



**COLORADO**

**Parks and Wildlife**

Department of Natural Resources

**Quaternary Ammonia Compound Disinfection Protocols (2015)**

INTERNAL AGENCY RECOMMENDATIONS

The following information is provided for within-agency wader and gear disinfection when well-known, commercially available quaternary ammonia compound (QAC) disinfectant products are in use.

*Bath Disinfection Recommendations*

Submersion of small gear and waders:

- Prior to disinfection, clean debris, mud, and vegetation off of equipment and waders.
  - Muddy disinfectant solution can lose its effectiveness and capacity to kill invasive organisms.
- Visually inspect waders and equipment for New Zealand mudsnails and other invasive aquatic organisms prior to cleaning.
- The recommended minimum active QAC concentration for effective disinfection is 0.4% or 4.0 ml of QAC per L of water; amount of disinfectant per gallon varies, and is dependent upon the percent active QAC in the disinfectant being used (Table 1).
- Equipment and waders should be submerged in disinfectant solution for a minimum of 10 minutes.
- Follow all handling instructions on disinfectant label or Material Safety Data Sheet (MSDS).

**Table 1.** Commercially available QAC disinfectants, percent (%) active QAC, percent QAC concentration in solution, amount of disinfectant needed (ml and ounces) per gallon of water to obtain a minimum active QAC concentration of 0.4%, and ratio of disinfectant to water. Italics indicate that product has been discontinued.

<b>Disinfectant Name</b>	<b>% Active QAC (MSDS)</b>	<b>% QAC Conc. In Solution</b>	<b>ml per gal</b>	<b>Ounces per gal</b>	<b>QAC:H<sub>2</sub>O</b>
<i>Sparquat 256</i>	<i>12.5</i>	<i>0.4</i>	<i>121.2</i>	<i>4.1</i>	<i>1:31</i>
Quat 4	10.0	0.4	153.8	5.2	1:25
Super HDQ Neutral	16.9	0.4	91.7	3.1	1:41
Green Solutions (GS) High Dilution Disinfectant 256	21.7	0.4	71	2.4	1:53
Vedco 128	8.45	0.4	180.4	6.1	1:21
Quat 128	8.45	0.4	180.4	6.1	1:21

### Checking Disinfectant Solution Efficacy

Muddy or diluted disinfectant can lead to a loss of effectiveness and capacity to kill invasive organisms. It is important to change the solution once it becomes muddy and/or diluted due to repeated use. If you are uncertain about the concentration, “Quat Check 1000” Test Papers can be purchased from Grainger. The solution is diluted to a ratio of 1:5 (one cup of solution to five cups of water) prior to testing. If the diluted solution is between 600 and 800 ppm (or higher), as indicated by the color of the test strip, the solution can continue to be used. If the solution is less than 600 ppm, the solution is no longer effective at killing invasive organisms. Dispose of per the manufacturer’s label and make a new disinfection bath using the guidelines provided above.

### Spray Disinfection Recommendations

Cleaning off small gear and waders using disinfectant spray:

- Prior to disinfection, clean debris, mud, and vegetation off of equipment and waders.
- Visually inspect waders and equipment for New Zealand mudsnails and other invasive aquatic organisms prior to cleaning.
- The recommended minimum active QAC concentration for effective spray-application disinfection is twice that for submersion disinfection, 0.8% or 8.0 ml of QAC per L of water (Table 2).
- Equipment and waders should be fully covered in disinfectant solution for a minimum of 10 minutes. Reapplication may be necessary if hot (evaporative) or wet conditions dilute spray solution on equipment.
- Follow all handling instructions on disinfectant label or MSDS.
- Power washing with hot water (140° F) is an option, if available.

**Table 2.** Commercially available QAC disinfectants, percent (%) active QAC, percent QAC concentration in solution, amount of disinfectant needed (ml and ounces) per gallon of water to obtain a minimum active QAC concentration of 0.8%, and ratio of disinfectant to water. Italics indicate that product has been discontinued.

