

# Fumigation of Burrowing Rodents with Aluminum Phosphide or Gas Cartridges

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This NebGuide describes how to use aluminum phosphide or gas cartridge fumigants safely and effectively in managing burrowing rodents.

Aluminum phosphide (ALP) is a pesticide used for fumigating burrows to kill burrowing rodents, especially rats, field mice or voles, ground squirrels, prairie dogs, and woodchucks. It is also registered for moles in some states. ALP is also used in controlling insects in stored grain facilities (For more information, see NebGuide G790, Fumigating Farm-stored Grain with Aluminum Phosphide).

ALP reacts with moisture, water, acids, or other liquids to form phosphine gas ( $\text{PH}_3$ ). Warm humid air accelerates the chemical reaction that releases  $\text{PH}_3$  while cool dry air slows it down. Any animal, including humans, can be affected by  $\text{PH}_3$  exposure.

Gas cartridges and “smoke bombs” are nonexplosive devices that are ignited and placed into rodent burrows to emit poisonous gases. They produce smoke and carbon monoxide that kill by suffocation. Gas cartridges are registered for use in controlling ground squirrels, pocket gophers, Norway rats, house mice, black-tailed prairie dogs, striped skunks, red fox and coyotes.

ALP is a Restricted Use Pesticide due to acute inhalation toxicity of this highly toxic gas. You must be a licensed pesticide applicator to purchase ALP. Gas cartridges are General Use Pesticides; no special license or certificate is required to purchase or use them. Read the pesticide label carefully for details on use and safety.

ALP is formulated in both tablets and pellets for control of burrowing rodents. Several types of gas cartridges are sold by retail suppliers. Typically gas cartridges are 6 inches long and 1 inch in diameter. The USDA-APHIS-Division of Wildlife Services sells two sizes of gas cartridge, 3 1/2 inches long x 1 5/8 inches in diameter and 12 inches long x 1 5/8 inches in diameter. The cartridges illustrated and described in this NebGuide are manufactured and sold by USDA and contain a mixture of sodium nitrate and charcoal within a cardboard cylinder.

## Application

ALP and gas cartridges must be applied to active, occupied burrows of target animals to be effective and safe. Evidence of active burrows may include fresh droppings, tracks, mounds,

or diggings. Do not apply ALP or gas cartridges in or near buildings occupied by humans, livestock, or pets. Do not apply gas cartridges in the vicinity of structures made of wood or other flammable materials.

It is most effective to apply ALP or gas cartridges into the deeper tunnels of target animals. Moles, field mice, and rats create shallow burrows in loose soil that may cause toxic gases to escape and become ineffective or dangerous. Pocket gophers and moles have extensive burrow systems where they feed. If possible, fumigants should be placed in the deeper nesting or living chambers of moles and pocket gophers. Soil near the surface may be too dry or porous to effectively use fumigants. Pocket gophers may also plug burrows when they detect gases.

## Applying Aluminum Phosphide

ALP pellets or tablets can be dropped through a 4- to 5-foot length of PVC or ABS plastic pipe that is inserted deep into the burrow entrance of an active burrow. Plug the entrance with crushed newspaper or other material as recommended by the pesticide label to prevent soil from covering the tablets or pellets. A cow chip or slice of sod can also be used to block the entrance before two or three shovelful of moist soil are placed over the top to create an air-tight seal. Seal other entrances to the burrow, if they occur. Prairie dogs have burrows that are relatively short and typically have only one or two entrances. *Figures 1 through 5* illustrate the proper application of aluminum phosphide.

Complete release of phosphine gas from the tablets or pellets may take hours or even days, depending upon temperature and moisture. Initial release of phosphine gas is quicker from the smaller pellets than from larger tablets. In a test trial of ALP within grain in bins,  $\text{PH}_3$  from pellets attained a peak concentration of 400 to 700 ppm in 48 hours whereas  $\text{PH}_3$  from tablets attained a peak concentration of 150 to 250 ppm at 48 to 60 hours. The smaller size of the pellets, however, make them more difficult to handle.

