PREVENTING SPREAD OF AQUATIC INVASIVE ORGANISMS (AIS) COMMON TO THE STATE OF MONTANA

OPERATIONAL GUIDELINES FOR 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.

PREVENTION GUIDELINES

Preventing exposure to AIS through best management practices (BMP) is the easiest and simplest way to control their spread. These guidelines were primarily developed by US Forest Service personnel to help their fire managers avoid the spread of aquatic invasive species. The Montana DNRC altered and added to the original Forest Service source document to meet the DNRC’s needs and to incorporate guidance previously developed within that agency. Many of the best management practices presented here are currently under review by the National Wildfire Coordinating Group for adoption. In the interim, the NRCG suggests that member agencies apply these guidelines to fire operations in the Northern Rockies.

GENERAL PREVENTION

Know the distribution of aquatic invasive organisms in watersheds where the operation will take place (Figure 1). See the following link to the Department of Fish Wildlife and Parks AIS species locations in Montana:  http://fwp.mt.gov/fishAndWildlife/species/ais/speciesId/default.html

- 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.

Aquatic Invasive Species Locations in Montana - 2015

Figure 1. Map distribution of aquatic invasive species on your unit!
• Avoid transferring water between drainages or between unconnected waters within the same drainage. Do not dump water from one waterbody (e.g., stream, lake, or 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.

• 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 tendertanks.

• 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 water came from a different watershed (Figure 2).

• To prevent leakage and to maintain the prime, be sure that foot valves are screwed snugly onto drafting hoses, closed fully and are 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.

- Priming the engine pump for drafting— To minimize the potential for engine water leakage through the foot valve, prime 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.

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

  o OR use hot water (140°F, or hotter) and allow spray to contact surface for 5 to 10 seconds [up to 5 minutes preferred]).

  o 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.

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 portable 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).

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 or hotter for 5 to 10 seconds [up to 5 minutes preferred]). Power washing greatly reduces the likelihood that any target aquatic invasives remain. 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) or hotter 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.

- Decontaminate internal tanks by spraying the internal surface with hot water (140°F) or hotter 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.

**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.

**STATE OF MONTANA DNRC HELITACK OPERATIONS**

Aquatic Invasive Species (AIS) are easily transported in a variety of ways (i.e. helicopter buckets, fixed tank helicopters and SEATs utilizing open water sources, engines and tenders, and other water handling equipment). Agency personnel should become knowledgeable in the preventive measures associated with the prevention of the spread of aquatic plants and invertebrates.

Montana Fish Wildlife and Parks determined that invasive species need water to survive. Exposure to sunlight and elimination of residual water will prevent the transfer of (AIS).

According to the United States Forest Service, the transfer of (AIS) can also be reduced by removing plants and killing the micro-organisms left on the bucket with the use of a bleach and water mixture. (Although there are other products available, bleach and water is the most cost effective solution).
Montana Helitack will take a pro-active approach in the effort to reduce the transfer of Aquatic Invasive Species from one water source to another.

**PROCEDURES**

I. Initial Attack

Helitack’s mission is to protect firefighters, civilians, private property, and Montana’s natural resources from wildland fires. We recognize the importance of protecting our water sources from AIS.

Pilots will use water sources as they deem necessary for the mission.

During high fire activity we will follow the following steps:

1) **PREP**
   When time permits and the helicopter lands with the bucket deployed (such as refueling operations), open the bucket as much as possible to expose to air and sunlight.

2) **INSPECT**
  Inspect the bucket for mud, water, and vegetation that could carry aquatic invasive species.

3) **CLEAN**
   Remove all mud, water, and vegetation as much as possible. No need to use soap or chemicals.

4) **DRY**
   Aquatic invaders can survive only in water and wet areas. By drying the bucket thoroughly, most invasive species will cease to exist. The longer the bucket remains in direct sunlight the better.

II. Post Flight or Re-Comp

When practical, after the last fight of the day or at the start of the following day, the bucket should be sprayed down with a 6% bleach/water solution and allowed to dry completely before handling.

