



**A Review of the State of Idaho
Dreissenid Mussel
Prevention and Contingency Plans**

**Idaho Department of Agriculture
Aquatic Ecosystem Restoration Foundation
Pacific States Marine Fisheries Commission
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EXECUTIVE SUMMARY

William Haller, University of Florida Center for Aquatic and Invasive Plants

The Idaho State Department of Agriculture convened a panel of dreissenid experts in the Spring of 2011 to review the Department's prevention program and to debate contingency plans that could be undertaken if prevention efforts fail and invasive mussels become established in waterbodies in the state. Idaho has implemented an aggressive boat inspection and mussel prevention program; as a result, several boats contaminated with dreissenid mussels have been intercepted and decontaminated in the past three years. Invasive mussel eradication efforts have also been undertaken in relatively small waterbodies in other states. These efforts have not been uniformly successful but they have been uniformly expensive, with costs ranging from \$4,000 to greater than \$30,000 per acre. The few options available for control of mussels – even in small systems – further highlights the importance of prevention programs. These prevention programs should be expanded to a regional level because many very large watersheds in Idaho originate from neighboring states.

Most molluscicides are lethal (or have the potential to be lethal) to non-target fish and aquatic invertebrates. The presence in Idaho of several endangered species, coupled with the state's large, hydrologically connected lakes, makes eradication and control measures expensive and unlikely to succeed. Suggestions to the Department include: 1) the registration of molluscicides before a crisis occurs; 2) coordination and education of tribal, federal and state stakeholders; 3) development of a rapid response program to treat or contain mussels in marinas, bays or other enclosed areas (the most likely points of introduction) before mussels can establish reproducing populations in larger systems; and 4) the development of contingency plans for containing exotic mussels in all watersheds. The panel unanimously agrees that boat inspections and educational programs are critical and constitute the most effective means that are under Idaho's jurisdiction that can protect Idaho's waters from exotic dreissenid mussels.

SECTION I: INTRODUCTION

Amy Ferriter, Idaho State Department of Agriculture

Overview

Zebra and quagga mussels were introduced to North America's Great Lakes in ballast water in the late 1980s. Soon after introduction, the invasive mussels spread throughout the Great Lakes region, disrupting food chains and outcompeting native species. They are fouling organisms and have caused hundreds of millions of dollars in damage to water delivery systems in the Midwest and eastern US. They were first detected in the western US in January 2007 at the Lake Mead National Recreation Area and have since spread throughout the Lower Colorado River system and into several other western states.

Although these exotic mussels have not been found in Idaho, calcium and temperature levels are suitable for establishment in the majority of the state's waters. Ninety "Critical" and "High Risk" waterbodies have been identified in the state (see Section VII).

In addition to devastating environmental impacts, zebra and quagga mussels pose an economic threat to Idaho. The mussels can colonize boat hulls, engines and steering components of boats and other recreational equipment and can damage boat motors and restrict cooling. This invasive species also attaches to aquatic plants, submerged sediment and surfaces such as piers, pilings, water intakes, fish screens and ladders. Mussels frequently settle in massive colonies that can block water intakes and threaten municipal water supply, agricultural irrigation and power plant operations. It is estimated that if introduced to Idaho, these mussels would cost more than \$94 million annually in direct and indirect impacts to infrastructure, facilities, agriculture and recreation.

Given the well-documented impacts associated with these species, many western states are on high alert to prevent, contain and control exotic mussels in the region. The states of Nevada, California, Arizona, Colorado and Utah have all detected these species in critical water supply systems and are attempting to minimize impacts, but despite these efforts, they continue to spread. In 2011, quagga mussel veligers (the immature stage of the mussels) were found in a Nevada waterbody that is just 110 miles from the Idaho state line.

Prevention

The mussels are transported from waterbody to waterbody primarily by boats. Idaho's resource managers have developed a proactive prevention program to minimize the risk of introduction to Idaho's waters via mussel-fouled watercraft. In 2011, the Idaho State Department of Agriculture (ISDA) operated 15 watercraft inspection stations on highways

and major roads. Additionally, Idaho Transportation Department Port of Entry (POE) staff is trained to inspect commercially hauled watercraft at Idaho's 11 POEs (Figure 1).

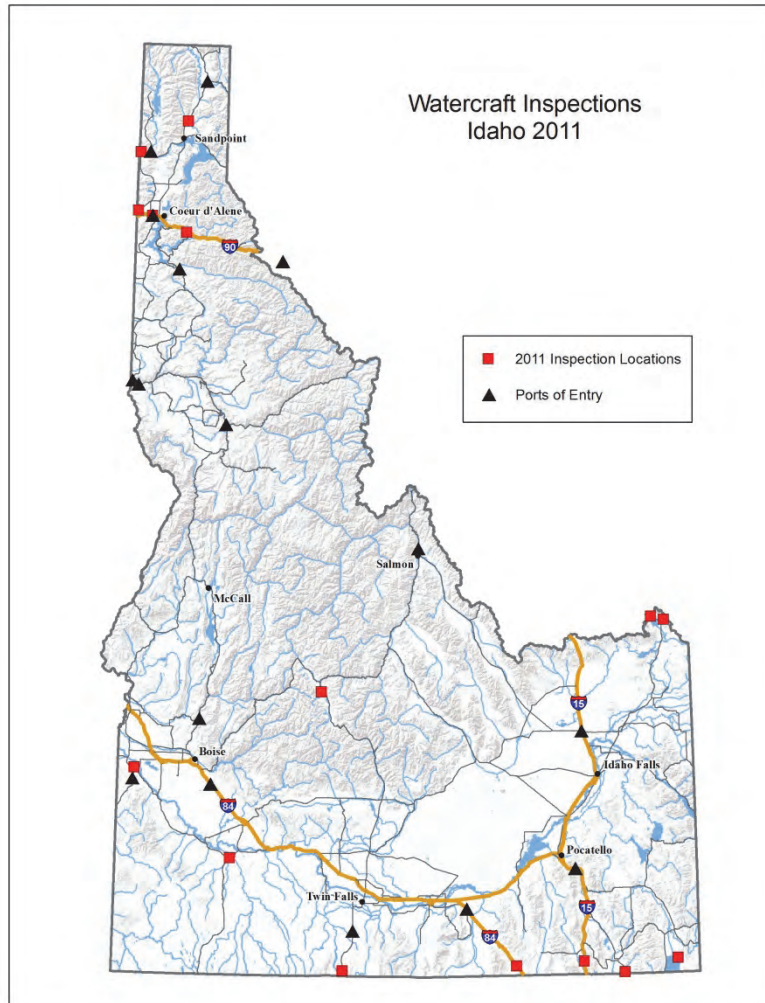


Figure 1. Watercraft inspection stations operated by the Idaho State Department of Agriculture (ISDA) and major points of entry on highways and major roads in 2011.

More than 100,000 inspections have been conducted on boats from 49 different states since July 2009. As of Fall 2011, 38 mussel-fouled boats have been intercepted by the Idaho prevention program. The state plans to continue this work until partners that manage infested waterbodies institute mandatory inspections and decontamination at the “point sources.” Inspection and decontamination of watercraft as they are removed from mussel-infested waters is an economical and environmentally sound strategy to reduce mussel transfer to uninfested waters. A functional point source decontamination program such as this targets and focuses resources on watercraft known to have been in infested waters, which could reduce the need for inefficient and costly inspection of all boats in Idaho, where only a small percentage of vessels are identified as harboring exotic mussels.

Contingency Planning – What if Prevention Fails?

The chances of eradicating a newly discovered population of zebra or quagga mussels in Idaho are small, but those chances depend directly on the ability of the state to respond quickly and effectively once a population of exotic mussels is detected. Many of Idaho's "Critical" and "High Priority" waterbodies are extremely large, deep and often free flowing, which severely limits management options.

The Idaho Invasive Species Council convened a roundtable of stakeholders to determine the steps that should be taken to prepare the state for a zebra or quagga mussel outbreak. These stakeholders included conservation groups, water users, canal companies, irrigation districts, utilities, municipal water companies and germane state and federal agencies. The participants were asked to weigh options in the event these species are discovered in the state. Given the complexity of management options if quagga or zebra mussels are discovered in Idaho, the stakeholder group recommended that the Idaho State Department of Agriculture develop an "Idaho Exclusion Strategy and Contingency Plan."

The ISDA, in conjunction with the Aquatic Ecosystem Restoration Foundation (AERF), convened a panel of experts in April 2011 to evaluate the following:

1. The effectiveness and soundness of the current Idaho prevention strategy, and
2. The potential scenarios in which control and containment efforts can be initiated to eradicate or contain new infestations in the state's waters.

This report was developed as a result of the cooperative efforts of the task force and other contributors solicited by the AERF.

SECTION II: GENERAL BIOLOGY

Robert McMahon, University of Texas – Arlington

General Biology

Zebra mussels (*Dreissena polymorpha*) and quagga mussels (*Dreissena rostriformis bugensis*) are freshwater members of the family Dreissenidae and are often referred to collectively as dreissenid mussels. Both species are native to the Caspian and Black Sea regions and associated drainages in Eastern Europe and Western Asia. In North America these mussels can grow to as large as 1 to 2 inches over their 3 to 5 year life spans, depending on habitat productivity and temperature regime. In highly productive, warmer habitats, zebra mussels grow more rapidly and have shorter life spans than individuals in less productive and/or cooler habitats.

Zebra mussels were first found in North America in Lake St. Clair and the eastern basin of Lake Erie in 1989. It is believed they were introduced to these systems around 1986 as larvae released with ballast water by ships coming from ports on the northern coast of the Black Sea in the Ukraine. From their initial site of introduction, zebra mussels spread rapidly throughout major US and Canadian drainage systems east of the Rocky Mountains, the Great Lakes, the Mississippi River and its eastern tributaries, the lower Missouri River, the Arkansas River and isolated lakes and rivers (Figure 2).

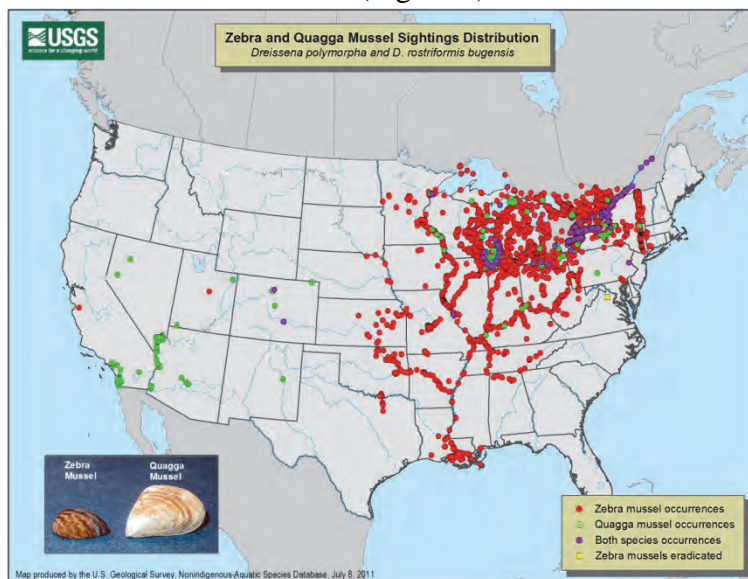


Figure 2. Current (November 2011) distribution of zebra and quagga mussels in North America. Source: US Geological Service NAS – Nonindigenous Aquatic Species – Current Zebra and Quagga Mussels Sightings Distribution. Accessed on 22 November 2011 at:

http://nas.er.usgs.gov/taxgroup/molluscs/zebramussel/maps/current_zm_quag_map.jpg

They were rapidly dispersed through navigable waterways by attachment to the hulls of commercial vessels. Mussels dispersed more slowly into isolated waterbodies, where introduction was mostly dependent on overland transport on the hulls of recreational boats, as larvae in water contained in boat live boxes or in water associated with bait transfers and fish stocking. Until recently, zebra mussels were only found in waterbodies east of the Rocky Mountains; however, an established population was recently identified in the San Justo Reservoir in Central California, where its vector for this long-range introduction is unknown.

The quagga mussel, another dreissenid species that is closely related to the zebra mussel, is believed to have been introduced to the Great Lakes with the zebra mussel. Originally dominant only in deeper waters of the Great Lakes, it progressively outcompeted zebra mussels in the lower Great Lakes and St. Lawrence River, where it is now the dominant species in both deep and shallow water habitats. Unlike zebra mussels, quagga mussels have not invaded many other North American waterbodies outside of the lower Great Lakes and St. Lawrence River. However, in 2009 they were discovered in the Boulder Basin of Lake Mead (NV, AZ) and they have since spread rapidly through the lower Colorado River into Lakes Mohave and Havasu. Quagga mussels have subsequently infested a number of reservoirs in southern California and Arizona as a result of the transport of larval stages in raw water transfers through piping and canals.

Reproduction and Development

Both zebra and quagga mussels have distinct male and female individuals that shed sperm and eggs, respectively, directly into the water column for external fertilization. Large female zebra mussels are highly fecund and capable of releasing up to one million eggs in a single spawning event. Individuals of both species typically reach sexual maturity by the time they are 1 year old.

Following external fertilization, the zygote passes through several larval stages, which remain in the water column prior to settlement and development into a juvenile (Figure 3). In both species, the initial larval stage is referred to as the trocophore, which is a microscopically small mass of ciliated cells that can reach 40 μm (less than 1/500 of an inch) in diameter. The trocophore rapidly metamorphoses into a veliger larva, which in its early form has a calcareous bivalve shell with a straight hinge line that produces a pronounced “D” shape (Figure 3).

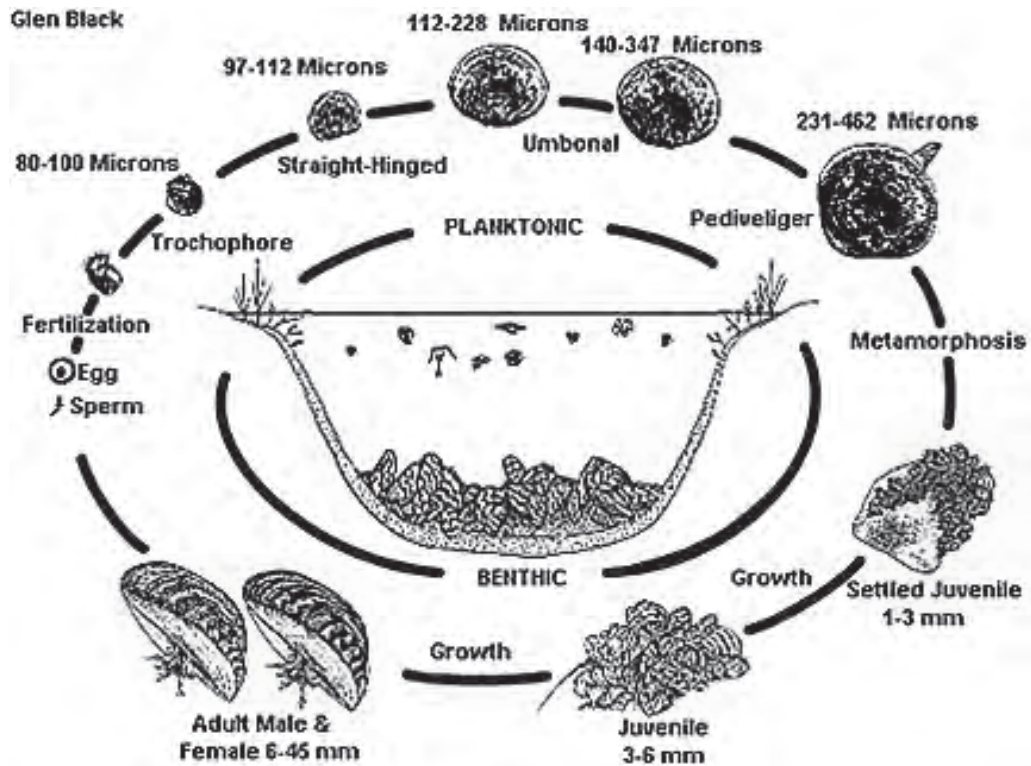


Figure 3. Zebra and quagga mussel life cycle. Source: US Fish and Wildlife Service. Accessed on 22 November 2011 at: http://www.fws.gov/midwest/mussel/image_library_line_drawings.html on 11/22/2011

A distinguishing characteristic of the veliger larva is the presence of an expansive, flattened mass of tissue called the velum which can be extended beyond the shell valves. The velum is covered with nearly microscopic cilia that move rapidly on the velum, which allows the veliger to swim non-directionally but generally toward the water's surface. The beating of the cilia also directs the unicellular algae and bacteria into the veliger's mouth. As the early veliger grows, it develops a more curved shell hinge line, which causes each valve to form a distinct hump or "umbo" on either side of the hinge and results in what is referred to as the umbonal veliger stage (Figure 3). At the end of the umbonal stage the shell of veliger is 250-300 μm (1/100 of an inch) in length. At this point, the veliger develops a distinct foot and is referred to as a "pediveliger." The pediveliger eventually settles to the substratum, where it attaches by secreting byssal threads, then metamorphoses into the juvenile stage that is marked by a typical "mussel-shaped shell" that measures approximately 1/25 of an inch in length (Figure 3).

Byssal Attachment to Hard Substrata

A unique feature of dreissenid mussels compared to native North American freshwater bivalves is that adults possess a specialized organ for secretion of proteinaceous "byssal" attachment threads (Figure 4). The threads are initially extruded as a fluid along a groove on

the posterior side of the extendable foot, then the fluid hardens to form attachment threads, which firmly attach the mussel to hard substrata.