ALP may be used any time of the year, but we recommend applying it when soil temperature is above 60°F (15°C). Use higher recommended doses when cool, dry soil exists. We do not recommend applying ALP when soil temperature is less than 40°F (4°C).

For large numbers or high densities of burrows, such as in black-tailed prairie dog colonies, you may want to work in pairs to simplify the application of ALP. One person can



**Figure 1.** Materials for ALP fumigation include ALP, shovel, and a 4-foot length of 2-inch diameter plastic pipe (cotton gloves and newspaper not shown).



**Figure 2.** Apply pellets or tablets directly into the burrow or insert through the plastic pipe. Remember to close the canister after each application.



**Figure 3.** Plug the burrow entrance by inserting crushed newspaper, followed by a cow chip or slice of sod and moist soil.



**Figure 4.** Fill the burrow with two or three shovelful of soil, and pack it well to make an air-tight seal.



**Figure 5.** For large jobs, flag or mark each burrow to assess the effectiveness of the fumigant.

dispense the ALP while the other covers the burrow entrances. Always work apart or so that the other person is not downwind of the pesticide. Avoid breathing the gas by working into the wind.

Wear dry cotton gloves to avoid contacting the skin with ALP. Remove metal jewelry to avoid its corrosion, as specified on the pesticide label. Replace the cap of the canister after every dose is applied into a burrow to avoid exposure to phosphine gas. Replacing the cap after each dose also limits exposure of ALP to atmospheric moisture. Apply ALP at the approximate dose (usually two to four tablets or 10 to 20 pellets) per burrow as recommended by the pesticide label

Prairie dogs and ground squirrels are active during the day, so schedule completion of the fumigation just prior to night to ensure that surviving animals will not dig out the sealed plug before an adequate dose of  $\text{PH}_3$  is released.

### **Applying Gas Cartridges**

Prepare to fumigate a burrow by enlarging it, if necessary, to accommodate the gas cartridge. Use the large size gas cartridge for striped skunk and coyote burrows. Use the small cartridge for burrowing rodents. Tunnels of ground squirrels, Norway rats and moles may have to be enlarged with a hand trowel. Make sure that a sod plug and moist soil are readily available at the burrow entrance before igniting the gas cartridge. Use a screwdriver or large nail to puncture the designated end of the cartridge in several locations. The center hole should be large enough to accommodate about 2 inches of the fuse. Grasp only the end of the cartridge away from the fuse and point the cartridge and fuse slightly downward into the burrow entrance. With extended arms, light the fuse in the direction of the burrow entrance. Make sure the fuse and cartridge are ignited before placing the

cartridge gently on the floor of the burrow or rolling it into the burrow. Do not toss the cartridge as it may become extinguished. Plug the burrow with a piece of sod and seal the burrow with packed soil. Several shovelful of soil may be necessary to completely seal the entrance, particularly if low soil moisture is available. Pack each shovelful of soil as it is put into place with your heel or the back of the shovel. If smoke still emits from the burrow entrance, add more soil and pack it. *Figures 6 through 13* illustrate proper application of gas cartridges.

### **Evaluating Your Options**

Consideration should be given to the high costs of labor and chemicals involved in fumigation, especially where high densities or numbers of burrows occur, such as in prairie dog colonies. Materials and labor for fumigation of prairie dog colonies with ALP or gas cartridges usually cost between \$30 and \$40 per acre, which is three to four times that of zinc phosphide-treated grain bait applications. We recommend using ALP or gas cartridges as a follow-up to a late summer or fall application of the zinc phosphide-treated baits. Under ideal conditions, zinc phosphide baits are 75 to 85 percent effective. Applications of ALP are typically 90 to 100 percent effective.

