENS (RAB005) STANDARD OPERATING PROCEDURE

BACKGROUND

Fumigation of rabbit warrens is used to minimise the impact of the introduced European rabbit (*Oryctolagus cuniculus*) on agricultural production and the environment. Other rabbit control methods include poisoning, warren and harbour destruction, shooting, trapping, exclusion fencing and biological control with rabbit haemorrhagic disease (RHD) and myxomatosis.

Fumigation involves the introduction of toxic fumes into a warren where it is inhaled by rabbits leading to their death. There are two types of fumigation: pressure fumigation, in which the fumigant gases or vapours are generated outside the warren and forced into the warren under pressure, usually from a pump and; diffusion fumigation, where tablets are placed in active burrows and the gas generated is allowed to diffuse through the warren.

Diffusion fumigation is commonly carried out using phosphine gas. Warrens are treated with aluminium phosphide tablets which liberate phosphine gas on exposure to atmospheric or soil moisture. Phosphine is a systemic poison which depresses the central nervous system and respiratory function. It is highly toxic to humans; therefore operators performing warren fumigation must take adequate precautions to safeguard against accidental exposure.

This standard operating procedure (SOP) is a guide only; it does not replace or override the legislation that applies in the relevant state or territory jurisdiction. The SOP should only be used subject to the applicable legal requirements (including OH&S) operating in the relevant jurisdiction.

APPLICATION

- Fumigation should only be used in a strategic manner as part of a co-ordinated program designed to achieve sustained effective control. Reducing and maintaining low rabbit numbers by a combination of control methods over time is more effective than repeated (seasonal) use of a single method.
- Fumigation is labour intensive and costly. It is best used as a follow-up technique to warren ripping and poisoning i.e. when rabbit density is low but may also be effective in the following situations:
- where ripping cannot be done due to inaccessible location (e.g. near rocky outcrops, along fences or riverbanks, around trees) or when there is a risk of soil erosion or damage to conservation areas;
- as an alternative to poisons in situations where 1080 and pindone cannot be used e.g. when the risk of non-target poisoning is unacceptably high, distance restrictions cannot be adhered to etc.; and
- when treating small areas or isolated rabbit populations.
- Fumigation can only be used for warren dwelling rabbits. It is not effective against surface dwelling rabbits.
- Fumigation can be carried out at any time of year but it has the greatest long-term effect if done shortly before the commencement of the rabbit breeding season.
- Fumigation with aluminum phosphide is most effective in non-porous soils through which the gas will not diffuse e.g. compacted heavy or wet soils rather than dry sand or cracked clay.

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- As phosphine gas is released from the tablets when wet, do not fumigate in weather conditions where the tablets cannot be protected from wetting prior to placement in the warren. Avoid fumigating in small sheltered gullies where the operator may be exposed to the toxic fumes. It is best to fumigate on windy days so that fumes are dispersed rather than building up in the air around the warren.
- Trained dogs can be used to drive rabbits underground prior to warren fumigation. However, it is unacceptable, and in some jurisdictions illegal, to set a dog onto a rabbit with the intention of catching or killing.
- Aluminium phosphide is listed as a Schedule 7 substance, a restricted chemical product which requires special precautions in manufacture, handling, storage and use, along with individual regulations regarding labelling or availability. In some States, fumigants can only be obtained by persons with appropriate training in their use (e.g. in Victoria an Agricultural Chemical Users Permit is required) or used by competent operators working in accordance with the relevant State and Territory legislation (*see Appendix*).
- Fumigants must be used according to instructions on approved labels and guidelines issued by relevant State authorities for vertebrate pest control.
- Phosphine is currently the preferred toxin for diffusion fumigation until more humane methods are developed. Chloropicrin (trichloronitromethane) is considered to be highly inhumane and its use is not recommended. It causes intense irritation of the respiratory tract and profuse watering of the eyes for a considerable period before death. Exhaust from idling internal combustion engines is also not acceptable as adequate CO concentrations cannot be achieved (particularly with modern car engines) and exhaust contaminants such as hydrocarbons, ozone, nitrogen dioxide and nitric oxides cause severe irritation before death. Also, the exhaust gases produced may be unacceptably hot.