Figure 4. Adult zebra mussel with byssal attachment threads. Courtesy Robert F. McMahon, The University of Texas at Arlington.

Besides natural substrata of rocks, sunken wood and aquatic vegetation, dreissenid mussels can use byssal threads to attach equally well to manmade surfaces such as boat hulls, cement, plastics, iron, steel, fiberglass, glass and other hard surfaces. They can also attach to the shells of other mussels, allowing them to form dense mats of individuals that can entirely cover hard natural surfaces. Byssal attachment also allows zebra and quagga mussels to settle in low-flow areas of manmade raw water systems and develop thick encrustations that slow or block water flow, which often reduces the system's operational efficiency or results in cessation of operations.

The ability of zebra and quagga mussels to attach to hard surfaces with byssal threads, sustain high reproductive rates and population densities, and foul the raw water systems of water treatment plants, power stations and water-using industrial facilities have made them the most ecologically and economically damaging invasive species to ever be introduced to North America. Zebra and quagga mussels can achieve densities of more than 75,000 individuals per square foot, greatly impacting infested water bodies and the raw water systems drawing from those water bodies.

Ecological Impacts

A single adult mussel can filter more than a gallon of water per day. They are filter feeders and use stiff, stereo cilia on enlarged and modified gills to capture microscopic algae, bacteria, animals and detritus for food. At high densities, it is possible for dreissenid mussel populations to filter the entire volume of a waterbody every day, which greatly increases the water's clarity and massively reduces populations of phytoplankton and zooplankton.

Decreases in phytoplankton and zooplankton abundance can negatively impact energy transfer or disrupt food chain dynamics to higher trophic levels such as fish populations, which generally do not feed on adult dreissenid mussels. In addition, water clarification can increase light penetration to greater depths, which leads to increased growth of aquatic plants and allows growth of plants at greater depths. Selective filtration and ingestion of phytoplankton instead of cyanobacteria (i.e., blue-green algae), along with dreissenid-induced reduction in N:P ratios, can result in environmentally damaging toxic cyanobacterial blooms during summer months.

Dreissenid mussels attach to hard substrata, including native unionid bivalve shells, many of which are already imperiled. Native mussel species infested with dreissenid mussels have restricted valve function, food availability and mobility, which eventually results in death by starvation. Thus, dreissenid infestations have been implicated in massive native mussel mortalities and even extirpations in North America.

Economic Impacts

Despite the extensive negative ecological consequences of zebra and quagga mussel infestations, it is these species' impacts on industrial raw water systems that have received the most attention. Dreissenid mussels negatively impact the operations of industrial, electrical (particularly nuclear) power-generating and potable water facilities that rely on raw water intake and distribution systems for cooling and other processes. Both zebra and quagga mussels attach to and foul piping, screens, cement structures and other raw water system components. Such mussel fouling occludes or blocks flow, which reduces operational efficiency or prevents operation of these systems. Such mussel fouling is often difficult and costly to control or mitigate; in addition, the use of molluscicides in industrial systems raises environmental, water quality and human health concerns. It has been estimated that as much as \$500 million is spent annually in the Great Lakes region alone for mitigation and control of dreissenid mussels and the resultant fouling in raw water facilities.

Further Invasion of North American Waters

It is generally accepted that dreissenid mussel veligers were accidentally transported to the Great Lakes by commercial transoceanic vessels in ballast water that was taken on in European freshwater ports and then released in the Great Lakes prior to entering port. However, others suggest that dreissenids may have been introduced as adults attached to the anchors and/or anchor chains of transoceanic vessels. Adult dreissenids can survive out of water for several weeks in cool, moist conditions. As a result, United States federal legislation now requires transoceanic vessels to exchange ballast water at sea or to destroy potential aquatic hitchhikers in their ballast water by approved alternative means prior to

entering the St. Lawrence Seaway and the Great Lakes (Nonindigenous Aquatic Nuisance Prevention and Control Act, 104 Stat. 4761, 16 U.S.C. 4701, enacted November 29, 1990).

The rapid spread of zebra mussels through the interconnected navigable waterways of North America has been primarily due to downstream hydrological transport of larval stages and upstream human-facilitated movement of adults attached to watercraft, particularly to barge hulls. Within one year of being reported in Lake St. Clair (MI) in 1988, zebra mussel populations were found in all of the Great Lakes and by 1991 zebra mussels were recorded in the Illinois and upper Mississippi Rivers. Currently, the North American distribution of zebra mussels includes the majority of freshwater river drainages and lakes in the US east of the 100th meridian, with newly introduced populations in Offutt Air Force Base Lake (NE) and San Justo Lake in San Benito County (CA).

Dispersal of quagga mussels in the Great Lakes was considerably slower than that of zebra mussels. Quagga mussel populations have been mostly restricted to the lower Great Lakes, the St. Lawrence River and several drainages associated with the Erie Canal in New York State. Between 1995 and 2005, populations were also recorded in the Mississippi River near St. Louis (MO) and at several sites in the lower Ohio River. In January 2007, quagga mussels were discovered in the lower Colorado River at Lake Mead (NV/AZ) and, soon afterwards, downstream in Lakes Mohave and Havasu, where veliger larvae from Lake Mead were presumed to have been hydrologically dispersed. Soon after their discovery in the Lower Colorado River, quagga mussel populations were reported in several California reservoirs that received water carrying veliger larvae through piping and canals from the infested Lakes Mead, Havasu and Mohave. Because of the abundance of such inter-drainage water transfers and heavy recreational boat traffic between drainage systems, quagga mussels appear certain to expand their range in the southwestern US unless their human dispersal vectors are controlled.

Further distribution of zebra and quagga mussels to currently uninfested drainage systems and isolated water bodies in North America, particularly in the western US, will require overland transport from infested waters. While rare, long distance overland transports (<1% of boater movements) represent a threat to pristine waterbodies. In an analysis of boater movements in the western US, Britton and McMahon recorded 793 unique waterbodies visited by boaters; they found that 93 waterbodies in 16 different states and a Canadian province not harboring zebra or quagga mussels were visited by boaters who had previously launched in areas infested with one or both species. This analysis identified 10 lakes at high risk of dreissenid introduction due to elevated levels of boater traffic from infested reservoirs, and 6 of these lakes later became infested with zebra mussels. The quagga mussel population in Lake Mead (AZ/NV) was more than 1250 miles from the next nearest known population in Lake Michigan, indicating that recreational boats or submerged equipment infested with

dreissenids can be transported long distances overland to successfully establish new dreissenid populations. Even though such introductions may be rare events, the intensity of overland transport through recreational boating is likely to assure eventual dispersal of dreissenids into the majority of suitable, presently uninfested freshwater habitats in North America if efforts are not made on a cooperative and integrated state, interstate and federal basis to regulate, manage and prevent the overland transport of mussels by recreational boaters and commercial boat haulers.

The movement of quagga mussels into Lake Mead from the nearest infested site – over 1000 miles distant – confirms the need for a continued boat inspection and mussel prevention program in Idaho. Although the threat of infestation in Idaho waters is most likely to occur from infested sites that are closer (such as Lake Mead or the Colorado River), zip code data collected at the Cedars Station during the 2011 inspection season revealed that there is significant movement of boats from infested sites in the eastern United States into Idaho (Figure 5).

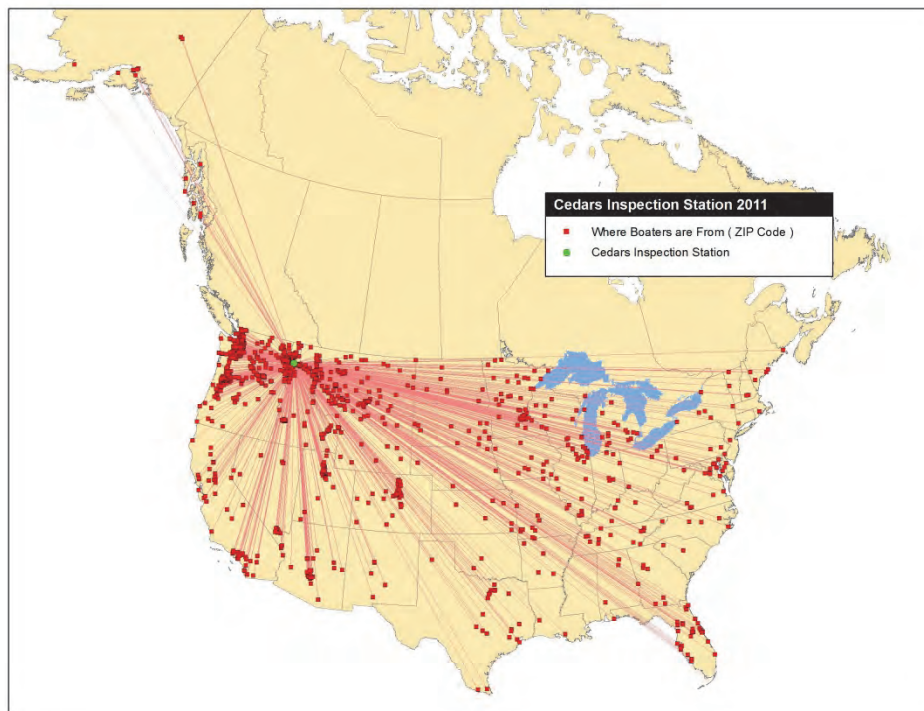


Figure 5. Zip codes (origins) of recreational boats inspected at the Cedars Station in 2011.

Establishment of New Dreissenid Infestations

Dr. John Morse at The University of Texas at Arlington performed an extensive study in 2009 of the molecular genetics of US populations of zebra and quagga mussels and found that there was little genetic differentiation among isolated, long existing and newly established populations of either species and that all populations of both species had high

levels of genetic diversity. The broad genetic diversity and apparent lack of genetic bottlenecks in newly established zebra and quagga mussel populations suggests that dreissenid invasions must result from either multiple introductions or a single introduction of a large number of genetically diverse individuals. In a number of cases, it was highly unlikely that the dreissenid populations under investigation resulted from multiple introductions. Considerable gene flow is unlikely to occur between dreissenid populations in hydrologically isolated waterbodies; therefore, the lack of genetic bottlenecks in US dreissenid populations suggests that initial introductions by overland dispersal on trailered boats and other submerged equipment include a large number of individuals.

The likelihood that establishment of zebra or quagga mussel populations requires an initial introduction of a large number of individuals has important implications to help prevent invasion of uninfested water bodies by either species. Separate multiple introductions of small numbers of individuals may not be capable of establishing viable dreissenid populations because the mussels may settle in areas distant from one another. Under ideal laboratory conditions, only 41 to 52% of zebra mussel eggs are successfully fertilized. It has been hypothesized that in natural populations of externally fertilizing species such as dreissenids, fertilization success decreases linearly with decreasing adult density, falling below 10% at 0.5 individuals per cubic yard. Also, it has been shown that less than 2% of zebra mussel veliger larvae develop to the settled juvenile stage even under ideal laboratory conditions. Based on these estimates, only 0.82–1.03% of spawned eggs would likely be fertilized and survive to settled juveniles under ideal conditions in dense populations. However, based on data from several investigators, survivorship of spawned eggs to settled juveniles would decline to <0.003% in newly introduced populations of very low density (<0.1 per square yard).

Based on his model for fertilization success in externally spawning species, Claereboudt (1999) stated that

“...for free-spawning, colonizing species (such as the zebra mussel *Dreissena polymorpha*), the probability of these recruits to start a new population remains low unless sufficiently high numbers of new recruits settle simultaneously at the same location. This implies that either several successful settlement episodes or a massive immigration would be required before a self sustainable density of colonizers is reached.”

If simultaneous introduction of a large number of individuals is required to form a sustainably reproducing dreissenid population in a new location, prevention and containment measures that eliminate mussels from recreational boats and other submerged equipment or prevent mussel-infested boats from entering uninfested waters may not require 100% accuracy to be effective. Thus, preventative and containment measures for exotic mussels (such as the decontamination of attached juvenile and adult mussels on boats,

decontamination of boats leaving infested waters, prevention of infested boats from entering uninfested waters and interception and inspection of trailered boats at critical entry points), although unlikely to be 100% successful, will probably reduce the number of transported mussels to levels that preclude successful colonization of uninfested waterbodies. Therefore, although imperfect, prevention and containment measures should be maintained and expanded, as they appear capable of preventing establishment of dreissenids in uninfested waterbodies. In addition, it also implies that prevention and containment methods could be further improved and supplemented by intensified monitoring of uninfested waterbodies, analysis of boater movements, increased public awareness campaigns, closing of unmanned, unmonitored boat launching sites, and provision of efficient, readily accessible mussel decontamination facilities at launch sites. Though expensive, inspection and decontamination of infested boats is well worth the effort.

Idaho Watercraft Inspection Program

The panel of experts convened by the ISDA and AERF has reviewed the Idaho Watercraft Inspection Program and members of the panel are highly complimentary of Idaho's activities in both preventing human movement of exotic mussels into Idaho and its educational efforts. During the 2011 recreational season, more than 47,000 recreational and commercially hauled watercrafts were inspected and 25 boats were identified as carrying invasive mussels (Idaho State Department of Agriculture); these boats were decontaminated. The program has been in place since 2009 and over 100,000 recreational and commercially hauled boats have been inspected during this time. Idaho now has the most aggressive and comprehensive exotic mussel prevention program in North America. As noted in the previous discussion, a few undiscovered exotic mussels are unlikely to be sufficient to establish a reproducing population, but the heavy infestations most likely to be found by boat inspections would probably result in the development and establishment of new self-sustaining populations. The panel, while complimentary of Idaho's prevention program, noted the following deficiencies beyond the control of the state of Idaho.

1. Boats and equipment that depart from waters known to be contaminated with exotic mussels need to be decontaminated and certified free of exotic mussels. It is clear that those responsible for the infested waterways should be required to take responsibility for ensuring that vessels and equipment leaving their waters do not contribute to further spread of these economically and environmentally damaging organisms. For example, the Minnesota legislature in 2011/2012 instituted a system of fines for any boat found carrying zebra or quagga mussels in that state. In addition, Minnesota is installing wash stations at 40 infested lakes where boaters must decontaminate their vessels before leaving the boat ramp (USA Today, January 10, 2012).

2. Idaho cannot be solely responsible for protecting its sovereign waters. While human overland introductions of exotic mussels can be controlled by prevention programs, the interstate movement of water cannot be controlled. Many rivers (e.g., Bruneau, Snake, Clark Fork and others) originate from neighboring states. If these drainages become infested there is no way to prevent movement downstream into Idaho waters, as has been dramatically shown by the expansion of exotic mussels in the Great Lakes. It is clear that a concerted regional approach is required to stop the spread of exotic mussels. The panel discussed the need for additional assistance from agencies such as the USDA Animal and Plant Health and Inspection Service (APHIS) or the US Department of the Interior (DOI) under the Lacey Act. The point is this: over the past three years, the boat inspection program in Idaho *has clearly shown the need for a concerted regional prevention program*. This effort is even more critical when it is apparent that exotic mussels cannot be controlled once introduced into the large flow-through systems typical of the northwestern US (see Section III and Section VI).

While recreational boats are most likely responsible for overland transport of exotic mussels, the panel also reviewed other pathways, which are listed below. These are generally ranked in order of the greatest opportunity to introduce large numbers of exotic mussels to those likely to carry smaller numbers. A possible priority action list includes:

1. Large recreational boats. Though not proven, it is suspected that the overland movement of large recreational boats has introduced exotic mussels into previously uninfested waters. Idaho works closely with its transportation department to train POE staff to inspect boats. They also have an automatic notification system to alert regional partners when commercially hauled boats are being moved. Several fouled boats have been intercepted as a result of this work. Other states lack this type of system to inspect commercially trucked boats.
2. Construction equipment, barges, lake aerators, pumps, silt barriers, dock sections and irrigation pipes. The Idaho Department of Water Resources now requires decontamination of dredge equipment that is brought into the state, but more work needs to be done. Where did the railroad construction equipment being used for work on the Long Bridge come from? Can construction permits require an inspection before deployment in Idaho waters? Is it possible that irrigation pipe, purchased from an irrigation district on the Colorado River, can be brought into the Snake River Valley and introduce exotic mussels? Perhaps an educational program regarding this equipment would be beneficial.
3. Smaller recreational boats, fishing tournaments. This is the emphasis of the current prevention program. Is more needed for fishing tournaments?

4. Aquaculture programs, fish stocking, fish hatcheries/transport, aquatic plants. Some of these are suspected of introducing exotic mussels in other areas of the US.
5. Sand/gravel operations, river rock, bagged river rock, bagged moist. Exotic mussels prefer to attach to hard surfaces and can live for several weeks if kept moist.
6. US Department of Defense, US Navy and other federal facilities, US Army Corps of Engineers, US Bureau of Reclamation. Where is this equipment coming from? It is suspected that boats moved from the northeastern United States to Offutt Air Force Base in Nebraska introduced zebra mussels into a 100-acre lake in Nebraska.
7. Illegal, intentional introductions. The hardest to deal with; education is the key here.
8. Water gardens. These are very popular in some parts of the US and are often stocked with aquatic plants and equipment purchased on the internet.
9. Scuba equipment, nets, seines. Unlikely to carry large numbers of exotic mussels, but research boats, equipment, etc. need to be inspected.

These potential pathways of introduction need to be considered, particularly the first 6 items, because they are most likely to introduce large numbers of exotic mussels. Expansion of educational programs will be necessary to deal with items 7 through 9.