Disinfectant Name	% Active QAC (MSDS)	% QAC Conc. In Solution	ml per gal	Ounces per gal	QAC:H <sub>2</sub> O
<i>Sparquat 256</i>	<i>12.5</i>	<i>0.8</i>	<i>242.4</i>	<i>8.2</i>	<i>1:16</i>
Quat 4	10.0	0.8	307.6	10.4	1:12
Super HDQ Neutral	16.9	0.8	183.4	6.2	1:21
Green Solutions (GS) High Dilution Disinfectant 256	21.7	0.8	142	4.8	1:27
Vedco 128	8.45	0.8	360.8	12.2	1:11
Quat 128	8.45	0.8	360.8	12.2	1:11

### SPARQUAT REPLACEMENT RECOMMENDATIONS

Super HDQ Neutral (Spartan Chemical) produced the highest New Zealand mudsnail mortality (100%) following the manufacturer’s label recommendation for QACs in solution at an exposure duration of ten minutes. In addition, spray application of Super HDQ Neutral to breathable

wader material resulted in 100% mortality at concentrations of 0.4, 0.8, and 1.2% QACs in solution. Super HDQ is therefore recommended as replacement for Sparquat 256. Bath disinfection recommendations remain at 0.4% QACs in solution (lower than manufacturer’s recommendation). Spray disinfection recommendations remain at 0.8% QACs in solution (higher than manufacturer’s recommendation) to account for uneven application or shorter exposure durations (Stout et al., *In review*). Super HDQ Neutral distributors can be found through the Spartan Chemical website (<http://www.spartanchemical.com/distributor/lookup>).

### GENERAL PUBLIC RECOMMENDATIONS

Due to the disparate QAC concentrations in the various products available for purchase by the public, it is possible that confusion could be created by having different dilution recommendations for these various products. Therefore, a standard rate of dilution should be set for the general public when using QAC’s for disinfection, which will be of adequate active QAC concentration to produce complete disinfection when using even the lowest active ingredient products. The recommendation for *any* QAC used by the general public to disinfect waders is 6 ounces per gallon (see Table 3 for QAC concentration in solution); this ensures a full kill of invasive aquatic organisms if they are using lower concentration products (such as Vedco 128 or Quat 128). All steps in the disinfection process otherwise remain the same.

**Table 3.** Commercially available QAC disinfectants, percent (%) active QAC, percent QAC concentration in solution, and amount of disinfectant recommended to the public (ml and ounces) per gallon of water to obtain a full kill of invasive aquatic organisms. Italics indicate that product has been discontinued. NOTE: 6 ounces disinfectant per gallon equates to a ratio of QAC to water of 1:21.

<b>Disinfectant Name</b>	<b>% Active QAC (MSDS)</b>	<b>% QAC Conc. In Solution</b>	<b>ml per gal</b>	<b>Ounces per gal</b>
<i>Sparquat 256</i>	<i>12.5</i>	<i>0.59</i>	<i>177.5</i>	<i>6.0</i>
Quat 4	10.0	0.47	177.5	6.0
Super HDQ Neutral	16.9	0.79	177.5	6.0
Green Solutions (GS) High Dilution Disinfectant 256	21.7	1.0	177.5	6.0
Vedco 128	8.45	0.40	177.5	6.0
Quat 128	8.45	0.40	177.5	6.0

Additional non-chemical public disinfection recommendations include bagging or wrapping wading gear and equipment and freezing overnight (or longer in deep freeze), and allowing equipment and wading gear to dry in a warm or hot sunny location for 24-48 hours (Colorado Division of Wildlife 2005). Note that bleach has not been found to be effective at killing New Zealand mudsnails (USFS 2013).

### EFFICACY AGAINST OTHER ANS OF CONCERN

The recommendations made in this document for disinfecting gear that has come in contact with New Zealand mudsnail infested waters are higher than those for *Myxobolus cerebralis* (Hedrick

et al. 2008), chytrid fungus (Johnson et al. 2003), quagga mussels (Britton and Dingman 2011), and zebra mussels (Wong 2012). Therefore, these recommendations should be effective for preventing the spread of these species as well. Consult the literature for disinfection concentrations for other ANS of concern that are not included in this list.

#### DISPOSAL

Wastewater treatment plants are capable of processing water containing small amounts of QACs in solution. Therefore, rinsing used solutions of QACs down a sanitary sewer is a safe method of disposal. However, QACs should be kept out of storm sewers and other waterways. Always dilute old product before rinsing down sanitary sewers directly from the container, and follow MSDS and label recommendations regarding rinsing and disposal of empty containers. QACs become tightly bound to organic matter in soils and sediments (Owens et al. 2000) and are degraded by aerobic bacteria (Tezel 2009). Therefore, small amounts of QAC from spray or bath disinfection may come in contact with the environment with few negative effects. However, it is not recommended to dump large amounts of QAC solutions directly on the ground.

#### REFERENCES

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