ANIMAL WELFARE CONSIDERATIONS

Impact on target animals

- The toxicity of phosphine is due to inhibition of cytochrome oxidase – an enzyme essential for the use of oxygen for energy production. Inhalation of the gas causes a reduction in the activity of the central nervous system and breathing activity. The precise nature and extent of suffering of rabbits after inhalation of phosphine is unknown. Symptoms of phosphine toxicity in humans often include nausea, abdominal pain, headache and convulsions followed by coma. It is not known whether other mammals experience similar symptoms.
- Time to death can be highly variable depending on the concentration of gas in the burrow. For example, at concentrations of 400 ppm phosphine can kill rabbits in 30 minutes whereas at 25 ppm death will take 4 hours. The time taken to reach high concentrations throughout the warren largely depends on the amount of moisture in the soil and air, or on the tablets. In low humidity, complete release of phosphine gas from the tablets may take hours or even days. Higher humidity will cause a rapid rate of diffusion and therefore result in higher concentrations of gas so that the rabbit will be exposed to a lethal dose in a shorter time and will have less chance to dig out of the burrow.
- Failure to reach lethal levels of phosphine in some parts of the warren because of inadequate diffusion will result in ineffective killing but will not necessarily cause long-term suffering. Studies in other species (i.e. cats, guinea pigs and brown rats) have produced no evidence to suggest that exposure to sub-lethal levels of phosphine gas causes sub-acute or chronic poisoning. Therefore, rabbits that escape from fumigated warrens or those that are exposed to sub-lethal concentrations in deeper parts of the warren may only experience transient illness, not permanent debilitation.

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- Fumigation is considered to be less humane than poisoning with 1080. Therefore, it is desirable to fumigate only after a poisoning program when the density of rabbits is low. This minimises the number of rabbits that need to be killed by a less humane technique.

Impact on non-target animals

- Fumigation of rabbit warrens is one of the most target-specific means of rabbit destruction and will have little impact on non-target species if used correctly.
- Fumigation must only be used in active, occupied warrens. If a warren appears to be empty or possibly occupied by a non-target species (e.g. wombats, dingoes, lizards, snakes), fumigation must not be performed.
- There appears to be no significant risk of secondary poisoning if carcasses of gassed animals are consumed by non-target predatory or scavenger species.
- If using dogs to work an area prior to warren fumigation, the following should be observed:
- Dog handlers must be experienced and the dogs well trained i.e. they must be easily controlled by a whistle or call, obey the handlers' commands and will not chase or attack non-target animals including livestock. Dogs that are deliberately bred or trained to attack without provocation must not be used. Suitable breeds would include terriers, labradors and others that are keen to chase but unlikely to catch a rabbit.
- Handlers must not encourage dogs to attack and kill rabbits. Rabbits trapped in hollow logs etc. (where they are visible but the dogs can't access them), should be shot (refer to RAB009 *Ground shooting of rabbit*s).
- Rabbits inadvertently caught by dogs should be killed by a shot to the brain or by cervical dislocation. Rabbits should never be left to die a slow death after being maimed.
- To ensure that dogs are not exposed to phosphine gas or allowed access to treated warrens, handlers must ensure that dogs are well restrained during and after fumigation.
- For more details refer to GEN002 *The care and management of dogs used for pest animal control.*

EQUIPMENT REQUIRED

Fumigation tablets

Fumigants must be stored in the closed original container in a cool, dry, well ventilated, locked area out of the reach of children and unauthorised persons and away from buildings inhabited by humans, pets or livestock. Keep away from water and liquids which may cause immediate release of phosphine gas.

- Fumigation tablets contain 560 to 570 g/kg of aluminium phosphide which produces 330 g/kg phosphine gas. Each 3 gram tablet releases 1 gram of phosphine gas when exposed to moisture in the air or soil. The evolution of gas can be increased by adding extra water when the tablets are placed in the burrow.
- Phosphine gas is slightly heavier than air, colourless, and smells slightly of garlic.
- Phosphine generating fumigation tablets are produced under several brand names (e.g. Gastion®, Pestex® etc.) and are available from rural merchandise suppliers.

Other equipment

- personal protective equipment

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- towel, soap, dish or bucket
- first Aid kit
- warning signs
- newspaper or paper towel
- water for moistening paper
- a long handled device (at least 1 metre long) for placing fumigant down the warren
- shovel or mattock for digging back and sealing burrows

PROCEDURES.

Assessment of site and estimation of rabbit numbers

- To maximise effect on rabbit populations, a careful on-site risk assessment to confirm the need for fumigation and assess the suitability of the area should be undertaken before fumigation is commenced.
- Fumigation must only be applied to active, occupied rabbit warrens to be effective and safe. Evidence of active warrens may include fresh rabbit droppings, tracks, mounds, or diggings.
- If it is suspected that native wildlife are using the warren, their presence can be determined by using sand pads – a 1m^2 area of raked earth or sand outside of the warren entrance- to detect and identify footprints.
- The density of rabbits on the site should be estimated using spotlight counts and warren monitoring. The location and numbers of rabbits on neighbouring properties should also be approximated.
- Contact your vertebrate pest control local authority for more information and advice on site assessment and monitoring of rabbit numbers.