The following section will outline water quality parameters in which exotic mussels are most likely to thrive. Unfortunately, water quality parameters in most of Idaho's natural waters all fall into the range of temperature and pH where exotic mussels are likely to do well if introduced.

Environmental Tolerance Limits

Temperature Limits

Both zebra and quagga mussels are adapted to a temperate climate and tolerate 0 °C during winter months in the northern portions of their European and North American ranges. Zebra mussels from the northeastern US have been estimated to have an upper thermal limit of 30 °C. However, the upper thermal limits of zebra mussels from a more southern population in Winfield City Lake (KS) were found to be 31.7 °C, the highest recorded limit for this species in North America.

Quagga mussels from Lake Ontario acclimated to 20 °C did not survive >14 d at 30 °C, while no mortality was recorded among concurrently tested zebra mussels from the same site, which indicates that quagga mussels may have a lower upper thermal limit than zebra mussels. Similarly, when tested in 2008, the upper thermal limit of quagga mussels from the relatively warm waters of Lake Mead (NV/AZ) was 27.2 °C, considerably lower than the 31.7 °C recorded for zebra mussels from Winfield City Lake (KS) using the same methodology; this also suggests that zebra mussels are more tolerant of elevated temperatures than quagga mussels. Zebra mussels appear to have a 2 to 3 °C higher upper thermal limit than quagga mussels in North America, which may allow them to be more successful at infesting the warm surface waters of the southern and southwestern US, where ambient summer surface water temperatures reach or exceed 30 °C.

Temperature impacts spawning and larval development in dreissenids. Zebra mussel spawning is initiated at $\geq 15-18$ °C. Zebra mussel eggs cannot be fertilized at ≤ 10 °C, but low numbers of veligers can occur at water temperatures as low as 12 °C. Shallow-water Lake Erie zebra and quagga mussels spawned simultaneously when water temperatures reached 18-20 °C, but when individuals of both species were moved to cooler waters at 23 m depth, quagga mussels initiated spawning at 9-11 °C, while zebra mussels did not spawn. Thus, it appears that quagga mussels can spawn at much lower temperatures than zebra mussels (at least in deep water), which may allow them to invade cooler water habitats and colonize waterbodies at more northern latitudes in North America.

Calcium Limits

Numerous North American studies have indicated that both zebra and quagga mussels require higher calcium concentrations than most other North American bivalves. The lower calcium limit for successful colonization by zebra mussels is considered to be 8 to 12 mg Ca²⁺ L⁻¹, while that for quagga mussels is somewhat higher at 12 mg Ca²⁺ L⁻¹. For this reason, calcium concentration is considered to be an important component of risk assessments for waterbody invasion by either zebra or quagga mussels.

Salinity Limits

Although results have been variable, studies indicate that the zebra mussels generally do not inhabit water bodies with salinities greater than 6 to 12 psu (practical salinity units), while quagga mussels generally do not tolerate salinities greater than 6 to 8 psu.

pH Limits

The tolerated pH range for zebra mussels is considered to be 6.0 to 9.6, with a pH of 7.4 to 9.4 required for larval development to the settled juvenile. The pH tolerances of quagga mussels have not been studied, but are likely to be similar to those of zebra mussels.

Oxygen Concentration Limits

Dreissenid mussels cannot tolerate “low” oxygen concentrations for extended periods of time, but they can survive anaerobic conditions in the short term by closing their shells. Mussels generally grow and reproduce best in the epilimnion or aerated zones of lakes, which are below the high energy wave line and above the anaerobic hypolimnion in temperate stratified lakes. Therefore, a winter drawdown to the level of the summer hypolimnion may expose the entire population of dreissenid mussels in some bodies of water, thus rendering them vulnerable to freezing temperatures and potentially destroying the entire population (see Freezing Tolerance, below). This strategy could be an effective method to control dreissenid mussels, but there is currently no experimental evidence to verify its potential utility as a control method.

Emersion Tolerance

The ability of zebra and quagga mussels to survive emersion (in air) is highly dependent on both temperature and relative humidity. Studies indicate that when relative humidity ranges from <5% to >95%, zebra mussels survive 10 to 28 days of emersion at 5 °C, 5 to 12 days at 15 °C and 2 to 6 days at 25 °C. Reported values for quagga mussels are 5 to 13.5 days at 15 °C and 3 to 5 days at 20 °C. The relatively long times that adults of both species tolerate emersion is due to their ability to close their shell valves and remain anaerobic to avoid rapid water loss. It also explains their ability to survive transportation across long distances overland on the hulls of trailered boats and other equipment that has been in contact with infested waters.

Freezing Tolerance

Zebra mussels are highly intolerant of aerial exposure to subfreezing temperatures. They can survive exposure to 0 to -1.5 °C for >48 hours, and -3.0 °C for 7.5 hours, with survival times decreasing to 2.7 hours at -10 °C. Although not studied, quagga mussel tolerance of subfreezing temperatures is likely to be similar to that of zebra mussels. Poor tolerance of subfreezing temperatures may be associated with their reduced densities in shallow, near-shore habitats in the northern portions of their European and North American ranges.

Current Velocity and Agitation

The ability of zebra mussels to generate a byssal holdfast begins to decline at flow rates >27 cm s⁻¹ and at agitation rates of >30 cycles min⁻¹. Filtration rates are inhibited in quagga mussels at flow rates >19 cm s⁻¹. The negative impacts of flow and agitation on dreissenids may explain their low densities in shallow water on shores exposed to high wave energies.

Turbidity

Zebra mussels appear to be tolerant of highly turbid waters containing much suspended sediment. Although not intensively studied, both zebra and quagga mussels are likely to tolerate turbidities of >100 NTU.

SECTION III: PESTICIDE OPTIONS FOR EXOTIC MUSSEL CONTROL

Don Stubbs, US Environmental Protection Agency (retired)

Despite the fact that several dozen – or even hundreds – of chemicals are toxic to exotic mussels, they must be registered for use as pesticides under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) administered by the US Environmental Protection Agency (EPA). In addition, permits may be required under the jurisdiction of the Clean Water Act, which administers the National Pollution Discharge Elimination System (NPDES). There are 4 circumstances (as outlined below) in which a molluscicide may be legally used in waters in the United States.

Section 3 registration

Section 3 registration is the federal registration of a pesticide under FIFRA which authorizes use of a pesticide at the federal level; however, each state has their own rules and regulations about the use of a pesticide within their boundaries. Some piggyback on the federal registration, whereas others conduct their own evaluations. Pesticides are regulated by their labeling and it is against the law to use a registered pesticide in a manner inconsistent with its labeling. A pesticide label is defined as the written, printed or graphic matter on or attached to the pesticide or any of its containers or wrappers. Pesticide labeling is defined as all labels and written, printed or graphic matter accompanying the pesticide at any time; or to which reference is made on the label or in literature accompanying the pesticide.

Prior to pesticide registration, the EPA must make a finding that the pesticide product will perform its intended function when used in accordance with its label without causing unreasonable adverse effects on the environment. The agency makes this finding based on scientific data submitted by the registrant. Once the EPA has made this finding, it grants a registration, notifies the requesting company of the decision and approves the label to be used with the product. All registered products include an approved label. The pesticide product's label is a legal document.

It can take 1 to 2 years for the EPA to act on the application for a new pesticide depending on the type of submission. Amending a pesticide label which is already registered may require additional data and can take up to 15 months to be processed by the EPA.

State Registration under FIFRA Section 24(c)

A state can register a pesticide under a special local need registration under the authority of Section 24(c) of FIFRA. Thus, the name “24(c) registration” is often used and a state may

only authorize a registration use within that state. A state may only issue a registration in order to meet a special local need. A need can include an additional use of a federally registered pesticide product or a new end use product which is not federally registered. A new end use product must contain active and inert ingredients found in federally registered products. The term “additional use” can include a new method or timing of application, new crop or new site, new pest, changed rate, application in particular soil type, new product or different formulation, and products useful in managing pesticide resistance in a particular crop.

Prior to registering a use under Section 24(c) of FIFRA, the state needs to determine:

1. That a special local need exists. This means there is an existing or imminent pest problem within a state for which the state lead agency has determined that an appropriate federally registered pesticide product is not sufficiently available. EPA does not second-guess a state’s finding that a special local need exists;
2. The use is covered by necessary food tolerances or other clearances under the Federal Food, Drug, and Cosmetic Act (FFDCA);
3. That registration of the same use has not previously:
 - a. been denied, disapproved, suspended, or canceled;
 - b. voluntarily canceled by the registrant subsequent to issuance of a notice of intent to cancel because of health or environmental concerns about an ingredient contained in the pesticide product, and
4. That the registration is in accord with the purposes of FIFRA. This is a vague phrase that has not been defined.

If the proposed use or product falls into one of the following categories, the state must determine that it will not cause unreasonable adverse effects on man or the environment when used in accordance with labeling directions or widespread and commonly recognized practices:

1. Use of a product which has a composition not similar to any federally registered product, or
2. Use of a product involving a use pattern not similar to any federally registered use of the same product or a product of similar composition.

The EPA reviews state registrations to determine whether they meet the requirements of FIFRA, since these registrations become federal registrations within 90 days unless the EPA disapproves them. Problems found by the EPA are discussed with the appropriate state. The EPA makes an effort to work out problems with states, but as a last resort EPA may disapprove the state registration. For state 24(c) registered products which are not substantially similar to a registered product, the EPA requires a brief summary of the data,

the state's conclusions, and a certification that the product will not cause unreasonable adverse effects as defined in FIFRA for registration of pesticides.

The state is required to submit a complete 24(c) notification package for each registration. The EPA has 90 days from the date the state registration was issued to make a final decision on the 24(c) application. When a state issues the 24(c) registration, it is assumed to be valid and the product may be sold or distributed and used upon the state issuance. If a disapproval notice is issued, sale and distribution by the registrant or other persons must stop beginning on the date of disapproval. However, use of product already sold and distributed may continue unless the disapproval notice states otherwise. The EPA may rescind the right for a state to issue a 24(c) registration if the state's registrations are routinely denied or found unacceptable.

The application package should include:

1. A Notification of State Registration form (EPA Form 8570-25);
2. A cover letter with a description of what special local need is being met by the issuance of the 24(c) and a clear explanation of how the definition of special local need is met;
3. A copy of the labeling approved by the state;
4. A Confidential Statement of Formula if the product is not federally registered;
5. An Unreasonable Adverse Effects Determination Statement which summarizes the state's assessment of risks and benefits which supports its conclusion that no unreasonable adverse effects will occur.

Generally, labeling submitted by states for a 24(c) registration for an additional use (an additional use 24(c) registration is often referred to as an amendment since the registration will amend the federal registration after 90 days) is supplemental in nature. However, if a state authorizes a 24(c) registration for a new product, it must contain a full Section 3 label.

The state must require that at the time of sale to users, labeling from the federally registered product be accompanied by supplemental labeling which contains:

1. A statement identifying the state where registration is valid;
2. Directions for use to meet the special local need (provides instructions to the user on how to use the product, and identifies the pest(s) to be controlled, the application sites, application rates and any required application equipment;
3. The trade name of the product;
4. An ingredient statement;
5. The name and address of the Section 24(c) registrant;
6. The EPA registration number of the federally registered product;
7. The special local need registration number assigned by the state;

8. A statement prohibiting use of the product in a manner inconsistent with all applicable directions, restrictions, and precautions found in the labeling of the federally registered product and accompanying supplemental labeling.

When a federally registered product is already in the stream of commerce at the time the state issues a registration for an additional use of that product, the state must ensure that supplemental labeling for the additional use is made available to purchasers and users of the product.

Emergency Use of Pesticides under FIFRA Section 18

Section 18 of FIFRA allows for the administrator to exempt any federal or state agency from the provisions of FIFRA if an emergency condition exists. An emergency condition has been defined as an urgent, non-routine situation that requires the use of a pesticide where:

1. No effective pesticides are available;
2. No alternative practices are available; and
3. the situation:
 - a. Involves the introduction or dissemination of an invasive species; or
 - b. Will present significant risks to human health; or
 - c. Will present significant risks to threatened or endangered species, beneficial organisms, or the environment; or
 - d. Will cause significant economic loss due to:
 - i. An outbreak or an expected outbreak of a pest; or
 - ii. A change in plant growth or development caused by unusual environmental conditions where such change can be rectified by the use of a pesticide.

Types of Exemptions

Emergency exemptions are broken down into 4 types: specific, quarantine, public health, and crisis exemptions.

A specific exemption may be authorized in an emergency condition to avert:

1. A significant economic loss; or
2. A significant risk to:
 - a. Endangered species,
 - b. Threatened species,
 - c. Beneficial organisms, or
 - d. The environment.

A quarantine exemption may be authorized in an emergency condition to control the introduction or spread of any pest that is an invasive species, or is otherwise new to or not theretofore known to be widely prevalent or distributed within and throughout the US and its territories.

A public health exemption may be authorized in an emergency condition to control a pest that will cause a significant risk to human health.

A crisis exemption may be utilized in an emergency condition when the time from discovery of the emergency to the time when the pesticide use is needed is insufficient to allow for the authorization of other types of exemptions.

In the case of an aquatic use for control of mollusks, a specific or quarantine exemption may be possible. By definition, use of the crisis provision would be extremely hard to justify for mollusk control. Most exemptions handled by the EPA are in the specific category and deal with food crops, whereas most quarantine exemptions are submitted by the USDA for controlling pests arriving at the US border. As of 2008, only one specific exemption had been authorized for an aquatic use (aquatic herbicide). Therefore, the EPA has little experience dealing with aquatic uses under Section 18 and an education process would be beneficial. USE OF A PESTICIDE ALREADY REGISTERED FOR OTHER USES IS THE MOST COMMON MECHANISM FOR AN EXEMPTION. USE OF AN UNREGISTERED PESTICIDE UNDER AN EXEMPTION IS ALLOWED BUT VERY HARD TO JUSTIFY.

General information required for a specific or quarantine exemption for registered pesticide includes:

1. What pesticide is to be used, how it is to be used, amount of area to be treated, amount of pesticide to be used, duration of use and appropriate labeling;
2. A detailed description of alternative methods of control and, if a pesticide is registered, why it will not work;
3. Data on the effectiveness of the proposed pesticide to be used; and
4. A discussion of risks, food residues, and a proposed enforcement program, and an acknowledgement by the registrant of their pesticide use.

In addition to the general information, additional information for a specific exemption includes:

1. The scientific and common name of the pest or pest complex;
2. A discussion of the events which brought about the emergency condition;
3. A discussion of the anticipated risks to endangered or threatened species, beneficial organisms, or the environment that would be remedied by the proposed use of the pesticide; and

4. A discussion of the anticipated significant economic loss (guidance is based for the most part on agricultural crops).

In addition to the general information, additional information for a quarantine exemption includes:

1. The scientific and common name of pest;
2. The origin of pest and the means of its introduction or spread if known; and
3. The anticipated impact of not controlling the pest.

The EPA reviews all requests as expeditiously as possible. The EPA reviews the application and other available data necessary to make a determination concerning whether an emergency condition exists, what the anticipated benefits from the use are, potential risks posed from the use, and if necessary, whether temporary tolerances can be established. An exemption may be authorized if an emergency condition exists and the use will not cause unreasonable adverse effects on the environment.

Specific exemptions are authorized for up to a period of one year and quarantine exemptions are authorized for up to a period of 3 years.

Section 2(ee) of FIFRA

This variance to the pesticide label has been commonly used for control of exotic mollusks. It has been used to control island apple snails (*Pomacea insularum*) in Florida (copper sulfate) and zebra mussels in Nebraska [24(c)] and Minnesota (Cutrine Plus). Section 2(ee) of FIFRA essentially states that a labeled pesticide may be used for a pest not named on the label, provided use of the pesticide on the site is allowed. The maximum label rate cannot be exceeded and all other provisions of the label must be adhered to. A good example of this is the use of copper sulfate. This pesticide is registered for use as a herbicide at up to 1 ppm to control algae and aquatic plants in ponds, lakes, reservoirs, drainage and irrigation canals. There is no mention of mollusk control on the label; however, under Section 2(ee) of FIFRA, copper sulfate can also be applied at up to 1 ppm for mollusk control in ponds, lakes, reservoirs, drainage and irrigation canals, ***but not in rivers***. In this example, rivers are not listed as an approved site on the FIFRA label and thus copper sulfate cannot be used in rivers. Other labels for copper sulfate may include rivers as an approved site; use of those products would therefore be legal to control an unnamed pest (such as mollusks) in rivers.

Major agrichemical companies generally do not seek pesticides that will control exotic mussels. On the contrary, the major emphasis in the development of new agrichemicals favors the registration of products with minimum toxicity to aquatic organisms such as zooplankton, crustaceans and mollusks, as well as selectivity to protect desirable non-target

insects and other species. The potential market for molluscicides is also very small compared to the large markets in crop protection products used in agriculture. For these reasons, the development of control technologies for exotic mussels has been slow and this work has to be accomplished by small companies in cooperation with federal or state funded research programs (see Section V). As a result, for the present time, those wishing to control exotic mussels must rely heavily upon the use of Section 2(ee) for FIFRA registered products that by chance are also toxic to mussels.

Federally labeled products that can be used for mollusk control in accordance with Section 2(ee) are described below and listed in Table 1. Non-oxidizing molluscicides, which cannot be used in natural waters, are shown in Table 2.

