PREVENTING SPREAD OF AQUATIC INVASIVE ORGANISMS COMMON TO THE INTERMOUNTAIN REGION

***INTERIM* OPERATIONAL GUIDELINES FOR *2016* FIRE ACTIVITIES**

Why? Firefighter and public safety is still the first priority, but aquatic invasive plants and animals pose a risk to both the environment and to firefighting equipment (some species can clog valves and pumps if equipment is not completely drained or treated). Avoidance and decontamination can prevent the spread of these organisms.

These 2016 guidelines were developed for USFS fire managers to help them avoid the spread of aquatic invasive species. The best management practices presented here are currently under review by the National Wildfire Coordinating Group for adoption. In the interim, these guidelines are suggested for use in the Intermountain Region.

All documents are available on the Region 4 Aquatic Invasive Species website: http://www.fs.usda.gov/detail/r4/landmanagement/resourcemanagement/?cid=fsbdev3_016101

PREVENTION GUIDELINES

Preventing exposure to AIS through best management practices is the easiest and simplest way to control their spread.

GENERAL PREVENTION

- Map the distribution of aquatic invasive organisms in watersheds where the operation will take place (Figure 1). An ArcMap project file and a geodatabase of species layers are available for download at: http://www.fs.usda.gov/detail/r4/landmanagement/resourcemanagement/?cid=fsbdev3_016100. You can never be certain that invasives are NOT present, but at least you will know ahead of time where they ARE known to be present.

- Fill tanks from municipal water sources whenever possible.

- When possible, avoid drafting from waterbodies with known infestations of aquatic invasive species.

- Avoid transferring water between drainages or between unconnected waters within the same drainage. Do not dump water from one waterbody (e.g., stream, lake, reservoir) into another waterbody.

- Avoid sucking organic and bottom material into water intakes when drafting from shallow water. Use screens. If collapsible tanks can be filled with municipal water, draft from those tanks instead of raw water sources.

- Avoid obtaining water from multiple sources during a single operational period unless drafting/dipping equipment is decontaminated or changed out with clean equipment between sources.

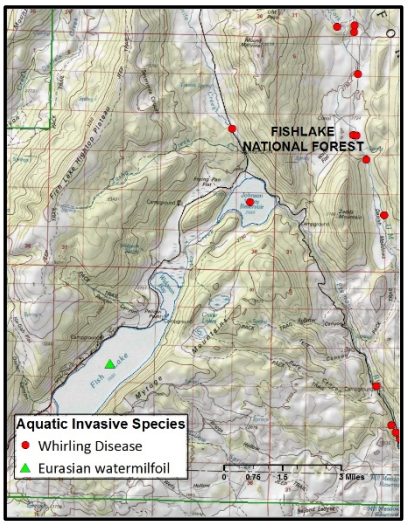

Figure 1. Map distribution of aquatic invasive species on your unit. Aquatic plants and whirling disease are present in this watershed on Fishlake National Forest.

- If contamination of equipment with raw water or mud/plants is unavoidable, see 'Decontaminating Ground Equipment' and 'Decontaminating Aviation Equipment', below.

GROUND OPERATIONS

Of great concern for ground equipment is the possibility that residual tank water contaminated with AIS could be transferred to uncontaminated waterbodies during the drafting process. However, if proper drafting and water handling BMPs are used and foot valves are working correctly, there is low risk that contaminated tank water could "seep" into the drafting water source. We do NOT recommend decontamination of engine or water tender tanks.

- When possible, fill engines from a municipal hydrant, a water tender, or from a pump assigned to a single drafting source.

- When spraying water to suppress a fire, avoid application of untreated water into local water bodies (ponds, lakes, rivers, streams, wetlands, seeps, or springs), especially if the hose water came from a different watershed (Figure 2).

Figure 2. Water delivery equipment is low risk if contaminated water is pumped onto a fire and not applied to another waterbody.