Fumigation procedure

Always read the product label for specific directions on use.

Do not carry fumigants inside an enclosed vehicle, especially after the seals on the containers have been broken.

- Fumigate when the weather is hot to ensure most rabbits are underground and the survival of rabbits above ground is low. Rabbits can be driven underground before fumigation by making loud noises or using dogs to work the area, chasing the rabbits into the warrens.
- Dig back the opening of the burrow so there is a 30 cm lip between the surface and the burrow. This exposes any branching tunnels and provides a solid shelf against which to back-fill soil.
- Place two aluminium phosphide tablets at least 60 cm into the burrow. Wrap the tablets in damp newspaper or paper towel to start the release of gas. To facilitate the easy placement of the tablet into the hole, a length of wire or piece of polythene pipe containing a push-rod can be used.
- The hole should then be filled, digging back the sides of the entrance and tamping down the soil. The ground should end up relatively flat to discourage opening up from the outside.
- The entire procedure, with two tablets and backfilling, should be repeated for each hole. Always work toward the windward side of the warren.

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- It is essential that all entrances to the warren are sealed. Check under nearby scrub and fallen timber for any missed burrows.
- Complete decomposition of the tablets may take up to 72 hours if the humidity in the warren is low.
- Check for re-openings around one week after fumigating and treat again as necessary.

Assessing effectiveness

- The effectiveness of a fumigation operation should be monitored by recording the number of burrow entrances treated and then recording the number of re-opened entrances that need re-treated at subsequent visits. A follow–up visit and re-treatment should not be performed until at least 48 hours after the previous treatment. Repeat the procedure until no new burrows are found.

PROCEDURAL NOTES

More detailed information on diffusion fumigation using phosphine can be found on approved labels, from various State guidelines (eg. vertebrate pest control manuals, Landcare Notes, Farmnotes etc.) and relevant federal, state and territory legislation.

REFERENCES

1. Anon. (1997). Vertebrate Pesticide Manual: A guide to the use of vertebrate pesticides in Queensland. Department of Resources, Queensland.
2. Anon. (1999). Threat abatement plan for competition and land degradation by feral rabbits. Biodiversity Group, Environment Australia.
3. Anon. (2001). Fumigation for rabbit control. Farmnote 119/2000. Department of Agriculture, Western Australia.
4. Anon. (2003). Rabbit Control – Fumigation. Agdex 671, Number 236. Department of Primary Industries, Water and Environment, Tasmania.
5. Anon. (2004).Vertebrate Pest Control Manual. Agricultural Protection Program. NSW Agriculture.
6. Bloomfield, T. (1999). Rabbits: Methods of fumigating rabbit burrows. Landcare Notes LC0295. Department of Natural Resources and Environment, Victoria.
7. Coman (1994). District Rabbit control: A guide for co-ordinators and leaders. Landcare Australia and Bureau of Rural Sciences.
8. Dobbie, W. (1997). Rabbit control in Central Australia: A guide for landholders. Centralian Land Management Association, Alice Springs.
9. Gigliotti, F., Marks, C.A. & Busana, F., 2009. Performance and humaneness of chloropicrin, phosphine and carbon monoxide as rabbit-warren fumigants. *Wildlife Research*, 36, 333–341.
10. Marks, C.A. (1996). Research directions for humane burrow fumigation and 1080 predator baiting. In: Fisher P. M. & Marks C.A. (Eds) Humaneness and Vertebrate Pest control. Ropet Printing, Tynong North pp 50-57.
11. Williams, K., Parer, I., Coman, B., Burley, J and Braysher, M. (1995). *Managing vertebrate pests: rabbits*. Australian Government Publishing Service, Canberra.

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APPENDICES

Relevant federal, state and territory legislation for the use of fumigants

Commonwealth

Environment Protection and Biodiversity Conservation Act 1999

Australian Capital Territory

Environment Protection Act 1997

New South Wales

Pesticides Act 1999

Northern Territory

Poison and Dangerous Drugs Act 1999

Territory Parks and Wildlife Conservation Act 1998

Queensland

Health (Drugs and Poisons) Regulations 1996

South Australia

Controlled Substances Act 1984
Controlled Substances (Poison) Regulations 1996

Tasmania

Poisons Act 1971
Agricultural and Veterinary Chemicals (Control of Use) Act 1995

Victoria

Agricultural and Veterinary Chemical (Control of Use) Act 1992

Western Australia

Poisons Act 1964
Poisons Regulations 1965

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