Zequanox

This biological control product was registered for use in industrial and commercial water systems (not natural waters) in the Fall of 2011. It is being evaluated in reservoirs by the US Bureau of Reclamation and will hopefully have an expanded label for additional uses in 2012. This product contains the bacterium *Pseudomonas fluorescens* and is considered highly selective against exotic mussels. It might be used in Idaho waters under an emergency declaration (Section 18, FIFRA) pending approval by the registrant and the US EPA.

Copper sulfate

There are many registrants and labels for copper sulfate and most products are registered for algae control in virtually all types of natural waters. At least one product (ChemOne) is also labeled for use as a molluscicide for snail control (see Appendix 1). Copper sulfate has been used in attempts to control the exotic island apple snail in Florida and zebra mussels in a 100-acre closed lake in Nebraska. Copper sulfate can be toxic to fish, particularly member of the *Cyprinid* family. Copper sulfate in Idaho could legally be used under Section 2(ee) or with approval of a 24(c) special local need label.

Chelated liquid copper

There are several formulations and aquatic labeled uses of chelated copper. These formulations contain copper bound by organic chelating agents and do not contain the sulfate ion (SO_4^{--}) that contributes to the fish toxicity of copper sulfate. Thus, it is generally believed that chelated copper formulations are less toxic to fish. Natrix® is a copper ethanolamine complex which has a 24(c) label for exotic mussel control in Idaho and is used as a molluscicide under 24(c) labels in other states. Recently, another ethanolamine chelated copper (Cutrine Plus) has been used under 2(ee) for zebra mussel control in Minnesota (J. Bondra, pers. comm.).

Chlorine

Chlorine has been used to control exotic mussels in potable water systems in several states. Adult mussels detect the chemical in the water and cease to feed, close their shells and are consequently less susceptible to chlorine than mollusks in juvenile growth stages. Chlorine is also very toxic to fish and other aquatic organisms, including invertebrates. There are more than 500 labels for chlorine in the US EPA registry and some are actually labeled for use in reservoirs. Chlorine can be used in potable water and might also be used where fish are not an important resource. The Task Force suggests that the various labels for chlorine be evaluated to determine whether any of these products are registered for use in irrigation canals and ponds.

Dimethylalkylamine salt of endothall

This pesticide is used most often as an aquatic herbicide and is registered for control of algae and aquatic weeds in most natural waters, but care must be taken to avoid fish mortality. It is also labeled for exotic mussel control as EVAC® by Calgon Corp. and as TD2335 Industrial Biocide-Molluscicide by United Phosphorus Inc. Both of these labels specify use only in recirculating or once-through cooling water systems. The concentration of the DMA salt of endothall that is necessary to control exotic mussels exceeds the toxicity limit for fish.

ANY PRODUCT USED FOR CONTROL OF EXOTIC MUSSELS UNDER SECTION 2(EF) OF FIFRA MUST BE LABELED FOR USE AT THAT SITE (POND, RIVER, RESERVOIR, CANAL) UNDER CONSIDERATION. IN ADDITION, NPDES PERMITS FOR USE ARE LIKELY NECESSARY AND WILL REQUIRE CONSIDERATION OF IMPACTS TO ENDANGERED SPECIES.

As noted earlier, there are likely hundreds of chemicals that are toxic to exotic mussels and many non-oxidizing ammoniated compounds are particularly toxic to mussels, but are labeled only for use in industrial cooling towers or other closed systems. Since most of these are not labeled for use in natural waters, they are not legal to use under Section 2(ee) of FIFRA, but some may be considered for 24(c) labels. See Table 2 for this listing and comments. Anyone considering registration of a product for mollusk control will need to contact the manufacturer (registrant) and the EPA to determine the feasibility of labeling, data requirements, and other factors.

Table 1. Molluscicides that may be used for control of exotic mussels based upon current registrations for aquatic use. These are based upon 24(c) local need registrations or under FIFRA Section 2(ee). See comments in text for additional information.

Product	Aquatic use	Application rate	Advantages	Disadvantages	Authority
Zequanox	Closed systems	?	<ul style="list-style-type: none"> •Selective control of mussels 	<ul style="list-style-type: none"> •Not registered for use in natural systems 	Full federal label (2012?)
Copper sulfate	Algaecide/molluscicide	1 ppm Cu (higher for mollusk control – see label)	<ul style="list-style-type: none"> •Readily available •Some registered for snail control •No irrigation restrictions 	<ul style="list-style-type: none"> •Corrosive to aluminum •Possible fish mortality, particularly cyprinids 	FIFRA 2(ee) label
Chelated liquid copper	Algaecide/molluscicide	Up to 2.5 ppm (see label)	<ul style="list-style-type: none"> •24c label (Matrix) for exotic mollusk control in Idaho •Less toxic to fish than CuSO4 •No irrigation restrictions 	<ul style="list-style-type: none"> •Efficacy on mussels not known or independently verified 	FIFRA 2(ee) and FIFRA 24(c) labels
Chlorine	Bactericide/molluscicide	1 ppm	<ul style="list-style-type: none"> •Readily available •Labeled for mussel control in industrial plants •Technology well-known •Veligers particularly susceptible •Can be used for crop irrigation, potable water 	<ul style="list-style-type: none"> •Volatile •Rapidly leaves water •Requires several days of exposure to kill adults •Toxic to fish 	Full federal Section 3 label
Endothall-amine	Algaecide/molluscicide	Up to 3 ppm	<ul style="list-style-type: none"> •Labeled for use in industrial sites, closed systems •Algaecide registered for use in ponds, lakes, natural sites, canals •Water can be used for irrigation •Possible 24(c) in Idaho? 	<ul style="list-style-type: none"> •Short half-life (2-4 days) •Toxic to fish 	FIFRA 2(ee)

Table 2. Nonoxidizing molluscicides that are toxic to zebra and quagga mussels but are not registered for use in natural waters. Information provided by Ricardo Deleon; labels reviewed and registration comments made by Don Stubbs are shown in red.

Molluscicide chemical name	Commercial name	Manufacturer	Lethality to dreissenid mussels
Poly(oxyethylene(dimethylimino)ethylene (dimethylimino)ethylene dichloride Possible 24c candidate but label would have to be very limited and address endangered species. No 2ee	Bulab 6002 or Busan 77 1448-42 Antimicrobial Highly toxic to fish and clams	Buckman Laboratories control algae, bacteria, fungi and mollusks in industrial cooling water and industrial process water systems	0.5 ppm for 826 h - 100% adult mortality 2 ppm for 313 h - 100% adult mortality 8 ppm for 197 h - 100% adult mortality CAS no 31512-74-0 PC code 069183
2-(Thiocyanomethylthio)benzothiazole Possible 24c candidate but label would have to be very limited and address endangered species. No 2ee	Bulab 6009 1448-37 TMTB antimicrobial Highly toxic to aquatic organisms	Buckman Laboratories Materials preservation, wood preservative, industrial processes and colliging towers and (seed treatment) tolerances 180,288	0.5 ppm for 758 h - 100% adult mortality 2 ppm for 313 h - 100% adult mortality 4 ppm for 260 h - 100% adult mortality CAS no 21546-17-0 PC code 03503
Didecyl dimethyl ammonium chloride Possible 24c candidate but label would have to be very limited and address endangered species. No 2ee	H-130 DDAC 1706-186 Antimicrobial persistent	Calgon? NLCO Used in industrial process and water systems, swimming pools, wood treatment , aquatic areas to include for algae control(Greenhouses/nurseries, golf courses, recreational parks, amusement parks, universities, and cemeteries)	1 ppm for 24 h - 100% adult mortality CAS no 7173-51-5
N-alkyl dimethyl benzyl ammonium chloride & Dodecylguanidine hydrochloride Possible 24c candidate but label would have to be very limited and address endangered species. No 2ee	Clam-trol-1 or CT-1 ADBAC Antimicrobial Highly toxic to fish and aquatic invertebrates	Betz Industrial Algicide, wood preservative, fungicide, molluscicide, reg no 3876-145- once-through closed-cycle fresh and sea water cooling systems, cooling ponds, canals and lagoons.	15 ppm for 12 h at 11°C - 100% adult mortality after 48 h 15 ppm for 14 h at 14°C - 100% adult mortality after 48 h 15 ppm for 6 h at 20°C - 100% adult mortality after 24 h 15 ppm for 14 h at 20°C - 100% adult mortality after 48 h
N-alkyl dimethyl benzyl ammonium chloride Possible 24c candidate but label would have to be very limited and address endangered species. No 2ee	Clam-trol-2 or CT-2 ADBAC Antimicrobial Highly toxic to fish and aquatic invertebrates	Betz Industrial See above	2-5 ppm applied for 6-24 h - 100% adult mortality

Table 2 continued

Molluscicide chemical name	Commercial name	Manufacturer	Lethality to dreissenid mussels
<p>Akyldimethylbenzyl ammonium chloride & Akyldimethylethylbenzyl ammonium chloride</p> <p>Possible 24c candidate but label would have to be very limited and address endangered species. No 2ee</p> <p>By-product produced from dead <i>Pseudomonas fluorescens</i> soil bacterium, strain CL145A</p> <p>Not sure if you could 24c this strain or the use pattern. No 2ee.</p>	<p>Mactrol 9210</p> <p>ADBAC Antimicrobial Highly toxic to fish and aquatic invertebrates</p> <p>Zequanox EPA Reg no 64004-3. Does not appear to have tox issues.</p>	<p>Nalco</p> <p>Algaecide, wood preservative, fungicide, molluscicide, reg no 3876-145- once-through closed-cycle fresh and sea water cooling systems, cooling ponds, canals and lagoons.</p> <p>Marrone Bio Innovations (MBI) BBPD registered for frost protection. Exempt from tolerance requirement 40cfr when used on crops 180.114- Strain A506 registered</p>	<p>0.5 ppm for 249 h at 18°C - 100% adult mortality</p> <p>0.5 ppm for 120 h at 22°C - 100% adult mortality</p> <p>2.0 ppm for 65 h at 18°C - 100% adult mortality</p> <p>2.0 ppm for 45 h at 22°C - 100% adult mortality</p> <p>CAS no 8001-54-5; RED available</p>
<p>Compound with Primary and Secondary Aminated Carbon Chains Possible 24c candidate but label would have to be very limited and address nontarget such as fish an endangered species. No 2ee</p>	<p>Mexel 432 Reg no 84304-1 - highly toxic to fish . Antimicrobial</p>	<p>Mexel-chemical term does not allow for a good search -Product name does show up for cooling towers and non potable water sources</p>	<p>200 mg/l applied for ≤24 h for ≥ 80% adult mussel kill</p> <p>6 mg/l applied ≤6 h/day no more than twice per week to prevent juvenile mussel settlement</p> <p>Registration review completed 2009.</p> <p>2 ppm for 1.5h/day for 30 days - 40% adult mortality</p> <p>10 ppm for 1.5 h/day for 30 days - 62-77% adult mortality</p> <p>ai is 1-(Alkyl*amino)-3 aminopropane</p>
<p>Dichloro-2nitro-4' salicylanilide possible 24c Restricted use pesticide. This is a heavily restricted label for use by Fish and Wildlife Service - No 2ee . The label and SOP for this product are what we probably need to do to get most of these chemicals registered for mussel use.</p>	<p>Bayluscide-Reg no 3125-218 or 6704-87 This chemical is toxic to fish and aquatic invertebrates. Directions for use must be strictly followed to minimize hazards to non-target organisms</p>	<p>Bayer registered as sea lamprey</p>	<p>0.05 ppm for 24 h - 70% adult mortality</p> <p>0.1 ppm for 24 h - 100% adult mortality</p> <p>Reg No 6704-87 Niclosamide, Aminoethanol Salt</p> <p>Read the entire label and Sea Lamprey Control Document No. SLC-92-001 [Standard Operating Procedures for Application of Lampricides in the Great Lakes Fishery Commission Integrated Management of Sea Lamprey (<i>Petromyzon marinus</i>) Control Program] for correct rates of application. This product must be used strictly in accordance with both label's precautionary statements and applicable use directions, as well as with all applicable State and Federal laws and regulations.</p>
<p>N-triphenylmethyl-morpholine (4-tritylmorpholine 4-(triphenylmethyl)morpholine)</p> <p>No 2ee no 24c</p>	<p>Frescon bayer not epa registered to my knowledge</p>	<p>Shell</p>	<p>0.5 ppm for 24 h - 70% adult mortality</p> <p>0.9 ppm for 24 h - 100% adult mortality</p> <p>CAS no 1420-06-0 PC no 498300</p>

SECTION IV: IDAHO EXOTIC MUSSEL CONTINGENCY PLAN

William T. Haller, University of Florida

The Idaho Panel of Experts clearly indicated that the discovery of exotic mussels in large river run reservoirs would most likely be impossible to eradicate. This conclusion is based in part upon the length of time (often weeks or months) between sample collection and analyses with confirmation. This temporal lag allows mussels to reproduce and spread beyond pioneer infestations in marinas or boat moorage locations into the reservoirs proper. In addition, past eradication efforts have generally been limited to closed ponds of <25 acres and has cost as much as >\$10,000 per acre (see Millbrook Quarry, VA). The likely cost of eradication, if possible, is therefore prohibitive in large reservoirs where the isolation of the newly discovered infestation is not possible.

Copper sulfate, chelated copper and endothall herbicides listed in Table 1 can generally be used for mussel control under Section 2(ee) of FIFRA in ponds, lakes, irrigation and drainage canals and in slow moving or quiescent water such as bays and coves adjacent to reservoirs. Not all labels list rivers as approved sites of application, so if a river is being considered for treatment, the pesticide chosen must be labeled for use in rivers. It is unlikely that control efforts will be undertaken in Idaho rivers due to their generally high discharge and velocity of flow. Other products that are toxic to mussels (such as chlorine, rotenone, antimycin A, potassium chloride, anhydrous ammonia and chlorine) should also be evaluated and researched to determine if they can be used in certain but specific aquatic sites in Idaho.

Because waterbodies in Idaho vary greatly in size and flow characteristics, the panel divided them into five (5) different types or categories based on the ability of the state to manage the water and the likelihood of the successful eradication of exotic mussels. It is understood that a specific eradication plan would be quickly developed on a case by case basis.

1. Enclosed pond or lake with no water exchange

The panel offered several suggestions for consideration should exotic mussels be discovered in this type of system (although many of these comments can be applied as applicable to any infested waters):

- Immediately close the water body to all public access to stop the further spread of the infestation;
- Determine and resolve any legal or jurisdictional issues which would impede the entry of state agents to the privately owned water bodies and the destruction of the exotic mussels and including collateral damage to other life forms in the water;
- Immediately survey all adjacent or nearby waters for infestations;

- Determine, if possible, the pathway of introduction and implement measures to prevent repeats;
- Consider mechanical methods of control, including drawdown to allow desiccation to occur. A minimum of 30 days of exposure is necessary to effect a positive outcome (See www.100thmeridian.org). Water cannot be permitted to contaminate other water bodies;
- A partial drawdown or drainage may enhance chemical treatment efficacy. Chemical treatments should be conducted when water temperature exceeds 15 °C; and
- Determine if any seepages or springs are located in the waterbody. Underground water exchange (subterranean inflow into the lake) will allow mussels to survive a chemical treatment.

2. Gravel pits

For the purposes of this plan, gravel pits refer to small lakes or borrow pits common along river beds in Idaho with the likely lateral movement of surficial ground or storm water. The response to detected infestations in these areas will be similar to the response identified above in enclosed ponds or lakes depending on water movement both into and out of the area. Additional considerations include:

- Chemical applications will have to account for potential dilution because of water fluctuations. Sequential treatments will have to be considered to optimize results;
- The proximity of potable water sources would have to be considered if the chemicals of choice would likely reach them. The wells, pumps or treatment systems would have to be closed, filtered or otherwise modified if the chemical(s) of choice do not have potable water tolerances. Chlorine would be a likely candidate chemical in these circumstances; and
- Fish populations, if any, are generally of less concern in these artificial areas.

3. Irrigation canals

These canals or canal bottoms are rarely completely dry, even in the off- or non-crop season (October to April). There are generally two types of canals: those with return flow to a natural waterway and those that have no water return flow to the source waterway. Irrigation canals are currently treated with aquatic herbicides for weed control. All chemicals applied to irrigation canals used to water crops must have established tolerances on the crops receiving the water or be exempt from tolerances. If irrigation return flow is returned to natural waterways, additional restrictions may apply [See Legal Considerations, Section III and FIFRA Section 2(ee)]. Chemicals used in irrigation water must be registered by the EPA for that site and use. For exceptions see FIFRA Section 18 and Legal Considerations. Additional considerations include:

- Possible potable water uses, cattle watering, and or other domestic water uses;
- Whether the return flow be held and, if so, for how long, and

- Endangered Species Act compliance.

4. Lakes

Lakes are generally considered to be between 100 and 1,000 acres. Data were presented at the meeting indicating that 17 of the 83 lakes listed in Appendix I of this report were <400 acres. Also, the Idaho Fish and Game representative felt that if exotic mussels were found in a lake of 500 to 1,000 acres in size, it would be possible to consider an eradication effort. Fish toxicants have been used in similar size lakes in the west to remove or regulate undesirable fish populations.

Large lakes would also be evaluated on a case by case basis and considerations for responses indicated in numbers 1 and 2 above would apply to a large extent. Hopefully, the infestation would be localized or would occur in a marina or a closed bay. Large lakes can be treated in their entirety much as ponds and borrow pits, but it is much more expensive and difficult. To our knowledge, no attempt has been made to eradicate exotic mussels in lakes greater than 125 acres. Outflow on large lakes is a concern and must be controlled or stopped before the infestation can move downstream. See the marina discussion below.