### **Evaluating Effectiveness**

The effect of fumigants on burrowing rodents can be evaluated quickly and accurately. To estimate the effectiveness of fumigants in a prairie dog colony, plug a number of treated burrows and then count the number of re-opened burrows after 24 hours. The behavior of prairie dogs can affect the accuracy of estimates. Some burrows that are treated may not be occu-

ped, exaggerating the effect. In other cases, some prairie dogs may emerge from burrows and dig out other flagged burrows and underestimation is likely. Try to fumigate all or most of a prairie dog colony at once to increase effectiveness.

To estimate the effectiveness of fumigants in pocket gopher burrows, use flagging to mark treated burrows. Re-open all treated burrows at least 24 hours after treatment. Return 24 hours later to determine the percent of burrows that have been closed by the surviving pocket gophers.

### **Purchasing ALP and Gas Cartridges**

In Nebraska, the USDA-APHIS-Division of Wildlife Services office sells ALP and gas cartridges and offers on-site assistance in cooperating counties for the fumigation of burrowing rodents. The state office is located at 5940 South 58th Street, P.O. Box 81866, Lincoln, NE 68501 (telephone: (402) 434-2340). ALP and gas cartridges are also available through local pesticide dealers, farmer's cooperatives, feed stores, and pest control operators.

ALP is available in sealed aluminum cannisters. The larger tablets come in quantities of 100 or 500 and the smaller pellets in quantities of 1,650. You must be a certified pesticide applicator to purchase ALP.

To determine the amount of ALP or gas cartridges that you need to purchase, you should conduct a burrow count. Typically, applicators underestimate the number of burrow entrances in a prairie dog colony. To estimate the number of burrows, mark off a one-acre square plot, which is about 70 yards X 70 yards. Count the number of active burrows and estimate the total area covered by the prairie dog colony.

### **Personal Safety Issues**

#### ***Aluminum Phosphide***

Avoid contacting the skin with ALP or breathing phosphine gas. Do not get the ALP material, including powder residing at the bottom of the cannister, in your eyes or on your skin or clothing. Do not eat, drink, or smoke while handling or applying ALP. The phosphine gas produced by ALP is slightly heavier than air, colorless, and in common forms smells like garlic. Certain formulations of ALP contain a compound that releases ammonia. This pungent gas serves as an initial warning that phosphine gas may be present. The absence of an ammonia-like odor, however, does not mean that phosphine gas is necessarily absent.

Symptoms of overexposure to phosphine gas include headache, dizziness, nausea, and difficulty breathing. Severe exposure may damage liver, kidneys, lungs, and nervous and circulatory systems, and may cause death. If a person is exposed to phosphine gas, get them to fresh air immediately. If the tablets, pellets, or powder are swallowed, administer one or two large glasses of water and induce vomiting. Read and observe the entire statement of practical treatment on the pesticide label before fumigation.

Never use ALP in or near buildings inhabited by humans, livestock, or pets. ALP is not hazardous to livestock in field or range situations, if used properly. ALP can be flammable or explosive. Always store ALP away from heat and in a cool, dry place under lock and key. Do not store in buildings inhabited by humans, livestock, or pets. ALP cannisters must be stored in a metal box outside the cab of a vehicle when transporting. A single vehicle cannot carry more than one case

of ALP canisters without installing warning placards (DOT Exemption #10753).

### ***Gas Cartridges***

Lighting fuses and handling ignited cartridges may pose burning hazards to the skin. Protect your hands with thick leather gloves and your arms with a loose-fitting long-sleeved shirt. Use a hand-held butane lighter to provide a constant, regulated ignition source for fuses. If used properly, lighters can reduce burns to skin. Lighters are particularly useful when lighting fuses in the wind.

Store gas cartridges in a dry location. Do not use gas cartridges near wooden structures or in buildings occupied by humans, livestock, or pets. Read all safety, storage, and disposal recommendations on the pesticide label. Keep all pesticides out of the reach of children.

