Aerial Application of Liquid Rotenone
SOP: 17.0

PURPOSE:

1. Minimize exposure to rotenone for wildlife and humans during aerial applications
2. Provide guidance on techniques, equipment, and procedures to use during aerial applications
3. Establish feasibility and necessity of aerial application

PROCEDURE:

I. Application Aircraft

All pilots must be licensed through the Federal Aviation Administration and certified as aerial pesticide applicators through the appropriate agency. Open cockpits are prohibited, and pilots must use a cockpit with a nonporous barrier that totally surrounds the cockpit occupants and prevents contact with pesticides outside the enclosed area. Any rotary or fixed-wing aircraft may be used, provided it can be equipped to dispense liquid rotenone in a manner consistent with stipulations in Section II below. Unmanned aircraft ("drones") may be used if authorized for pesticide application by the appropriate state/provincial agency. Drones operating on public lands and parks may have other restrictions, so seek consultation/guidance from the appropriate land management agency.

II. Application Equipment, Tecniques, and Procedures

A. General Requirements

Aerial applicators shall ensure that the flow of liquid rotenone to the spray nozzles is controlled by a positive shutoff system, and each nozzle is equipped with: (1) a check valve, with the flow controlled by a check-valve device or a boom pressure release device that puts a negative pressure on the system; or (2) a positive action valve system.

B. Dilution

Aerial applicators must dilute the liquid rotenone formulation to 10% or less with water before spraying in open water of a lake or stream; dilute formulation to 1–2% with water before spraying to shallow water (< 1 foot deep) such as wetlands, seeps, and springs. Use more dilute solutions if needed to maintain coarse droplet size.

C. Drift Control Requirements

For rotary-wing aircraft, the maximum release height (spray nozzle to the water or overstory vegetation) is 10 feet, and for fixed-wing aircraft it is the lowest height consistent with flight safety. The purpose for a low release height is to reduce spray evaporation and drift.

Maintain boom pressure at a maximum of 40 psi. Monitor spray pressure during flight, since changes in pressure can change the application rates and may change the droplet size.

The boom length must not exceed 75% of the wingspan for fixed-wing aircraft or 90% of the rotor blade diameter for rotary-wing aircraft. Orient spray nozzles backward with minimal downward angle into slip stream with downward angle of nozzle not exceeding 20 degrees.

Use types and sizes of nozzles designed for coarse or coarser droplet size according to American Society of Agricultural and Biological Engineers (ASABE) Standard 641. The Standard language can be accessed through the USABE website at www.asabe.org.

Review calibration data with pilot regarding nozzle pressure and delivery rate of spray to ensure proper-sized droplets are being applied.

Treatment Area must be surrounded by a buffer zone which extends ¼ mile inland from the shore line; if occupied dwellings or developed areas (see Section 4 for definition of developed areas) are present within the ¼ mile buffer, the buffer area is adjusted so the application does not occur within ¼ mile of the occupied dwellings or developed areas. Mark Treatment Area boundaries on the ground so they are clearly recognizable by the pilot. The certified applicator for the project should fly the treatment area with pilot prior to treatment to verify treatment boundaries. Require pilot to use GPS to document boundaries and record treatment flight paths.

Aerial applications are prohibited when wind speed exceeds 10 mph as measured by an anemometer. Project staff must continually monitor the anemometer during the aerial application and have ability to communicate with the pilot to stop spraying if wind speeds exceed 10 mph.

D. Monitoring Application

Monitor treatment area boundaries and buffer zones next to occupied dwellings or developed areas with water-sensitive spray deposit cards to detect any possible drift. Train people in how to handle and interpret the cards (many things can contaminate the cards such as dew, moisture from hands, insects) and also document results. Card lines should also be placed in treated areas under full spray to serve as a reference. See Figure SOP 17.1 for an example of a commercially available card from Syngenta (Switzerland). Other options include SpotOn Paper from Innoquest (United States) and WSPaper (Brazil).

E. Determining Flight Path

The certified applicator for the project must inspect the GPS route of the pilot in advance of treatment to confirm spraying will stay within treatment area boundaries and outside the ¼-mile spray inland from the shore line and occupied dwellings and developed areas. Do not apply within ¼ mile inland from the shore line and occupied dwellings and developed areas. When wind is present, applicators must use ½ swath displacement upwind at the downwind edge of the waterbody.