5. Reservoirs and river-run impoundments and large lakes

There are 66 reservoirs in Idaho which are >1,000 acres and often impound large rivers. It is impossible for mussels to be eradicated once established in these systems in numbers capable of reproduction. Thus, the panel felt that prevention and sampling has to be concentrated at or near these very high risk areas which usually attract the highest number of users and recreation boaters. These systems include Priest Lake, Lake Pend Oreille, Big Bear Lake, etc. If reproducing populations of exotic mussels are found in open bays outside of closed or restricted water-flow marinas, it will be impossible to eradicate them or prevent downstream movement in river-run reservoirs.

The most likely scenario, and one in which eradication in these large systems may be possible, is when an infestation is found in an isolated bay or a restricted-flow or water-movement marina. Another example is if a heavily infested boat with live mussels is launched and moored at a marina. In this case, it may be possible to consider some of the options for water bodies noted in 1 through 3 above with the following considerations:

- a. Immediately close the marina or bay to boat traffic and immediately remove any contaminated boats;
- b. Establish mandatory decontamination procedures for all existing watercraft;
- c. Collect samples inside and outside of the contaminated area for immediate analysis;
- d. Determine the feasibility of using silt curtains or barriers to close the bay or marina to open water;

- e. Remove and decontaminate all boats;
- f. Treat the entire enclosed area to kill all veligers and possible adults; and
- g. Be prepared to collect and remove dead fish.

SECTION V: RESEARCH NEEDS AND RECOMMENDATIONS

Denise Hosler, US Bureau of Reclamation

Research

The biology and ecology of exotic mussels are well known, as are their pathways of introduction. However, data and products that could be useful for management and monitoring of mussels are lacking.

There are currently no economic or technical means to control exotic mussels in large river run reservoirs such as Lakes Pend Oreille, Coeur d'Alene and similar waterbodies. Thus, early detection and treatment of mussels in marinas or coves of such waterbodies is the only means to stop or slow expansion of these species. Unfortunately, most of the molluscicides that could be employed for exotic mussel control are toxic to native mussels as well. In addition, many are toxic to fish, some of which may be classified as endangered species.

The panel identified the following research needs:

- A more rapid means of water sampling for detection of exotic mussels. The time required for sample collection, shipping, analysis and confirmation of the presence of exotic mussels is at minimum several days and more often requires several weeks. This time lag could result in veliger movement away from an enclosed boat ramp, marina or bay and into a much larger system.
- Research on control methods of exotic mussels that have less impact on non-target species. The continued progress on the registration of bacteria for mussel control is a very positive move forward. However, additional control methods are needed to prevent reliance on one means of control. For example, chelated copper compounds could perhaps offer effective control of exotic mussels with little danger of fish mortality.
- Comparison of the toxicity to exotic mussels of FIFRA products registered for aquatic use. In 1993, Waller et al. reported the toxicity of copper sulfate and 18 piscicides, lampricides and industrial molluscicides to zebra mussels and selected non-target species. Similar research is needed on chemicals currently registered for aquatic use in natural waters (Table 1), many of which have been used or are being considered for use to control exotic mussels. The legal hurdles required to gain exotic mussel control under Sections 24(c) or 2(ee) for herbicides already registered for aquatic weed and algae control are typically much less arduous than for chemicals not labeled for use in natural waters.

- Irrigation canals, particularly those with outflow to natural waters, are unique and provide other opportunities for mussel control. Chlorine and fertilizer components (such as anhydrous ammonia and potassium chloride) might offer an inexpensive means of control. The toxicities of chlorine (1-2 ppm) and potassium chloride (100 ppm) have been determined but similar information is not available for anhydrous ammonia. The Pesticide Registration section of the Idaho Department of Agriculture should determine whether the use of these products is legal and whether the necessary crop tolerances have been identified.

Other Panel Recommendations

- The Idaho Department of Agriculture should share the invasive mussel contingency plan with federal agencies and adjoining states to foster greater cooperation and to integrate and increase regional prevention efforts;
- Idaho and neighboring states should encourage, insist on and use all possible means to ensure that states and authorities enforce decontamination of boats leaving mussel-infested waters, similar to the program instituted in Minnesota. **Every one** of these vessels has the potential to infest other waterways, so it is common sense – from both environmental and economic standpoints – to ensure that departing vessels are decontaminated.
- Increase, improve and intensify prevention and monitoring programs near Category 4 and 5 waterways;
- Educational efforts need to be expanded to include marina owners/operators and commercial boat haulers;
- Engage with a Rapid Response Team (similar to the Columbia River Basin Team that includes WA, OR, MT and ID) that represents appropriate state, federal and tribal interests from all neighboring states to evaluate and coordinate the response to any suspected mussel finds, develop specific treatment plans and define agency responsibilities and commitments;
- Work with other Idaho state agencies as appropriate to include mussel exclusion clauses and inspections in state construction contracts when equipment (barges, silt barriers, water tanks, gold dredges, etc.) might be brought into Idaho and placed in waters of the state; and
- Collect additional water temperature data on highly vulnerable lakes to optimize the timing of monitoring efforts (see Section VIII).

SECTION VI: CONTINGENCY PLANNING FOR INVASION OF MUSSELS INTO IDAHO FROM CONTAMINATED WATERSHEDS

William Haller, University of Florida Center for Aquatic and Invasive Plants

While the Idaho inspection and decontamination plan is and will continue to be successful, the next most likely pathway of introduction of exotic mussels into Idaho is beyond the control of the state. This is due to three major factors:

1. Because Idaho is a long and narrow state, most watersheds in the state originate from outside the state on the western slope of the Rocky Mountains.
2. There is currently no regional prevention program that includes boat inspection and decontamination for watersheds that feed into Idaho's waters.
3. There is no national program in place to detect and decontaminate boats leaving mussel-infested waters such as the Mississippi River and the Great Lakes.

After zebra and quagga mussels became established in the Great Lakes, boats harboring exotic mussels moved quickly from these contaminated waters into isolated inland lakes in Michigan and other Great Lake states. The Idaho inspection program has documented significant numbers of recreational boat traffic into Idaho from locations infested with mussels. It is possible – and even likely – that contaminated boats could launch into reservoirs in neighboring states, which would result in contamination of the entire watersheds from the Continental Divide to the Pacific Ocean. Thus, Idaho's state agencies must consider a plan to prevent inter- and intrastate movement of mussels if they become established in watersheds passing through Idaho.

For example, if the heavily utilized Flathead Reservoir is invaded by mussels and becomes host to an established mussel population, there is no feasible means to prevent movement of mussels down the Clark Fork River into Lake Pend Oreille. The question then becomes how mussel movement from a contaminated lake to other watersheds in Idaho can be prevented. In this example, mussels entering Lake Pend Oreille from the Clark Fork River cannot be excluded, controlled or eradicated. Thus, evaluation by state agencies should be conducted to determine the feasibility of preventing movement of mussels from the newly established population in Lake Pend Oreille to Priest Lake, Lake Coeur d'Alene, the Salmon River watershed and others. Questions to be answered include:

1. What can be done to prevent boats from transporting mussels from an infested lake to other areas?
2. Which boat ramps can be closed? Which boat ramps have decontamination stations?
3. When (hours and times of year) are decontamination stations in operation? Can boaters legally be prevented from leaving a lake without first being decontaminated?
4. How many boats (perhaps all) will need to be decontaminated and at what cost? Where will the funds come from? Will there be a fee for decontamination?

This contingency should be developed for each watershed in Idaho. Funding, regulations and other legal issues must be resolved before exotic mussels are found in waters that pass through Idaho. Exotic species do not recognize state boundaries and rapidly move through

hydrologically connected watersheds, but planning that addresses this type of scenario appears to be limited. Preventing the movement of exotic mussels and other invasive species from a contaminated watershed will require a major planning effort and must be done quickly. Therefore, pre-planning and contingency plans should be developed for each watershed in Idaho.

Idaho is concerned with the introduction of invasive species into Idaho waters from floating craft or other devices, including recreational and mining equipment that has previously been used in contaminated waters outside the state. To prevent the introduction of invasive aquatic species, specifically quagga and zebra mussels, Idaho's Invasive Species Law makes it illegal to import, transport or possess invasive species. Recreational mining equipment operators are required to decontaminate their equipment before they come to Idaho or before returning to Idaho after mining out of state. The Idaho Department of Water Resources also strongly recommends that all mining equipment be decontaminated when moving into another watershed within the state. See 100thmeridian.org for information on decontamination of equipment.

Operators of recreational mining equipment shall ensure that all internal and external surfaces of their equipment are cleaned and free of bacterial growth by circulating hot water internally and thoroughly pressure washing all exterior surfaces. Cleaning should ensure that all rough or gritty spots (microscopic mussels feel like sandpaper) are cleaned using high pressure 140+ degree Fahrenheit water or similar cleaning processes and thoroughly drying dredges and equipment for a minimum of 24 hours prior to use. Also see the Idaho Department of Agriculture's web site.

The expert panel has made several comments in this report that emphasize the need for regional cooperation. This may be overstated due to the fact that the Columbia River Basin states have worked together to develop a rapid response plan for dealing with aquatic invasive species. For more information about this collaborative effort, please see http://www.100thmeridian.org/ActionTeams/Columbia/CRB_Dreissenid_Rapid_Response_Plan_September_19_2011.pdf.

In addition, Idaho has developed its own draft rapid response plan as an addendum to the Columbia River plan noted above; the Idaho state plan outlines the responsibilities of various state agencies (see Appendix 4).

SECTION VII: RANKING IDAHO WATERBODIES FOR LIKELIHOOD OF INVASION BY ZEBRA AND QUAGGA MUSSELS

Amy Ferriter, Idaho State Department of Agriculture

The Idaho State Department of Agriculture, in cooperation with other state and federal agencies, compiled this list of waterbodies in Idaho with an assessment of their potential for invasion by exotic mussels. Factors considered included the requirement for calcium for mussel growth and survival, along with the potential for recreational use as indicated by the number of access points and “destination” data collected by the boat inspection program. The results of this assessment are presented below and indicate that many waterways in Idaho have a high potential for invasion by exotic mussels.

1. Calcium

Calcium levels in waterbodies are widely seen as an important risk factor for zebra/quagga mussel establishment. The following categories were used to classify waterbodies based on available calcium data:

- Less than 11 ppm = 0 points
- 11-25 ppm = 1 points
- Greater than 25 ppm = 3 points

2. Use

Ramps – Number of ramps/access points to the waterbody was used in combination with the other variables to estimate relative use. The following categories were used:

- 1 ramp = 1 points
- 2-3 ramps = 3 points
- 4-5 ramps = 4 points
- More than 5 ramps = 7 points

Moorage – If a waterbody has a boat moorage facility, the waterbody was given 4 points. This information was used to factor in long term boater usage (vs. “day tripper” use). Long term usage is seen as higher risk for inoculation of a waterbody.

Fishing tournaments – Waterbodies that have at least one permitted fishing tournament per years are given 3 points. This data was factored into use due to the large number of out-of-state boats that compete in these events.

Inspection station “Destination” data – Data collected from Idaho’s watercraft inspection stations was used to determine the most frequent “destination waterbodies.” Data from the 2009 and 2010 watercraft inspection seasons was used (approximately 63,000 inspections).

This data was collected from roadside inspection stations and largely measures destinations for boats that are crossing the state line.

- Less than 100 inspections = 0 points
- 100-500 inspections = 4 points
- More than 500 inspections = 6 points

Proximity to impacted state – Spatial data was used to determine the proximity of the subject waterbody to a “mussel positive” state. Waterbodies that are less than 50 miles from a “mussel positive” state (per the USGS NAS database) were given 3 points. The rationale for using this variable is that fouled boats that launch into Idaho’s waters are more likely to have live mussels attached if the boat has travelled a shorter distance.

3. Endangered/Threatened Species

The presence of endangered and threatened species is not considered a “risk factor” *per se*, but the presence of these species in a waterbody will severely limit control options if zebra and quagga mussels are discovered in the waterbody. This data was included in the prioritization step for this reason. If a waterbody has endangered species, it is given 6 points, if a waterbody has threatened species, it is given 3 points.

RANKING:

Based on the point system, waterbodies are given the following rankings:

- **Greater than 10 Points = Critical.** “Critical” waterbodies are either highly susceptible to invasion (high calcium, high use, close proximity to impacted states, or any combination of these factors), and/or have significant threatened and endangered species concerns. In a “Critical” waterbody, it is considered essential that robust monitoring continue.
- **6 – 10 Points = High Priority.** “High Priority” waterbodies are considered susceptible to invasion (adequate calcium levels, significant use, or a combination of these factors) and/or have threatened species concerns.
- **1 – 5 Points = Medium Priority.** “Medium Priority” waterbodies are considered susceptible to invasion, but have calcium levels that are considered unfavorable for zebra/quagga mussel establishment and/or the waterbody has limited access and low use.

Table 3: Priority Ranking of Idaho Waters

Name	Basin	Ca max (mg/L)	Boat ramps	Acres	Priority	Dam owner	Federal land	ESA	Fishery
Alexander Res	Bear River	53	1	1,011	High	Pacificorp			Cutthroat
Bear Lake	Bear River	28	3	34,413	Critical	IDWR	USFWS		Cutthroat, Lake trout
Daniels Res	Bear River		1	361	High	St Johns Irr. Dist.			Cutthroat, Rainbow
Deep Creek Res	Bear River		1	63	High	Deep Crk. Irr. Co			
Devil Crk. Res	Bear River		1	85	High	Malad. valley irrigation			White Sturgeon
Glendale Res	Bear River		1	203	High	Preston Whiney Irr. Co			Rainbow
Oneida Narrows	Bear River	61	1	420	High	Pacificorp	BOR_BLM		Perch, Walleye
Stone Res	Bear River	38	1	124	High	Delomere Canal Co	USFS		Rainbow
Treasureton Res	Bear River		1	152	High	Strongarm Res Irr. Dist.			Rainbow
Twin Lake Res	Bear River		1	437	Critical	Twin Lakes Canal Co			
Clearwater River, Orofino	Clearwater	6	25	0	High		USFS	Chinook, Steelhead	Chinook, Steelhead
Clearwater, Lewiston	Clearwater	6	0	0	Critical			Chinook, Steelhead	Chinook, Steelhead
Dworshak Reservoir	Clearwater	6	7	14,658	Critical	CENWW	USACE	Bull Trout	Kokanee, Rainbow
Elk Creek Res	Clearwater		1	76	Moderate	Elk R Res Co			Rainbows, Brook
Moose Creek Res	Clearwater		1	7	Moderate	IDL			LM Bass, rainbows
Snake River (Lewiston)	Clearwater		0	0	Critical				Chinook, Steelhead
Spring Valley Res	Clearwater		1	47	Moderate	IDFG			Rainbow, LM Bass
Winchester Lake	Clearwater		1	86	Moderate	IDFG			Rainbow, LM Bass
Arrowrock Res	Lower Snake	12	2	1,937	High	BOR	BOR_USFS	Bull Trout	SM Bass, Kokanee
Bell Rapids	Middle Snake	44	1	719	Critical	Idaho Power		Snails	Sturgeon, Rainbow
Black Canyon Res	Lower Snake	11	4	1,032	High	BOR	BOR		LM Bass
Brownlee Reservoir	Lower Snake	36	4	13,250	Critical	Idaho Power	BLM		SM Bass, LM Bass, Sturgeon
C J Strike Reservoir	Lower Snake	36	8	7,539	Critical	Idaho Power	BLM		SM Bass, LM Bass, Sturgeon

Name	Basin	Ca max (mg/L)	Boat ramps	Acres	Priority	Dam owner	Federal land	ESA	Fishery
Cascade Reservoir	Lower Snake	4	9	19,626	Critical	BOR	BOR		Rainbow, Kokanee
Crane Creek Res	Lower Snake	10	2	2,324	High	Crane Crk. Res Admin. Board	BLM		LM Bass
Deadwood Res	Lower Snake	9	1	3,023	Moderate	BOR	BOR	Bull Trout	Kokanee, cutthroat
Lake Lowell	Lower Snake	58	2	6,084	High	BOR	BOR_USFWS		LM Bass, SM Bass
Lost Valley Res	Lower Snake	13	1	524	Moderate	Lost Valley Res Co	USFS		Rainbows
Lucky Peak Reservoir	Lower Snake	12	5	3,019	Critical	USACE	USFS	Bull Trout	Kokanee, SM Bass
Mann Creek Res	Lower Snake	27	2	270	Critical	BOR			LM Bass
Mountain View Lake	Lower Snake		1	406	High	BIA	Duck Valley IR		Rainbow
Mt Home Res	Lower Snake	31	1	406	Moderate	Mt Home Irr. Dist.	BLM		Rainbow
Owyhee River	Lower Snake	23	0	0	High		BLM		Redband
Oxbow Res	Lower Snake		3	2,520	High	Idaho Power	BLM		SM Bass, LM Bass Sturgeon
Paddock Valley Res	Lower Snake	21	1	1,194	Moderate	Little Willow Irr. Dist.	BLM		LM Bass
Payette Lake	Lower Snake	11	4	5,003	Critical	Lake Res Co			Rainbow, Cutthroat
Sage Hen Res	Lower Snake		1	293	Moderate	Squaw Crk. Irr. Dist.	USFS		Rainbows
Snake River (I-84)	Lower Snake		0	0	Critical		BLM		
Swan Falls (Snake River)	Lower Snake		1	0	High	Idaho Power	BLM		SM Bass, LM Bass, Sturgeon
Upper Payette Lake	Lower Snake	1	1	303	Moderate	Lake Res Co	USFS		Rainbow, Brook
Wilson Lake Res	Middle Snake	59	2	484	High	Northside Canal Co	BLM		Bullhead, Perch
American Falls Reservoir	Middle Snake	60	5	55,501	Critical	BOR	BOR		Rainbow, Cutthroat
Anderson Ranch Res	Middle Snake	12	6	4,618	Critical	BOR	BOR_USFS	Bull Trout	Rainbows
Cedar Creek Res	Middle Snake	62	1	973	High	Cerar Res and Mesa Canal Co	BLM		
Chesterfield Res	Middle Snake	37	1	1,245	High	Port Chest Canal Co	BLM		Cutthroat, Rainbow
Fish Creek Res	Middle Snake		1	0	Moderate	Fish Crk. Res Co	BLM		