### **Environmental Safety**

Gas cartridges have the disadvantage of remaining in the environment once they are spent. On occasion, cartridges are extricated to the soil surface by an animal. Gas cartridges that occur aboveground should be picked up and disposed of properly. Risk of range fire caused by ignited cartridges is very low but caution should be used in dry conditions.

Any nontarget animal that occupies a burrow treated with ALP or gas cartridges may be killed or affected by gases emitted. Do not use fumigants if you suspect swift fox, black-footed ferrets, burrowing owls, or other threatened or endangered species or species in need of conservation are in the vicinity.

Burrowing owls construct nests in inactive badger burrows and in inactive prairie dog burrows. They often line their burrow entrance with finely-shredded livestock manure and leave whitewash, regurgitated pellets that contain insect parts, and finely shredded livestock manure at their burrow entrances. Burrowing owls are active during the day and are often seen resting on the ground or on fence posts. They migrate southward in October and return in April. One way to reduce impacts on these owls is to fumigate only between the months of October and April. The burrowing owl is listed as a species in need of conservation within Nebraska.

The swift fox is a small, tan colored fox with a black-tipped tail. It is seldom seen, partly because it is active at night. Swift fox often feed on prairie dogs, mice, rabbits, and insects. When digging a den, a swift fox will spread soil over an area six feet or more from its burrow entrance, which is quite different from prairie dogs that form volcano-shaped mounds. At burrow entrances of rodents, watch for small dog-like tracks and the bones and partial remains of rodents and other animals fed upon by swift fox. The swift fox is listed as an endangered species in Nebraska.

The black-footed ferret feeds almost exclusively on prairie dogs. They are active at night and are extremely reclusive. Evidence of black-footed ferrets at prairie dog colonies include trough-like excavation ramps that lead away from burrow entrances and plugged burrows made by prairie dogs to escape ferret predation. The black-footed ferret is listed as an endangered species by the governments of Nebraska and the United States. Ferret surveys can be conducted during the day or at night with spotlights. Consult with the U.S. Fish and Wildlife Service for details (308) 382-6468. Check the pesticide label for details and special

requirements in monitoring for threatened or endangered species.

More information on threatened or endangered wildlife can be found at the offices of the Nebraska Game and Parks Commission (402) 471-0641. For more information on managing prairie dogs, read *Prairie Dogs and Their Control*, G1476, available at your local University of Nebraska–Lincoln Extension office.

Reference to commercial products or trade names is made with the understanding that no discrimination is intended of those not mentioned and no endorsement by University of Nebraska–Lincoln Extension is implied for those mentioned.

### Illustrated Use of Gas Cartridges (Read the Pesticide Label for Details)



**Figure 6.** Use a shovel or hand trowel to prepare the burrow, if necessary, by enlarging it to accommodate the cartridge when lit.



**Figure 7.** With a nail or Phillips screwdriver, punch several holes about 1/2 inch in diameter into the designated end of the cartridge. Rotate the nail with each punch to loosen the contents.



**Figure 8.** Insert the fuse deep into one of the center holes but with enough fuse extended to insure safety.



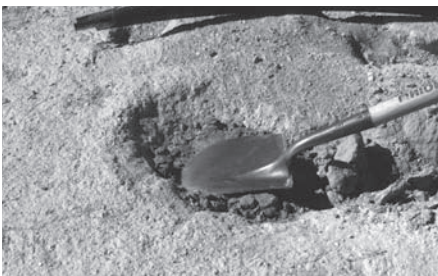
**Figure 9.** Point the fuse away from you to light it.



**Figure 10.** When the cartridge is ignited, place the cartridge as far into the burrow as possible. CAUTION: Fire and smoke will be emitted from the fuse end of the cartridge.



**Figure 11.** Immediately plug the burrow entrance with a piece of sod. Avoid letting loose soil fall into the burrow to smother the burning cartridge.



**Figure 12.** Pack the soil tightly with your heel or the back of the shovel to minimize the amount of smoke that escapes.



**Figure 13.** For large jobs, flag or mark each burrow to assess the effectiveness of the fumigant.

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