**WARNING:**

DO NOT USE GRANULATED/POWDERED BLEACH. Granulated/powdered bleach could have adverse effects when in contact with fuel products and will not be used. Refer to Appendix A for alternative solutions when liquid bleach is not used.

A. **Equipment Needed:**
   1) Rubber Gloves
   2) Goggles
   3) Measuring cup – marked for 2.5 cups
   4) 2-Gallon weed sprayer w/warning label (poison)
5) Liquid bleach (2.5 cups)
6) Water (2 gallons)

**WARNING:**
Liquid Bleach will cause blindness if splashed in eyes. Use goggles and rubber gloves when mixing solution.

**CAUTION:**
Liquid bleach will stain/discard/damage equipment. Mix solution 50 feet away from equipment. Use rubber gloves to protect hands. DO NOT use flight gloves or leather gloves.

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For the lack of better terms 100% bleach can cause a real mess. Ample drying time for the bucket is truly desired as we do not want to replace expensive fire pants or t-shirts that come in contact with bleach.

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B. **Mixing Instructions:**
- 100% bleach is a poison and an additional hazard to have on the fuel tenders. Therefore, we will mix at home station and transport the diluted solution on the fuel tender to have available in the field.
- Wear goggles and rubber gloves when working with bleach.
- Use extreme care to prevent getting bleach on clothing as it will discolor or stain.
- Mixing will be accomplished 50 feet away from aircraft and/or fuel tender.

**6% MIXING RATIO**
1 1/8 th cups (9 ounces) of bleach to 1 gallons of water

1) Pour 2 1/4th cups of liquid bleach into weed sprayer.
2) Add 2 gallons of water to weed sprayer

C. **Application:**
1) Move bucket 50 feet away from any equipment.
2) Remove tie-down strap (if installed).
3) Open bucket and extend cage.
4) Completely remove all mud, water, and vegetation.
5) Wear goggles and rubber gloves when working with bleach.
6) Lightly spray solution onto bucket inside and out.
7) Allow bucket to completely dry before handling.
8) Collapse cage and close bucket.
9) Reinstall (install) tie-down strap
10) Stow bucket on aircraft.

III. Contaminated Dip-sites

**NOTE:**
Dip-sites that have a confirmation of AIS may be used, however; the bucket will be cleaned with bleach/water solution prior to changing dip-sites.

A. Resource advisors on large incidents may identify dip-sites that contain AIS. Montana Helitack personnel will comply with the incident’s requests for bucket sterilization using our methods and procedures mentioned in section II of this appendix.

This procedure presents a practical approach for Helitack to help prevent the spread of Aquatic Invasive Species.

**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 such as bleach, are acceptable to use in addition to the products listed below. It is important to note that chlorine products may cause corrosion to occur in fabrics, plastics, rubber, and metal and they have limited effectiveness against snails. However, bleaches are extremely effective against certain invasive organisms.

**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.

<table>
<thead>
<tr>
<th>Volume of tap water</th>
<th>Super HDQ®</th>
<th>Green Solutions High Dilution256®</th>
<th>Soak Time</th>
<th>Spray Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 gallon water</td>
<td>½ oz</td>
<td>½ oz</td>
<td>10 min</td>
<td>5 sec spray; let stand 10 minutes; rinse</td>
</tr>
<tr>
<td>1 gallon water</td>
<td>1 Tbsp.</td>
<td>1 Tbsp.</td>
<td>10 min</td>
<td>5 sec spray; let stand 10 minutes; rinse</td>
</tr>
</tbody>
</table>

**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**.

<table>
<thead>
<tr>
<th>Volume of tap water</th>
<th>“Regular Clorox® Bleach” (6% sodium hypochlorite)</th>
<th>Soak Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 gallon water</td>
<td>9 oz</td>
<td>10 min</td>
</tr>
<tr>
<td>1 gallon water</td>
<td>1 1/8th Cups</td>
<td>10 min</td>
</tr>
</tbody>
</table>

**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 foot valve.
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.