Name	Basin	Ca max (mg/L)	Boat ramps	Acres	Priority	Dam owner	Federal land	ESA	Fishery
Goose Creek (Oakley Res)	Middle Snake	75	1	1,007	High	Oakly Canal Co	BLM		
Horsechief Res	Middle Snake	4	1	250	Moderate	IDFG			Rainbow, Brook
Lake Walcott	Middle Snake	47	2	8,392	Critical	BOR	BOR		Cutthroat, Rainbow
Little Wood River Res	Middle Snake	34	1	600	Moderate	BOR	BOR		
Mackay Res	Middle Snake	42	1	1,174	Moderate	Big Lost Irr. Dist.	BLM		Rainbow, Kokanee
Magic Res	Middle Snake	62	6	3,570	Critical	Magic Res Hydro	BLM		Rainbow
Milner Reservoir	Middle Snake	50	1	4,342	Critical	Milner Dam Inc.	BOR_BLM	Snails	Rainbow, Smallmouth
Mormon Res	Middle Snake	24	1	1,587	High	Twin Lakes Res Irr. Dist. Co	BLM		
Mud Lake	Middle Snake	47	2	3,094	Moderate				Perch, Largemouth Bass
Murtaugh Lake	Middle Snake	46	1	837	High	Twin Falls Canal Co	BLM		Channeleat, perch
Salmon Falls Creek Reservoir	Middle Snake	82	1	2,655	High	Salmon R Canal Co	BLM		Walleye, Rainbow
Little Camas Res	Middle Snake	12	1	968	Moderate	Mt Home Irr. Dist.	USFS		Rainbows
Clark Fork River (Cabinet Gorge)	Panhandle	25	0	0	Critical	Avista	USFS	Bull Trout	Cutthroat
Cocolalla Lake	Panhandle	7	1	806	Moderate				Rainbow
Coeur d'Alene Lake	Panhandle	42	21	27,360	Critical	Avista	CDA Tribe	Bull Trout	Cutthroat, Kokanee
Coeur d'Alene River	Panhandle	42	1	0	High		USFS_BLM	Bull Trout	Cutthroat
Ferman Lake	Panhandle		2	341	Critical				Rainbow, cutthroat
Hauser Lake	Panhandle	5	1	541	Moderate				Rainbow, cutthroat
Hayden Lake	Panhandle	11	2	3,813	Critical		USFS		Rainbow, Cutthroat
								Bull Trout, Burbot, white sturgeon	
Kootenai River	Panhandle	43	4	0	Critical		USFS_BLM		Rainbow, Cutthroat
Lake Pend Oreille	Panhandle	28	31	66,924	Critical	USACE	USACE_USFS	Bull Trout	Kokanee, Cutthroat
Priest Lake	Panhandle	11	15	23,423	Critical	IDWR	USFS	Bull trout	Cutthroat, Kokanee
Spirit	Panhandle	2	3	1,547	High				Kokanee, Rainbow
Spokane River	Panhandle		2	0	Moderate	Avista			Rainbow, Browns
Twin Lakes	Panhandle	33	3	919	High				Rainbow, cutthroat

Name	Basin	Ca max (mg/L)	Boat ramps	Acres	Priority	Dam owner	Federal land	ESA	Fishery
Alturas Lake	Salmon	8	1	826	High		USFS	Sockeye	Sockeye, rainbow
Redfish Lake	Salmon	6	1	1,515	Critical		USFS	Sockeye	Sockeye, rainbow
Salmon River (Riggins)	Salmon	28	18	0	Critical		USFS_BLM	Chinook, Steelhead	Chinook, Steelhead
Salmon River (Salmon)	Salmon	28	0	0	Critical		USFS, BLM	Chinook, Steelhead	Chinook, Steelhead
Warm Lake	Salmon	4	1	413	Moderate		USFS		
Ashton Res	Upper Snake	19	1	356	Moderate	Pacificorp			Rainbow
Blackfoot Reservoir	Upper Snake	86	7	17,442	Critical	BIA	BLM		Cutthroat, Rainbow
Gem Lake	Upper Snake	41	2	301	High	Idaho Falls			Cutthroat, Rainbow
Henry's Lake	Upper Snake	19	5	6,072	Critical	Northfor Res Co	BLM		Cutthroat, Brook
Island Park Reservoir	Upper Snake	19	4	7,551	High	BOR			Rainbow, Cutthroat
Palisades Reservoir	Upper Snake	73	6	13,457	Critical	BOR	BOR		Cutthroat, Brown
Rire Res	Upper Snake	53	2	1,414	High	BOR	BOR		Cutthroat, Kokanee
Alexander Res	Bear River	53	1	1,011	High	Pacificorp			Cutthroat
Bear Lake	Bear River	28	3	34,413	Critical	IDWR	USFWS		Cutthroat, Lake trout
Daniels Res	Bear River		1	361	High	St Johns Irr. Dist.			Cutthroat, Rainbow
Deep Creek Res	Bear River		1	63	High	Deep Crk. Irr. Co			
Devil Crk. Res	Bear River		1	85	High	Malad. valley irrigation			White Sturgeon

SECTION VIII: CURRENT MONITORING FOR EARLY DETECTION OF EXOTIC MUSSEL POPULATIONS IN IDAHO

Tom Woolf, Idaho State Department of Agriculture

The monitoring program for dreissenid mussels in Idaho waters utilizes several methods, including:

1. Plankton tow sample collection for veliger detection,
2. Static substrate monitoring, and
3. Shoreline monitoring.

Sampling is focused on high use and high priority areas that are identified in the Idaho Waterbody Ranking Assessment (Section VII).

Plankton tow samples for veliger detection are collected following US Bureau of Reclamation (BOR) protocols. Sampling is conducted on waterbodies throughout the state, with the highest sampling frequency focused on high-use “Critical” ranked waterbodies. Waterbody ranking also determines sampling frequency, varying from one sampling event per season in lower risk waters to sampling at three-week intervals at multiple locations in “Critical” waterbodies. Plankton sampling is initiated in the spring when water temperatures rise above 10 °C and continues through the summer until water temperatures at depth exceed 20 °C. Sampling early in the season can be delayed due to very high flow conditions and high turbidity as a result of snow runoff.

Shoreline surveys are conducted in conjunction with plankton tow sampling activities. Shoreline surveys are conducted at each waterbody visited and are focused on high-use boat launches. Plant material and shells along the shoreline are inspected for evidence of invasive aquatic species. If possible, the shoreline is also waded and rocks are picked up and inspected for invasive mussels, snails and crayfish. This survey varies depending on shoreline access and flow conditions.

Sampling for settled adult mussels is also conducted using static substrate samplers at high-use waterbodies throughout the state. The substrate sampling effort has been led by the Idaho Department of Environmental Quality. Samplers are deployed on or adjacent to high watercraft use areas, which are inspected several times per season. Other partners – including lake associations, tribes and canal companies – also monitor substrate samplers throughout the year. A new public monitoring program called the Mussel Patrol (MP) will be implemented in 2012; this program will provide kits of substrate samplers and sampling supplies to interested organizations and the public to improve substrate monitoring and reporting throughout the state.

In the 2011 season, 532 plankton tow samples from 76 waterbodies were collected and analyzed for dreissenid veligers in Idaho. BOR provided sample analysis services for the 2011 season and found no evidence of dreissenid veligers. Plankton samples were analyzed using cross polarized microscopy. If a suspected dreissenid veliger was encountered, BOR utilized a scanning electron microscope for improved visual analysis and also utilized PCR to conduct DNA analysis on suspect samples. No evidence of mussels was found during shoreline surveys or on substrate monitors in Idaho during the 2011 season.

Partners around the state assist with dreissenid mussel monitoring, including county personnel from around the state, Idaho Department of Environmental Quality, US Army Corps of Engineers, US Forest Service, The North Side Canal Company and The Coeur d'Alene Tribe.

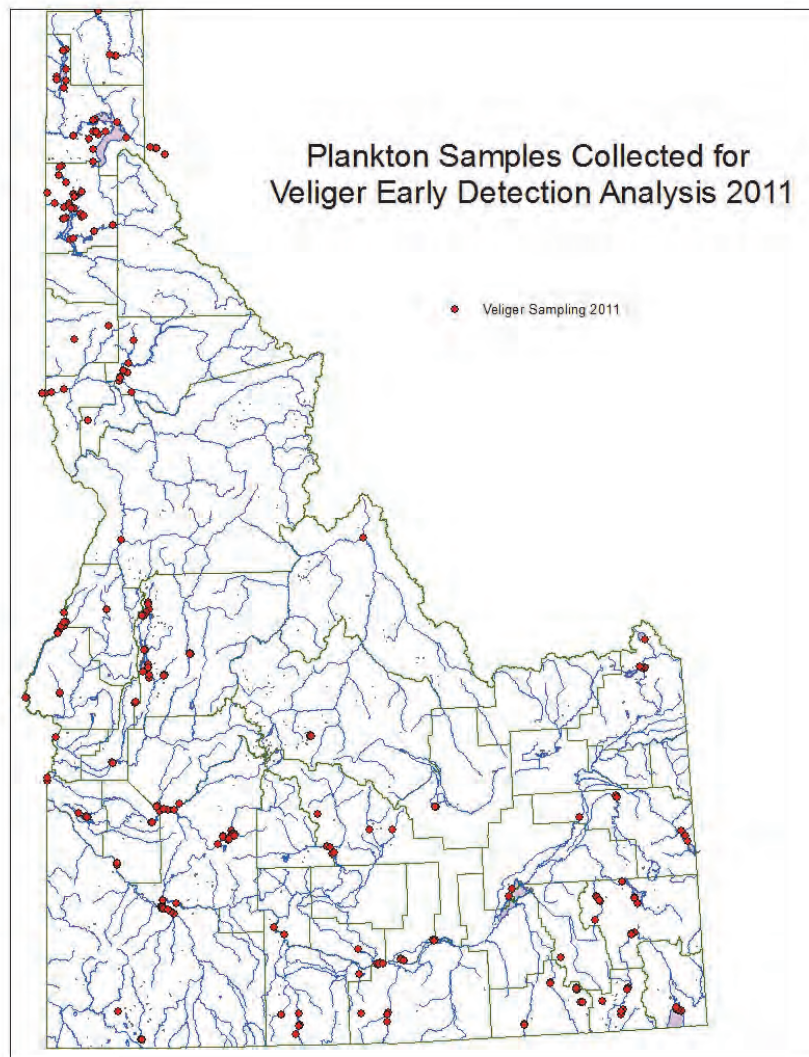


Figure 6. Plankton samples collected for veliger early detection analysis in 2011.

SECTION IX: CASE STUDIES – PAST EXPERIENCE

William Haller, University of Florida Center for Aquatic and Invasive Plants

Zebra and quagga mussel control efforts have been conducted in natural waters in several states in the past. We have compiled information from some of these projects from published reports and personal contacts to determine which molluscicides were used, approximate costs and the results of these treatments.

Millbrook Quarry (near Manassas), Virginia. This privately owned pond is located in Prince William County, Virginia, and is used extensively for scuba diving and training. The first infestation of zebra mussels in the state of Virginia was confirmed in this 12 acre, 93 feet deep quarry in August 2002. An eradication effort was initiated because 54% of freshwater mussel species in Virginia are endangered, threatened or species of special concern, and the spread of zebra mussels from this site would likely cause extirpation of a number of these protected species. Potassium chloride was applied to the quarry in February 2006 under a Section 18 Emergency Use Permit to achieve a potassium concentration of 100 ppm – approximately twice the concentration considered toxic to zebra mussels, but well below levels that would cause environmental or human health concerns. The environmental assessment indicated that there would be no impacts on any species other than mollusks, which appeared to be a correct assessment. In addition, the potassium content of the water in this closed system would remain toxic to zebra mussels for several years. Treatment and subsequent monitoring of the 12-acre site cost approximately \$400,000, or slightly more than \$33,000 per acre. Eradication of zebra mussels from Millbrook Quarry was very successful; see <http://www.dgif.virginia.gov/zebramussels/> for more details.

Offutt Lake (near Omaha), Nebraska. Zebra mussels were found at Offutt Lake in April 2006 and were likely introduced into this 123 acre, 20 feet deep military recreational lake from paddle boats shipped to the site from the northeastern US. Offutt Lake is a large borrow pit used for runway construction at the base and represented the first discovery of dreissenid mussels in Nebraska. The lake is located a few hundred yards from the Missouri River and overflows into the Missouri under high water conditions. Several stakeholder meetings were held in 2007 and 2008, and four products – Spectrus CT1300 (Clamtrol), endothall, potassium and copper sulfate – were considered for eradication efforts. For various reasons, copper sulfate was selected for eradication efforts and a 24(C) Special Local Need label was obtained for the use of medium-size granular copper sulfate. This product was applied to achieve a concentration of 1 ppm elemental copper in the entire water column, which would control veligers and larval stages and provide a temporary higher concentration of the lake bottom to control adult mussels. To ensure eradication, copper sulfate was applied twice (in September 2008 and in April 2009). Copper concentrations in the water immediately after completion of the first application averaged 0.7 ppm. Over the next 30 days, nearly 20 tons

of fish (96% non-game fish – primarily cyprinids such as buffalo, bighead, common and grass carps) were collected from the lake. Total cost for monitoring, planning and treating the 123 acre lake was approximately \$480,000, or around \$4,000 per acre. No live zebra mussels were found following the first treatment until October 2010 (18 months after the second treatment), when five live zebra mussels were found on a tile sampler. It is unlikely that these mussels were the result of a reintroduction, because use of the lake was restricted. It is possible that zebra mussels survived the copper sulfate treatments in ground water seeps believed to occur on the eastern side of the lake when the Missouri River rises. The reasons for the failed eradication attempt remain unknown. For more details on Offutt Lake, see <http://snr.unl.edu/invasives/documents/NebraskaZebraMusselInfestationandEradicationLakeOffutt.pdf>.

Pelican Brook/Lake Ossawinnamakee (near Breezy Point), Minnesota. The Minnesota Department of Natural Resources reports that there are many inland lakes in Minnesota that are infested with zebra mussels. Lake Ossawinnamakee is a 64 acre mesotrophic hard-water flowthrough lake in the Pine River Watershed, which comprises around 150 lakes. The outlet on the southeastern corner of the lake exits into Pelican Brook, which flows into the Pine River and ultimately into the Mississippi River. Zebra mussels were found in the lake in the fall of 2003 and mussel control efforts were undertaken during the summers of 2004 and 2005. Chelated copper (Cutrine Ultra ®) was applied weekly from mid-June through September at concentrations of 0.6 ppm (in 2004) and 0.4 ppm (in 2005) to a 26 acre bay leading into the Pelican River. These treatments coincided with water temperatures that were favorable for mussel reproduction. The objective of these weekly treatments was to kill veligers and larval mussels before they could exit the lake through the bay and travel down Pelican Brook to infest downstream sites. At the time of the initial treatment (June 2004), a few adult mussels were present in Pelican Brook.

By the end of treatments in September 2005, there were no adult zebra mussels in Pelican Brook, which indicated that adult mussels were killed by long-term exposure to copper, and no settling or establishment of veligers in Pelican Brook. In the fall of 2005, adult mussels were found downstream at Rice Lake and the control efforts were stopped. Extensive sampling of benthic invertebrate communities in Pelican Brook suggested that the copper treatments prevented veliger movement downstream from the site. This conclusion was reached because adult mussels in Pelican Brook were killed and no re-establishment was noted during the period when copper treatments took place. Mussels were already present downstream prior to June 2004 and may have already infested Rice Lake, or a separate introduction of mussels to Rice Lake may have occurred. The pesticide in this effort was applied under the “unnamed pest” Section 2(ee) clause of FIFRA. This information was provided by Chip Welling and Gary Mantz of the Minnesota Department of Natural Resources (500 Lafayette Road, St. Paul, MN). See the following publication for more

details: Mantz, GR, JHirsch, R Rezanka and DF Staples. 2010. Impacts of copper on a lotic benthic invertebrate community: response and recovery. *Journal of Freshwater Ecology* 25(4):575-587.

Sister Grove Creek (Collin/Grayson Counties), Texas. The first zebra mussels found in Texas were discovered in Lake Texoma (northeast of Dallas) in April 2009. Lake Texoma, a US Army Corps of Engineers reservoir, is located in the Red River Watershed. Surveys in August 2009 confirmed that zebra mussels were also present downstream of the lake in Sister Grove Creek, which is the headwaters of Lake Lavon. These waterbodies are multi-use reservoirs and serve as potable water supplies. Water flow down the Creek from Lake Texoma has been stopped and a 30 mile section of Sister Grove Creek was treated with potassium chloride at a target concentration of 175 ppm in the fall of 2010. The upper half of the Creek was treated again in the summer of 2011 in an attempt to prevent zebra mussel establishment downstream. Cages of live adult mussels were placed in the Creek and monitored to determine whether treatments were effective. All caged mussels died following the treatments, but a small number of adults in the Creek have survived. The Creek has a number of nooks and crannies; also, water flow is highly variable and dependent on rainfall. There are also several seeps and springs along the Creek in which mussels may have taken refuge or avoided exposure to the potassium chloride treatments. As of the winter of 2011/2012, zebra mussels have only been found in Lake Texoma and in Sister Grove Creek. This information was provided by Brian Van Zee, Texas Parks and Wildlife. For more details, see <http://www.zebramussels.net>.