F. Temperature Inversion

Applications may not be made during temperature inversions, defined as a layer of warm air on top of a pocket of cold air. Pilots must assess site conditions to verify that no inversion exists before any application may begin.

III. Timing of Aerial Application

A. Minimizing Prolonged Exposure of Wildlife

Aerial applications should be timed to minimize exposure of wildlife to rotenone, especially those species least able to avoid spraying activity. Exposure scenarios to avoid include nesting birds, flightless young, or molting waterfowl that may receive direct contact with spray. To avoid the reproductive period, aerial applications should be delayed until after August 1, when animals have dispersed from natal sites. Seasonal presence and nesting chronology depends on species and location, so consult the local fish and wildlife agency to determine if additional delay is appropriate. If the waterbody is used as a staging area by migrating waterbirds it may be necessary to establish a date beyond which the aerial treatment should not occur. Also, many waterfowl species will not migrate if water remains open, while other species are considered "resident" and will not migrate under normal conditions. For these situations, it may be necessary to employ visual, auditory or exclusion techniques that disperse birds from their location in the treatment area (i.e., hazing).

B. Hazing

Hazing can be used as a technique to keep birds from occupying the treatment area during an aerial application. Waterfowl can be effectively hazed (see Gorenzel and Salmon 2008 for guidance) except during the molting period. Hazing should precede each application (within 15 minutes), using a flight path and height similar to the that used for the aerial application. Permits are likely to be necessary to haze birds, per protections of migratory birds under the Federal Migratory Bird Treaty Act and administered by the US Fish and Wildlife Service. State/provincial laws may require separate permits for bird hazing. Consult your federal and state/provincial fish and game agencies for necessary permitting. Hazing is mostly done using aircraft, but ground-based hazing using loud sound devices (cannons, loudspeakers), boats and other techniques are possible alternatives.

IV. Buffer Zones

To protect bystanders from spray drift, establish a buffer zone around the treated waterbody, which begins at the perimeter of the treatment area boundary and extends ¼ mile inland. Bystanders must be excluded from this area, and entry points to the buffer zone (roads, trails) must receive placarding consistent with stipulations required for placarding the Treatment and Project Areas (see SOPs 1.1 and 6.1). Placarding at the outside edge of the buffer zone can be removed upon completion of aerial application if other requirements listed on the label and SOP 1.1 are satisfied.

Aerial applications may not occur within ¼ mile of occupied dwellings or developed areas. Developed areas includes buildings, designated campgrounds, playgrounds

and park facilities (i.e., maintained picnic, viewing or swimming areas), maintained roads, parking lots and public trails, standing agricultural crops, or enclosures occupied by domestic animals. These dwellings/developed areas may be less than ¼ mile from the shoreline and hence the buffer zone around these areas may extend into the waterbody itself (see example in Figure SOP 17.2). Consideration should be given to conduct aerial applications only when the wind is blowing away from these areas as this will reduce the potential for adverse spray drift.

V. Worker Protection

Pilots in enclosed cockpits must wear a long-sleeved shirt, long pants, shoes, and socks. Workers on the ground who are within the Treatment Area at the time of aerial application may not be within ¼ mile of the aircraft when product is being applied. These same workers must be wearing PPE required for liquid formulations as described in Table SOP 3.2.

VI. Feasibility and Justification of Aerial Applications

The Certified Applicator in charge of the application should only apply rotenone with aerial equipment when it is not feasible by other means due to accessibility, safety, and efficacy issues. This assessment is incorporated into the planning and public involvement procedures (Chapter 2 of this manual).

VII. Compliance with Other SOPs

The circumstances that determine the need for aerial application (e.g., poor access) may also provide challenges for complying with other SOPs. Mandatory SOPs must be followed, but judgment should be used to determine the feasibility of compliance with advisory SOPs. Examples include, but are not limited to:

As described above in Section IV, placarding of the Treatment Areas as described in SOP 1.1 must be adjusted to include sites of public entry to buffer zone boundaries.