- To prevent leakage and to maintain the prime, be sure that foot valves are screwed snugly onto drafting hoses and are fully closing and not leaking before and during drafting (Figure 3). If foot valves are leaking, refrain from drafting and replace foot valve with one that is operating properly. See *Appendix B* for methods to field test foot valves for leakage.

Figure 3. Be sure foot valves are not leaking before and during drafting.

- Priming the engine pump for drafting— To minimize the potential for engine water leakage through the foot valve, p*rime with water from the drafting source rather than water from the engine tank* (Figure 4). When priming with a bucket, first make sure that the bucket is dry and is itself not a vector for AIS. Additionally, during drafting and water tending operations, don't leave draft hose full with foot valve engaged and submerged in water source when not pumping.

Figure 4. To minimize risk of engine water leakage through foot valve, prime with water from the drafting source rather than from the tank.

- Elevate foot valves above the bottom of the waterbody for clean, sediment-free operation—for example, duct tape foot valve to a shovel or place the valve in a hard hat or bucket.

- Remove water drain plug/s from self-priming pumps (e.g., trash pumps) to empty pump housing before moving to a new waterbody.

- When filling the engine tank, avoid tank overflow into the water source.

DECONTAMINATING GROUND EQUIPMENT

- Before moving to a new water source (in a different watershed), decontaminate all external and internal surfaces of foot valve and draft hose. Three options are:

    - Dry the gear until dry to the touch (sunlight accelerates the process).

    - OR use hot water (≥140^{o} F, allow spray to contact surface for 5 to 10 seconds [up to 5 minutes preferred]).

    - OR use a chemical solution (see *Appendix A: "Decontaminating with Chemical Disinfectants*"). All internal and external surfaces of the drafting hose with foot

valve can be decontaminated by coiling and submerging in a bucket filled with disinfectant (Figure 5).

- Consider carrying spare, clean, dry draft hoses and foot valves to switch out with used ones when moving to a new water source.

Figure 5. If drying or hot water are not options, draft hoses with foot valves can be decontaminated by submerging in a bucket filled with disinfectant.

AVIATION OPERATIONS

Aircraft such as air tankers and single engine air tankers, which use water from municipal sources, are unlikely to encounter AIS and are not addressed here. All other aircraft utilize untreated water and have the potential to transfer AIS.

GENERAL

- Avoid dipping or scooping water from multiple water sources within the same operational period to minimize cross-contamination of water sources.

- If possible, use water dipped from the same drainage that it will be dropped in. This can be accomplished by setting up heliwells (portable tanks/pumpkins) filled from small streams with Mark III pumps.

- Use deeper (blue) water whenever possible. Avoid areas that will intake mud or plants.

- Switch out a contaminated helicopter bucket with a clean bucket before moving to a new water source. Alternating used (possibly contaminated) helicopter buckets with spare (clean) buckets can save time and increase efficiency, as the first bucket can be decontaminated while the second bucket is being used.

- Helicopter snorkels do not need to be primed, with either source or tank water, so there is no risk of residual tank water entering a water source during drafting operations (Figure 6). However, snorkels and foot valves that encounter untreated water must be decontaminated between drainages (see below).

Figure 6. Helicopter snorkels, such as on this Sky Crane, do not need priming so no risk of tank water leakage during drafting. However, snorkels and foot valves that touch untreated water must still be decontaminated between drainages.

DECONTAMINATING AVIATION EQUIPMENT

Chemicals such as bleach and quaternary ammonium compounds do not meet corrosion requirements for aluminum and **shall not** be used in aircraft.

- Visually inspect water handling equipment (snorkel hoses, pumps, foot valves, screens, buckets, intakes & tanks) daily, during maintenance, and after every water dropping mission, when possible.