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INTRODUCTION TO APPENDICES 1 THROUGH 3

There are few molluscicides registered or labeled by the US EPA for use in natural waters, although several are labeled for use in industrial systems (see Table 2). This has forced management personnel to employ the “unnamed pest” provision of FIFRA [Section 2(ee)] to utilize herbicides and algaecides that happen to be toxic to mollusks and are registered for the application site (ponds, lakes, canals, etc.). The following appendices contain labels and information that will provide biologists who are unfamiliar with aquatic pesticides some insight into the 2(ee) process (Appendix 1), 24(c) registrations (Appendix 2) and federal labels (Appendix 3).

APPENDIX 1

Copper Sulfate

Copper sulfate is 25% elemental copper. The concentration of copper cannot exceed 1 ppm (elemental copper) or 4 ppm (copper sulfate) in potable water. Copper sulfate is used for algae control in lakes, reservoirs, ponds and irrigation canals but this particular product is NOT registered for use in rivers. Mollusks can only be treated along the shoreline portions of lakes, ponds and reservoirs, as described under “Fresh Water Snail Control.”

Other copper sulfate products may include labeling for other sites. The label included in this report is provided as an example and is not a recommendation or endorsement for its use in lieu of other copper sulfate products.

Revised 3-22-06 by notification to restore original language to Specific Instructions—control algae in irrigation conveyance systems
1-31-2006 Bordeaux, storage and disposal, Florida septic systems—changes and additions (Bordeaux) are indicated

50 LBS. NET WEIGHT (22.7 KILOS)

COPPER SULFATE CRYSTALS

ACTIVE INGREDIENT	BY WEIGHT
COPPER SULFATE PENTAHYDRATE.....	99.0%
OTHER INGREDIENTS.....	1.0%
TOTAL	100.0%

CAS #7758-99-8
COPPER AS METALLIC NOT LESS THAN 25%

See back panel for specific pesticidal use directions.

Also for non-pesticidal uses of copper sulfate including but not limited to:

- For Non-Pesticidal Manufacturing and Industrial Uses.
- For manufacturing, repackaging, formulation of algaecides and fungicides.
- For use as foot baths to control hoof rot in cattle.
- For use in preparing Bordeaux mixture.
- For use as a trace mineral for mixing in animal feeds at levels in accord with good feeding and feed manufacturing practices.
- For use as a fertilizer trace mineral for plant growth and used in accord with recommended agronomic practices.

(NOTE: For the states of Wisconsin, California, Oregon and Washington fertilizer recommendations and information, refer to back panel.)

When this product is used as a feed or fertilizer ingredient:
Guaranteed Analysis: Copper (Cu) = 25.0% Derived from Copper Sulfate

KEEP OUT OF REACH OF CHILDREN DANGER - PELIGRO

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle.
(If you do not understand the label, find someone to explain it to you in detail.)

FIRST AID	
If on skin or clothing:	Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice.
If inhaled:	Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably by mouth to mouth, if possible. Call a poison control center or doctor for further treatment advice.
If in eyes:	Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue to rinse eye. Call a poison control center or doctor for treatment advice.
If swallowed:	Call poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by the poison control center or doctor. Do not give anything by mouth to an unconscious person.
Notes:	Have the product container or label with you when calling a poison control center or doctor, or going for treatment. In the event of a medical emergency, you may also contact the National Pesticide Information Center at 1-800-858-7378.

CHEM ONE LTD. →

This product manufactured for
CHEM ONE LTD.
HOUSTON, TEXAS 77040-6519
TEL. (713) 896-9966

EPA REG. NO. 56576-1
EPA EST. NO. 52117-MX-001

PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS AND DOMESTIC ANIMALS

DANGER - PELIGRO

CORROSIVE: Causes eye damage and irritation to the skin and mucous membranes. Harmful or fatal if swallowed. Do not get in eyes, on skin or on clothing. Do not breathe dust or spray mist. May cause skin sensitization reactions to certain individuals.

PERSONAL PROTECTIVE EQUIPMENT

Applicators and other handlers must wear: Long-sleeved shirt and long pants, chemical-resistant gloves made of any waterproof material, shoes plus socks, and protective eyewear. Some materials that are chemical-resistant to this product are listed below. If you want more options, follow the instructions for category A on an EPA chemical resistance category selection chart. Discard clothing and other absorbent materials that have been drenched or heavily contaminated with this product's concentrate. Do not reuse them. Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

USER SAFETY RECOMMENDATIONS:

Users should: Wash hands before eating, drinking, chewing gum, using tobacco or using the toilet. Remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing. Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

ENVIRONMENTAL HAZARDS

This product is toxic to fish. Direct application of Copper Sulfate to water may cause a significant reduction in populations of aquatic invertebrates, plants and fish. Do not treat more than one-half of lake or pond at one time in order to avoid depletion of oxygen from decaying vegetation. Allow 1 to 2 weeks between treatments for oxygen levels to recover. Trout and other species of fish may be killed at application rates recommended on this label, especially in soft or acid waters. However, fish toxicity generally decreases when the hardness of water increases. Do not contaminate water by cleaning of equipment or disposal of wastes. Consult your local State Fish and Game Agency before applying this product to public waters. Permits may be required before treating such waters.

STORAGE AND DISPOSAL

PROHIBITIONS: Do not contaminate water, food or feed by storage or disposal. Open burning and dumping is prohibited. Do not re-use empty container.

STORAGE: Keep pesticide in original container. Do not put concentrate or dilutions of concentrate in food or drink containers.

PESTICIDE DISPOSAL: Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

CONTAINER DISPOSAL: Completely empty bag into application equipment. Then dispose of empty bag in a sanitary landfill or by incineration, or if allowed by state and local authorities, by burning. If burned, stay out of smoke. If Plastic Container: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal.

STORAGE: Store in original container and place in a locked storage area.

PESTICIDE DISPOSAL: Call your local solid waste agency (or 1-800-CLEANUP or equivalent organization) for disposal instructions. Unless otherwise instructed, place in the trash. Never pour unused product down the drain or on the ground.

CONTAINER DISPOSAL: Do not reuse this container. Do not rinse unless required for recycling. Place in trash.

DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling.

Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application. For requirements specific to your State or Tribe, consult the agency responsible for pesticide regulations.

AGRICULTURAL USE REQUIREMENTS

Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR part 170. This standard contains requirements for the protection of agricultural workers on farms, forests, nurseries, and greenhouses, and handlers of agricultural pesticides. It contains requirements for training, decontamination, notification, and emergency assistance. It also contains specific instructions and exceptions pertaining to the statements on this label about personal protective equipment (PPE), and restricted-entry interval. The requirements in this box only apply to uses of this product that are covered by the Worker Protection Standard.

Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 24 hours.

PPE required for early entry to treated areas that is permitted under the Worker Protection Standard and that involves contact with anything that has been treated, such as plants, soil, or water, is: Coveralls, chemical-resistant gloves made of any waterproof material (such as polyvinyl chloride, nitrile rubber, or butyl rubber), shoes plus socks, and protective eyewear.

NON-AGRICULTURAL USE REQUIREMENTS

The requirements in this box apply to uses of this product that are NOT within the scope of the Worker Protection Standard for agricultural pesticides (40 CFR Part 170). The WPS applies when this product is used to produce agricultural plants on farms, forests, nurseries, or greenhouses.

Applicators and other handlers who handle this pesticide for any use NOT covered by the Worker Protection Standard (40 CFR Part 170) must wear: long-sleeved shirt, chemical-resistant gloves made of any waterproof material (such as polyvinyl chloride, nitrile rubber, or butyl rubber), shoes plus socks, and protective eyewear.

GENERAL INSTRUCTIONS FOR USE

Water hardness, temperature of the water, the type and amount of vegetation to be controlled, and the amount of water flow are to be considered in using Copper Sulfate to control algae. Begin treatment soon after plant growth has started. If treatment is delayed until a large amount of algae is present, larger quantities of Copper Sulfate will be required. Algal growth is difficult to control with Copper Sulfate when water temperatures are low or when the water conditions are hard water. Larger quantities of Copper Sulfate will be required to kill and control algae in water which is flowing than in a body of stagnant water. If possible, curtail the flow of water before treatment and hold dormant for approximately three days after treatment or until the algae have begun to die. When preparing a Copper Sulfate solution in water, the mixing container should be made of plastic or glass; or, a painted, enameled, or copper lined metal container. It is usually best to treat algae on a sunny day when the heavy mats of filamentous algae are most likely to be floating on the surface where it can be sprayed directly. If there is some doubt about the concentration to apply, it is generally best to start with a lower concentration and to increase this concentration until the algae are killed.

Treatment of algae can result in oxygen loss from decomposition of dead algae. This loss can cause fish suffocation. Therefore, to minimize this hazard, treat one-third to one-half of the water area in a single operation and wait 10 to 14 days in between treatments. Begin treatments along the shore and proceed outward in bands to allow fish to move into untreated water. NOTE: If treated water is to be used as a source of potable water, the metallic copper residual must not exceed 1 ppm (4 ppm copper sulfate pentahydrate).

CALCULATIONS FOR THE AMOUNT OF WATER IMPOUNDED AND FOR THE AMOUNT OF COPPER SULFATE TO BE USED: Calculate water volume as follows: (1) Obtain surface area by measuring of regular shaped ponds or mapping of irregular ponds or by reference to previously recorded engineering data or maps. (2) Calculate average depth by sounding in a regular pattern and taking the mean of these readings or by reference to previously obtained data. (3) Multiply surface area in feet by average depth in feet to obtain cubic feet of water volume. (4) Multiply surface area in acres by average depth in feet to obtain total acre-feet of water volume.

CALCULATE WEIGHT OF WATER TO BE TREATED AS FOLLOWS: (1) Multiply volume in cubic feet by 62.44 to obtain total pounds of water, or (2) Multiply volume in acre feet by 2,720,000 to obtain pounds of water.

CALCULATIONS OF ACTIVE INGREDIENT TO BE ADDED: To calculate the amount of Copper Sulfate Pentahydrate needed to achieve the recommended concentration, multiply the weight of water by the recommended concentration of Copper Sulfate. Since recommended concentrations are normally given in parts per million (ppm), it will first be necessary to convert the value in parts per million to a decimal equivalent. For example, 2 ppm is the same as 0.000002 when used in this calculation. Therefore, to calculate the amount of Copper Sulfate Pentahydrate to treat 1 acre-foot of water with 2 ppm Copper Sulfate, the calculation would be as follows:

$$0.000002 \times 2,720,000 = 5.44 \text{ lbs. Copper Sulfate Pentahydrate}$$

CALCULATION OF WATER FLOW IN DITCHES, STREAMS, AND IRRIGATION SYSTEMS: The amount of water flow in cubic feet per second is found by means of a weir or other measuring device.

SPECIFIC INSTRUCTIONS

SEWER TREATMENT – ROOT DESTROYER*

ROOT CONTROL GENERAL INFORMATION: Plant roots can penetrate through small cracks and poorly sealed joints of sewer lines. If not controlled, these small roots will continue to grow larger in number causing breakage, reduced flow, and eventually, flow stoppage. Copper sulfate has been known to be an effective means to control roots in residential and commercial sewers.

COMMERCIAL, INSTITUTIONAL, AND MUNICIPAL SEWERS:

ROOT CONTROL IN SEWERS: As a preventive measure, apply into each junction or terminal manhole 2 pounds of Copper Sulfate Crystals every 6 to 12 months. At time of reduced flow (some water flow is essential), add copper sulfate. If flow has not completely stopped, but has a reduced flow due to root masses, add Copper Sulfate Crystals in the next manhole above the reduced flow area. For complete stoppage, penetrate the mass with a rod to enable some flow before treatment.

ROOT CONTROL IN STORM DRAINS: Apply when water flow is light. If no water flow, as in dry weather, use a hose to produce a flow. Apply 2 pounds Copper Sulfate Crystals per drain per year. It may be necessary to repeat treatments 3 to 4 times, at 2 week intervals, if drains become nearly plugged.

SEWER PUMPS AND FORCE MAINS: At the storage well inlet, place a cloth bag containing 2 pounds of Copper Sulfate Crystals. Repeat as necessary.

RESIDENTIAL OR HOUSEHOLD SEWER SYSTEMS:

When a reduced water flow is first noticed, and root growth is thought to be the cause, treat with Copper Sulfate Crystals. It is important not to wait until a stoppage occurs because some water flow is necessary to move the Copper Sulfate Crystals to the area of root growth. Usually, within 3 to 4 weeks, after roots have accumulated sufficient copper sulfate, the roots will die and begin to decay and water flow should increase. As the roots regrow, follow-up treatments with copper sulfate will be required. Applications may be made each year in the spring after plant growth begins, during late summer or early fall, or any time a reduced water flow, thought to be caused by root growth, occurs.

Apply 2-6 pounds Copper Sulfate Crystals two times a year to household sewers. Add Copper Sulfate Crystals to sewer line by pouring about ½ pound increments into the toilet bowl nearest the sewer line and flush, repeat this process until recommended dose has been added, or remove cleanout plug and pour entire recommended quantity directly into the sewer line. Replace the plug and flush the toilet several times.

ROOT CONTROL IN SEPTIC TANK AND LEACH LINES AND LEACH LINE PIPES:

SEPTIC TANKS – The majority of the copper sulfate will settle in the septic tank itself and little will pass into the leach lines. To treat leach line pipes, add 2 to 6 pounds of Copper Sulfate Crystals to the distribution box located between the septic tank and the leach lines. To achieve effective root control in the leach lines it is necessary to transfer Copper Sulfate Crystals from the septic tank to the leach lines. A cleanout plug opening may need to be installed if the distribution box does not have an opening leading to the leach lines.

*NOTE: Do not apply Copper Sulfate Crystals through sink or tub drains as it will corrode the metal drains.

*NOTE: Copper sulfate added to an active 300 gallon septic tank at 2, 4 and 6 pounds per treatment will temporarily reduce bacterial action, but it will return to normal approximately 15 days after treatment. Trees and shrubbery growing near a treated line normally are not affected due to only a small portion of their roots being in contact with the copper sulfate. The copper sulfate kills only those roots inside the leach line.

*NOTE: Do not use as a sewer additive where prohibited by State law. State law prohibits the use of this product in sewage systems in the State of Connecticut. Not for sale or use in the California counties of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma for root control in sewers. Not for sale or use in septic systems in the State of Florida.

TO CONTROL ALGAE AND THE POTOMOGETON POND WEEDS, LEAFY AND SAGO, IN IRRIGATION SYSTEMS:

Once the amount of Copper Sulfate required for treating ditches or streams has been calculated, use a continuous application method, selecting proper equipment to supply Copper Sulfate granular crystals as follows:

FOR ALGAE CONTROL – Begin continuous addition application of granular Copper Sulfate when water is first turned into the system and continue throughout the irrigation system, applying 0.1 to 0.2 lbs per cubic ft per second per day.

FOR LEAFY AND SAGO POND WEED CONTROL – Use the same continuous feeder, applying 1.6 to 2.4 pounds Copper Sulfate Pentahydrate per cubic foot per second per day. NOTE: For best control of leafy and sago pond weed, it is essential to begin Copper Sulfate additions when water is first turned into the system or ditch to be treated and to continue throughout the irrigation system. Copper Sulfate becomes less effective as the alkalinity increases. Its effectiveness is significantly reduced when the bicarbonate alkalinity exceeds 150 ppm. Should Copper Sulfate fail to control pond weeds satisfactorily, it may be necessary to treat the ditch with either a suitable approved herbicide or use a mechanical means to remove excess growth. In either case, resume Copper Sulfate addition as soon as possible.

TO CONTROL ALGAE IN IMPOUNDED WATERS, LAKES, PONDS AND RESERVOIRS: There are several methods by which to apply Copper Sulfate to impounded water. Probably the most satisfactory and simplest method is to dissolve the Copper Sulfate crystals in water and to spray this water over the body of water from a boat. A small pump mounted on the boat can easily be used for this purpose. Fine crystals may be broadcast directly on the water surface from a properly equipped boat. A specially equipped air blower can be used to discharge fine crystals at a specific rate over the surface of the water. When using this method, the direction of the wind is an important factor. Do not use this method unless completely familiar with this type of application. Where the situation permits, Copper Sulfate may be applied under the water by dragging burlap bags containing Copper Sulfate. The crystals are placed in burlap bags and dragged through the water by means of a boat. Begin treatment along the shoreline and proceed outward until one-third to one-half of the total area has been treated. Care should be taken that the course of the boat is such as to cause even distribution of the chemical. In large lakes, it is customary for the boat to travel in parallel lines about 20 to 100 feet apart. Continue dragging the burlap bags over the treated area until the minimum dosage is achieved and all crystals have been dissolved. Large or medium size crystals that dissolve slowly should be used with this method.

Copper Sulfate can be applied to impounded waters by injecting a copper sulfate solution in water via a piping system.