If aerial application includes treatment of wetlands with a connection to the rest of the Treatment Area, then recognize that the amount of rotenone applied to the wetlands must be included in the total amount used in order to calculate a treatment rate as described in SOP 5.1.

In areas where aerial application is used to treat wetlands or marshes where water mixing is poor or indeterminate, the procedures used to conduct bioassays to monitor efficacy (SOP 14.1) may need to be modified. In these situations, no one bioassay site may be representative of treatment conditions and multiple cages may be necessary to capture the full range of exposure conditions. In lentic systems, multiple bioassay cages spaced evenly or randomly around the wetlands may achieve this goal, while in lotic systems, cages placed at the upper end (where water enters wetlands complex), the middle and lower (exit from the complex) may be a useful sampling strategy.

The collection of dead fish (SOP 15.1) may be especially problematic. On remote lakes with little public activity, public nuisance issues associated with dead fish may be minimal.

VIII. Additional Information

Gorenzel, W. P., and T. P. Salmon. 2008. Bird Hazing Manual. Techniques and Strategies for Dispersing Birds from Spill Sites. University of California, Agricultural and Natural Resources Publication 21638.

US EPA. Reducing Pesticide Drift. Available: https://www.epa.gov/reducing-pesticide-drift. (September 2022).

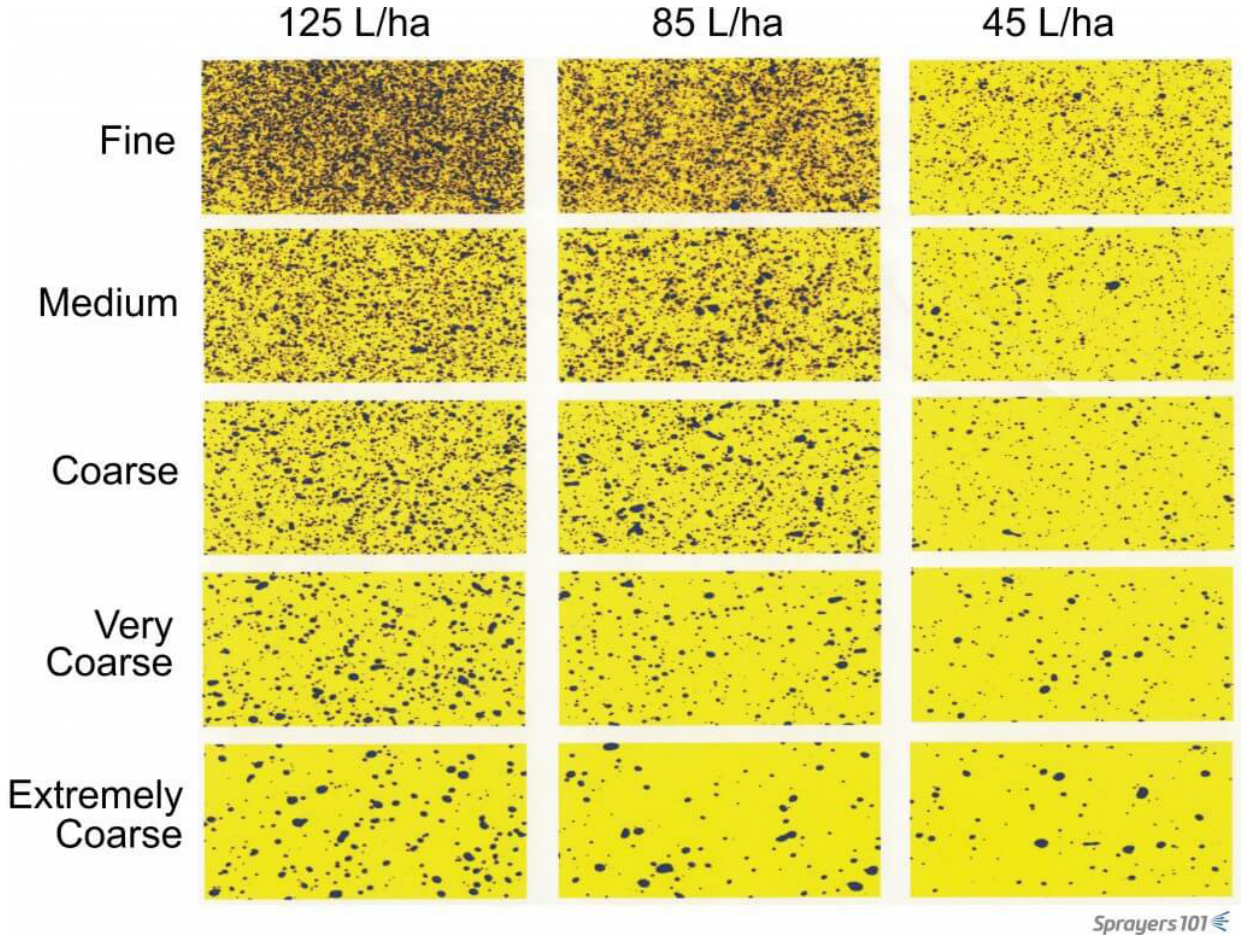

FIGURE SOP 17.1. Example of Syngenta water-sensitive spray card for measuring spray pattern. Can be purchased through Tee Jet, Inc.

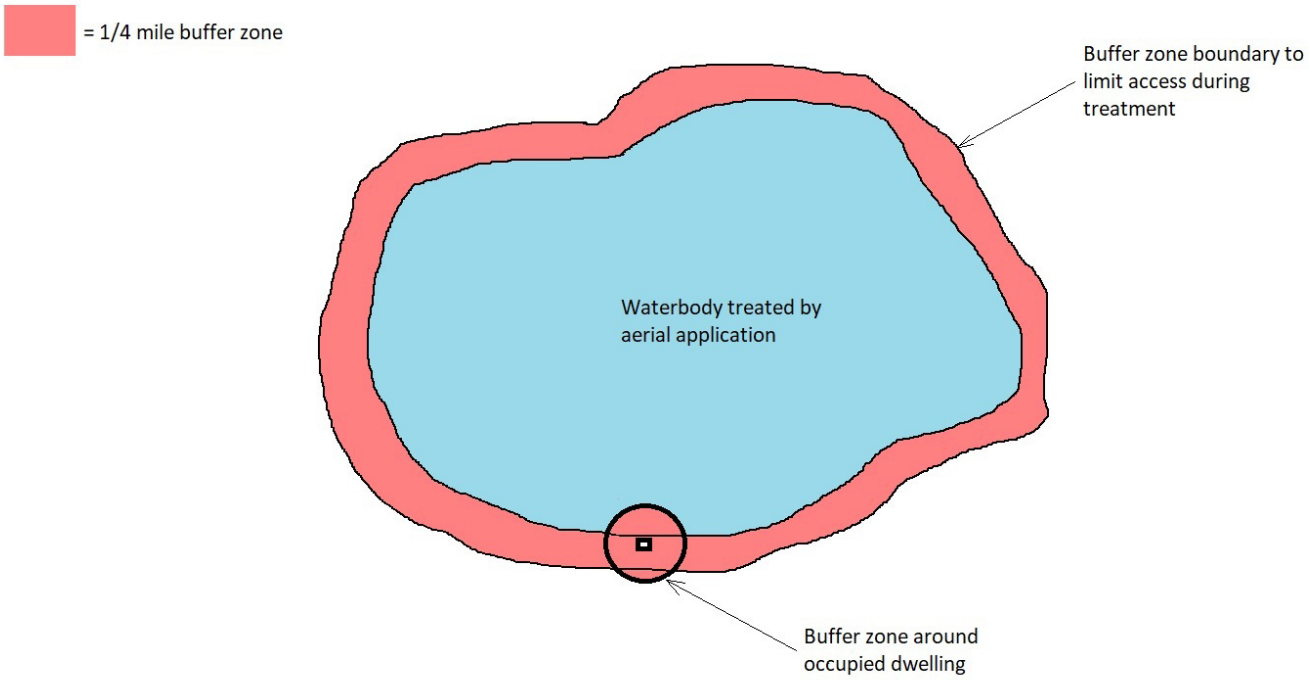

FIGURE SOP 17.2. Example of ¼ mile buffer zone around lake perimeter to protect bystanders from drift and ¼ mile exclusion zone from aerial spraying around dwelling.