- Remove visible plant parts and mud from external surfaces. Power wash all accessible surfaces with clean water (ideally, hot water ≥140°F for 5 to 10 seconds [up to 5 minutes preferred]). Power washing greatly reduces the likelihood that any target aquatic invasives are present. Chemical treatment of external surfaces is not recommended.

- When contact with untreated water has occurred or is suspected, clean and decontaminate accessible, exposed surfaces with hot water (≥140°F) for 5-10 sec (up to 5 minutes preferred) before moving to new, unconnected water sources or new incidents. When hot water (≥140°F) is not available or practical, use potable water to flush invasive species from the system. Ensure that run-off cannot reach a water source.

- Thorough drying alone is an easy and effective decontaminating method, though required drying times can vary with equipment materials (e.g., metal, rubber, fabric). Dry gear until dry to the touch. Drying may not be possible for a quick turnaround, so carry spare, clean gear to switch out with wet gear.

DECONTAMINATING ACCESSIBLE INTERNAL TANKS

Accessible tanks have doors or other openings that allow access for cleaning. Scooper aircraft (CL215 or CL415, and Fire Boss), Sky Crane helicopters (CH-54/S-64), and other tanked helicopters are examples of aircraft with accessible tanks.

Figure 7. A CL-415 scooper plane fills its belly tanks [inset]. Workers decontaminate belly tanks of CL-415 scooper plane by spraying hot water from a high pressure wand and a portable hot washer, or 'Hotsy.

- Decontaminate internal tanks by spraying the internal surface with hot water (≥140°F) from a hot washer or 'Hotsy'. Allow spray to contact surface for 5 to 10 seconds (up to 5 minutes preferred). This method is recommended for scooper and Fire Boss aircraft (Figure 7). Tanked helicopters have tank doors that open widely from below for easy tank access and draining. Hot water spray or thoroughly dry these surfaces.

Appendix A: Decontaminating with Chemical Disinfectants

Chemical disinfectants, though effective, can be hazardous, corrosive, and difficult to dispose of. However, when other decontamination methods, such as hot water or drying, are not options, chemicals can be used for small gear items ONLY (e.g., footvalves, draft hoses, or screens) in volumes appropriate for small buckets.

Quaternary ammonium compounds (quats), common cleaning agents used in homes and hospitals, are safe for MOST gear and equipment when used at recommended concentrations and rinsed. Chlorine products are not emphasized for use in these guidelines because of their corrosiveness to fabrics, plastics, rubber, and metal and their limited effectiveness against snails. However, bleaches are extremely effective against certain invasive organisms (see *Appendix D—Aquatic Invasive Species of Concern to Firefighters Nationwide and Disinfection Methods*), and are relatively inexpensive.

To decontaminate gear with quat disinfectant:

The quaternary ammonium formulations *Super HDQ*® and *Green Solutions High Dilution256*® (which replaces the discontinued *Sparquat* 256®) were recently (see *Appendix D,* Stout et al. 2016) found to be most effective against a variety of AIS. They can be used at concentrations according to the label (see below). Soak gear in a bucket for 10 minutes. Alternatively, gear may be disinfected by spraying with quat from a backpack weed sprayer. Afterwards, **rinse gear thoroughly in clean water**. Quat compounds are highly toxic to aquatic organisms but are immobile in soil. Keep effluent containing this product at least 100 feet from lakes, ponds, streams or other waters. Do NOT allow product to enter storm drains, lakes, streams, or other waterbodies.

Volume of tap water	Super HDQ®	Green Solutions High Dilution256®	Soak Time	Spray Time
1 gallon water	½ oz	½ oz	10 min	5 sec spray; let stand 10 minutes; rinse
1 gallon water	1 Tbsp.	1 Tbsp.	10 min	5 sec spray; let stand 10 minutes; rinse

To decontaminate gear with chlorine bleach:
Bleaches are corrosive to canvas, gaskets, and metal and have limited effectiveness against snails. However, bleaches are extremely effective against other invasive organisms, especially pathogens, and the bleach concentration below has been found to be effective for chytrid fungus and other AIS (see *Appendix D,* Johnson et al. 2003). Soak gear in a bucket for 10 minutes. Afterwards, **rinse gear thoroughly in clean water**.

Volume of tap water	"Regular Clorox® Bleach" (6% sodium hypochlorite)	Soak Time
1 gallon water	9 oz	10 min
1 gallon water	1 ⅛ Cup	10 min

Chemical Disposal

Small quantities of diluted quaternary ammonium products or bleach which have been used to disinfect foot-valves or other fire-fighting equipment may be disposed of in a sanitary sewer **as allowed by the product label**. Alternatively, used solutions of quaternary ammonium products or bleach may be disposed of by any application specified on product label direction, such as:

- Cleaning vehicle exteriors and tires by applying diluted materials through a high pressure system
- For the prevention of mildew on non-porous surfaces
- Disinfection of toilets (including portable)

Always consult the product label in determining the appropriate Personal Protective Equipment necessary for the mixing and use of these chemicals, and for final direction on a given products use and disposal. Do NOT allow these products to enter storm drains, lakes, streams, or other waterbodies.

Appendix B: Field Testing Foot Valves for Leaks

Background information:
Aquatic invasive species (AIS) can be found in the untreated water sources used in firefighting operations, either a natural source (a river or lake) or a human-made water body (a reservoir, canal, or stock tank). Untreated water sources may harbor a variety of AIS, including quagga and zebra mussels, New Zealand mud snails, whirling disease, didymo (*rock snot)*, and many others.

Of great concern for ground equipment is the possibility that residual tank water contaminated with AIS could be transferred to uncontaminated waterbodies during the drafting process. One best management practice to reduce this potential is to be sure that foot valves are screwed snugly and not leaking before and during drafting. The following protocol outlines a simple method that can be implemented in the field.

Equipment List

Some items may be part of an engine's supplied equipment. Other items may need to be purchased but are easily found at fire equipment vendors. Items needed to perform the leak test include:

- Foot valve
- Suction hose
- Assorted male-to-female adapters, increasers, and reducers
- 1 ½" Pump Test Kit with Gauge – CFE (Cascade Fire Equipment) P/N: 11495; or similar
- 1 ½" 90 Degree Elbow – CFE (Cascade Fire Equipment) P/N: 10251-90; or similar
- 1" ratchet straps

Low Pressure Test (3-5 psi)

To perform the low pressure test, fasten a 9' length of suction hose to the access ladder located on the rear of the engine (Figure 1). Use ratchet straps or another suitable method, as long as the suction hose is attached safely and securely to the ladder.

To adjust for size of the foot valve (e.g., 1½", 3"), use a combination of male-to-female adapters, increasers, and/or reducers to attach the foot valve to the suction hose (Figure 2). Fill the suction hose completely with water; the weight of the water will provide a pressure of 3-5 psi. Check the foot valve. There should be no leakage. If leakage occurs, replace the foot valve with one that does not leak.

Figure 1. Suction hose with foot valve attached to engine ladder.

Figure 2. Foot valve attached to suction line with various adapters as needed to adjust for foot valve size.

Figure 3. Pressure valve attached to the footvalve.

High Pressure Test (130 psi)

To perform the high pressure test, first attach a wye or other suitable shut-off valve to the rear discharge (Figure 3). Attach the *CFE Pump Test Kit with Gauge* to the shut-off, then attach the *CFE 90 degree Elbow*. Lastly, attach the foot valve to be tested to the elbow. The test set-up should resemble the one shown in Figure 3.

Using the engine's pump, increase the pressure until the *CFE Pump Test Kit Gauge* indicates 130 psi. Check the foot valve. There should be no leakage. If leakage occurs, replace the foot valve with one that does not leak.

Thanks to Carl Schaefer at U.S. Forest Service, San Dimas Technology and Development Center, for development of this test protocol.