CONTROL OF ALGAE AND BACTERIAL ODOR IN SEWAGE LAGOONS AND PITS (Except California):

Application rates may vary depending on amounts of organic matter in effluent stream or retention ponds. Use 2 lbs. of Copper Sulfate Crystals in 60,000 gals. (8,000 cu. ft.) of effluent to yield 1 ppm of dissolved copper. Dosage levels may vary depending upon organic load. Other Organic Sludges: Copper Sulfate Crystal solution must be thoroughly mixed with sludge. Dissolve 2 lbs. in 1-2 gals. of water and apply to each 30,000 gals. of sludge.

Useful formulas for calculating water volume flow rates: Multiply the water volume in cu. ft. times 7.5 to obtain gallons.

Note: 1 C.F.S./Hr. = 27,000 Gals. 1 Acre Foot = 326,000 Gals.

TO CONTROL ALGAE IN IRRIGATION CONVEYANCE SYSTEMS USING THE SLUG APPLICATION METHOD: Make an addition (dump) of Copper Sulfate into the irrigation ditch or lateral at 0.25 to 2.0 lbs. per cubic foot per second of water per treatment. Repeat on approximate 2-week intervals as required. Depending on water hardness, alkalinity and algae concentration, a dump is usually required every 5 to 30 miles. Effectiveness of Copper Sulfate decreases as the bicarbonate alkalinity increases and is significantly reduced when the alkalinity exceeds approximately 150 ppm as CaCO₃.

TO CONTROL ALGAE IN RICE (Domestic and Wild) FIELDS: Application should be made when algae have formed on the soil surface in the flooded field. Applications are most effective when made prior to the algae's leaving the soil surface and rising to the water surface. Apply 10-15 pounds Copper Sulfate Crystals per acre to the water surface as either crystals or dissolve in water and make a surface spray. Apply higher rate in deeper water (6 inches or greater).

TO CONTROL TADPOLE SHRIMP IN RICE FIELDS: Application should be made to the flooded fields any time the pest appears from planting time until the seedlings are well rooted and have emerged through the water. Apply 5-10 pounds Copper Sulfate Crystals per acre. The use rate per acre should be determined by the water depth and flow. Use the lower rate at minimum flow and water depth and the higher rate when water depth and flow are maximum.

STATE	SPECIES	BULLETIN NO.	COUNTY
CALIFORNIA	Solano grass	EPA/ES-85-13	Solano
TENNESSEE	Slackwater Darter	EPA/ES-85-04	Lawrence Wayne Hancock
	Freshwater Mussels	EPA/ES-85-07	Claiborne Hawkins Sullivan
ALABAMA	Slackwater Darter	EPA/ES-85-05	Lauderdale Limestone Madison
VIRGINIA	Freshwater Mussels	EPA/ES-85-06	Grayson Smyth Scott Washington Lee

ENDANGERED SPECIES RESTRICTIONS: It is a violation of Federal Law to use any pesticide in a manner that results in the death of an endangered species or adverse modification of their habitat. The use of this product may pose a hazard to certain Federally designated endangered species known to occur in specific areas within the above counties. *****PLEASE NOTE***** Before using this product in the above counties you must obtain the EPA Bulletin specific to your area. This Bulletin identifies areas within these counties where the use of this pesticide is prohibited, unless specified otherwise. The EPA Bulletin is available from either your County Agricultural Extension Agent, the Endangered Species Specialist in your State Wildlife Agency Headquarters, or the appropriate Regional Office of the U.S. Fish and Wildlife Service. **THIS BULLETIN MUST BE REVIEWED PRIOR TO PESTICIDE USE.**

COPPER SULFATE REQUIRED FOR TREATMENT OF DIFFERENT GENERA OF ALGAE

The genera of algae listed below are commonly found in waters of the United States. Use the lower recommended rate in soft waters (less than 50 ppm methyl orange alkalinity) and the higher concentration in hard waters (above 50 ppm alkalinity). Always consult State Fish and Game Agency before applying this product to municipal waters.

ORGANISM	¼ to ½ ppm*	½ to 1 ppm*	1 to 1½ ppm*	1½ to 2 ppm*
Cyanophyceae (Blue-green)	Anabaena Anacystis Aphanizomenon Gloeotrichia Gomphosphaeria Polycystis Rivularia	Cylindrospermum Oscillatoria Plectonema	Nostoc Phormidium	Calothrix Symploca
Chlorophyceae (Green)	Closterium Hydrodictyon Spirogyra Ulothrix	Botryococcus Cladophora Coelastrum Draparnaldia Enteromorpha Gloeocystis Microspora Tribonema Zygnema	Chlorella Crucigenia Desmidium Golenkinia Oocystis Palmella Pithophora Staurastrum Tetraedron	Ankistrodesmus Chara Nitella Scenedesmus
Diatomaceae (Diatoms)	Asterionella Fragilaria Melosira Navicula	Gomphonema Nitzschia Stephanodiscus Synedra Tabellaria	Achnanthes Cymbella Neidium	
Protozoa (Flagellates)	Dinobryon Synura Uroglena Volvox	Ceratium Cryptomonas Euglena Glenodinium Mallomonas	Chlamydomonas Hawmatococcus Peridinium	Eudorina Pandorina
	* ¼ - ½ ppm = .67 – 1.3 lbs/acre ft.		* 1 – 1½ ppm = 2.6-3.9 lbs/acre ft.	
	* ½ - 1 ppm = 1.3 – 2.6 lbs/acre ft.		* 1½ - 2 ppm = 3.9 – 5.32 lbs/acre ft.	

SCHISTOSOME-INFECTED FRESH WATER SNAILS

For recreational lakes, reservoirs, and ponds, 5.32 -13.3 lbs/acre-ft Copper Sulfate Crystals (i.e., 2-5 ppm copper sulfate), is usually sufficient for treatment of Schistosome-infected fresh water snails. Use surface area in acres multiplied by average depth in feet to determine water volume and application rate. Apply only along shoreline swimming areas and/or to infected snail beds on a calm sunny day when water temp is at least 60°F. Not allowing swimming for at least 12 hrs following treatment is recommended. If this lower dosage is not sufficient, up to 32 ppm copper sulfate, i.e., 87 lbs/acre (= 2 lbs/1000 sq ft) bottom surface area can be applied. Not allowing swimming for 48 hrs is recommended. Using either dosage, a second application may be made if necessary, 10 to 14 days later. DO NOT make more than two applications a season. Broadcast application using boat, aircraft, or hand equipped with power or hand seeder or underwater dispenser. Do not exceed 1 ppm copper (4 ppm Copper Sulfate) in potable water systems. This labeling must be in the possession of the user at the time of pesticide application. **NOTE : In the State of New York** –For use in recreational lakes, reservoirs and ponds ONLY in areas where infected snail beds have been identified. Apply medium grade crystals by hand broadcast method of application only. This product is a restricted use pesticide in New York State. Pesticide applicator certification or a special use permit is required for sale, possession, or use. Each individual treatment must be approved by the Department of Environmental Conservation. Therefore, you must contact the Pesticide Control Specialist at the appropriate regional office of the Department 30 days in advance of the proposed treatment.

FOOT BATHS FOR CATTLE

Foot baths of Copper Sulfate Crystals can be used as an aid in the treatment of hoof rot in cattle. Prior to treatment, a veterinarian should be consulted to confirm presence of hoof rot. Animals may be walked through a foot bath of 2% (add 2 lbs copper sulfate to 11.8 gals water) to 5% (add 5 lbs copper sulfate to 11.4 gals water) aqueous solution with an immersion time of 5 to 20 min twice daily for a period of time as prescribed by a veterinarian. Keep foot baths clean during treatment period. Do not allow cattle to drink from foot baths as copper sulfate is highly toxic. Follow instructions under Storage and Disposal when solutions are discarded at end of treatment period.

Crop	Pounds per Acre					
	Sands		Loams, silts, clays		Organic	
	Bdct ^b	Band	Bdct ^b	Band	Bdct ^b	Band
Lettuce, onion, Spinach	10	2	12	3	13	4
Carrot, cauliflower, celery, alfalfa, clover, corn, oat, radish, sudan grass, wheat	4	1	8	2	12	3
Asparagus, barley, beans, beet, broccoli, mint, pea, potato, rye, soybean	0	0	0	0	0	2

Information received by the Washington State Dept. of Agriculture regarding the components in this product is available on the internet at <http://agr.wa.gov> Information regarding the contents and levels of metals in this product is available at the Oregon Dept of Agriculture internet site: <http://oda.state.or.us/fertilizer>

³Recommendations are for inorganic sources of copper. Copper chelates can also be used at 1/6 of the rates recommended above. Do not apply copper unless a deficiency has been verified by plant analysis. ^bBdct = broadcast

BORDEAUX SPRAY MIXTURE

Understanding Bordeaux Formulations: If the Bordeaux mixture instructions read 10-10-100, the first figure indicates the number of lbs of Copper Sulfate Crystals. The second figure is the lbs of hydrated spray lime and the third figure is the gallons of water to be used. Use as a full coverage spray to point of runoff.

Preparation of Bordeaux Spray Mixture: Fill a tank 1/4 full with water. Then, with agitator running, mix in Copper Sulfate Crystals through a copper, bronze, stainless steel or plastic screen. Add water so the tank is 3/4 full. Mix in the hydrated spray lime through the screen and finish filling the tank with water.

CROP USE RECOMMENDATIONS

Almond, Apricot, Peach, Nectarine: Shot Hole Fungus – Prepare a 10-10-100 Bordeaux and apply as a dormant spray in late fall or early spring.

Almond, Apricot, Cherry, Peach, Nectarine, Plum, Prune: Brown Rot Blossom Blight – Prepare a 10-10-100 Bordeaux and apply when buds begin to swell.

Apple: Fireblight – Mix 5 lbs of Copper Sulfate Crystals in 100 gals of water and spray uniformly to the point of runoff. Apply in dormant only at silver tip stage. After silver tip, severe burn will occur on any exposed green tissue. Do not mix lime to make a Bordeaux spray for this treatment.

Blueberries: Bacterial Canker – Prepare and apply an 8-8-100 Bordeaux mixture in the fall before heavy rains begin and again 4 weeks later.

Bulbs (Easter Lily, Tulip, Gladiolus): Botrytis Blight – Prepare a 10-10-100 Bordeaux mixture and apply as a foliar spray to 1 acre. Apply for thorough coverage beginning at the first sign of disease and repeat as needed to control disease at 3 to 10 day intervals. Use the shorter intervals during periods of frequent rains or when severe disease conditions persist. Avoid spray just before flower cutting season if residues are a problem.

Caneberries: For leaf and cane spot and Pseudomonas blight, prepare and apply an 8-8-100 Bordeaux mixture in the fall before heavy rains begin and again 4 weeks later.

Cherry (Sweet): Dead Bud, Bacterial Canker (Pseudomonas Syringae) – Prepare a 12-12-100 Bordeaux. Apply at leaf fall and again in late winter before buds begin to swell. In wet cool Northwest U.S. winters, a third spray may be needed between above sprays.

Cherry (Sour): Leaf Spot – Prepare a 10-10-100 Bordeaux. Apply as a full coverage spray after petal fall or as recommended by the State Extension Service.

CITRUS

(NOTE: Adding foliar nutritionals to spray mixtures containing Copper Sulfate Crystals or other products and applying to citrus during the post-bloom period when young fruit is present may result in spray burn.)

Bacterial Blast – Prepare a 10-10-100 Bordeaux spray and apply a spray in late October to early November or before fall rains begin. Make a complete coverage spray using 10 to 25 gals per mature tree.

Lemon, Orange, Grapefruit: Phytophthora Brown Rot - Prepare a 3-4.5-100 Bordeaux mixture only where there is no history of copper injury or use a 3-2-6-100 (Zinc Sulfate-Copper Sulfate Crystals-Hydrated Lime-Gallons of water) Bordeaux mixture. Spray 6 gals on skirt of tree 3 to 4 ft high and 2 to 4 gals on trunk and ground under tree. If P. hibernalis is present, use 10 to 25 gals to completely cover each tree. Apply in November or December just before or after first rain. In severe brown rot season, apply second application in January or February.

Lemon, Orange, Grapefruit: Septoria Fruit, Leaf Spot; Central California – Brown Rot, Zinc, Copper Deficiencies – Prepare a 3-2-6-100 Bordeaux mixture (Zinc Sulfate-Copper Sulfate Crystals-Hydrated Lime Gallons of water) and use 10 to 25 gals to completely cover each tree. Apply in October, November or December before or just after first rain.

Grape: Downy Mildew – Prepare and apply a 2-6-100 Bordeaux spray beginning when downy mildew is detected. Repeat as needed to achieve and maintain control. This mixture and its use will exhibit some phytotoxicity on most varieties.

Grape (Dormant): Powdery Mildew – Apply in spring before bud-swell and before any green tissue is present. Use 4 to 8 lbs of Copper Sulfate Crystals per 100 gals of water. Apply in a high volume spray of 300 gals water per acre. Direct spray to thoroughly wet the dormant vine, especially the bark of the trunk, head or cordons.

Olive: Olive Leaf Spot (Peacock spot), Olive Knot – Prepare a 10-10-100 Bordeaux and apply up to 500 gals per acre. Apply in autumn before heavy winter rains to prevent peacock spot. In wet winters, a repeat spray may be needed in mid-winter. In areas with less than 10 inches of annual rainfall, a 5-5-100 Bordeaux applied in up to 500 gals per acre may be used. To help protect against olive knot, apply a 10-10-100 Bordeaux before heavy rains and again in the spring. Injury may occur in areas of less than 10 inches of rainfall.

Peach: Leaf Curl – Prepare a 10-10-100 Bordeaux and apply at leaf fall or as a dormant spray in late fall or early spring before buds begin to swell.

Potatoes: To enhance vine-kill and suppress late blight, apply 10 lbs. per acre in 10 to 100 gals of water (ground equipment) or in 5 to 10 gals (aerial equipment) with Diquat at vine-kill to enhance vine desiccation and suppress late blight. Additional applications can be made with Diquat if needed to within 7 days of harvest. Copper Sulfate Crystals may be applied alone until harvest to suppress late blight. NOTE: This product can be mixed with Diquat for use on potatoes in accordance with the most restrictive of label limitations and precautions. No label dosage rates should be exceeded.

Walnuts: Walnut Blight – Apply 15 lbs with 10 lbs of lime in 100 gals of water. Make application in early pre-bloom before catkin blooms are showing (10-20% pistillate) before or after rain. Use only if Bordeaux mixture has been shown to be non-phytotoxic in your area. If desired, add one-half gal summer oil emulsion per 100 gals of water. NOTE: Addition of summer oil emulsion to pre-bloom and early bloom sprays may result in plant injury.

GENERAL CHEMIGATION INSTRUCTIONS

Apply this product only through one or more of the following types of systems: sprinkler including center pivot, lateral move, end tow, side (wheel) roll, traveler, big gun, solid set, or hand move irrigation system(s). Do not apply this product through any other type of irrigation system. Crop injury, lack of effectiveness, or illegal pesticide residues in the crop can result from nonuniform distribution of treated water. If you have questions about calibration, you should contact State Extension Service specialists, equipment manufacturers or other experts. Do not connect an irrigation system (including greenhouse systems) used for pesticide application to a public water system unless the pesticide label-prescribed safety devices for public water systems are in place. A person knowledgeable of the chemigation system and responsible for its operation or under the supervision of the responsible person, shall shut the system down and make necessary adjustments should the need arise.

Posting of areas to be chemigated is required when 1) any part of a treated area is within 300 feet of sensitive areas such as residential area, labor camps, businesses, day care centers, hospitals, in-patient clinics, nursing homes or any public areas such as schools, parks, playgrounds, or other public facilities not including public roads, or 2) when the chemigated area is open to the public such as golf courses or retail greenhouses. Posting must conform to the following requirements. Treated areas shall be posted with signs at all usual points of entry and along likely routes of approach from the listed sensitive areas. When there are no usual points of entry, signs must be posted in the corners of the treated areas and in any other location affording maximum visibility to sensitive areas. The printed side of the sign should face away from the treated area towards the sensitive area. The signs shall be printed in English. Signs must be posted prior to application and must remain posted until foliage has dried and soil surface water has disappeared. Signs may remain in place indefinitely as long as they are composed of materials to prevent deterioration and maintain legibility for the duration of the posting period. At the top of the sign shall be the words "KEEP OUT", followed by an octagonal stop sign symbol at least 8 inches in diameter containing the word "STOP". Below the symbol shall be the words "PESTICIDES IN IRRIGATION WATER". All words shall consist of letters at least 2 ½ inches tall, and all letters and the symbol shall be a color that sharply contrasts with their immediate background. This sign is in addition to any sign posted to comply with the Worker Protection Standard.

CHEMIGATION SYSTEMS CONNECTED TO PUBLIC WATER SYSTEMS:

Public water system means a system for the provision to the public of piped water for human consumption if such system has at least 15 service connections or regularly serves an average of at least 25 individuals daily at least 60 days out of the year. Chemigation systems connected to public water systems must contain a functional, reduced-pressure zone, backflow preventer (RPZ) or the functional equivalent in the water supply line upstream from the point of pesticide introduction. As an option to the RPZ, the water from the public water system should be discharged into the reservoir tank prior to pesticide introduction. There shall be a complete physical break (air gap) between the flow outlet end of the fill pipe and the top or overflow rim of the reservoir tank of at least twice the inside diameter of the fill pipe. The pesticide injection pipeline must contain a functional, automatic, quick-closing check valve to prevent the flow of fluid back toward the injection pump. The pesticide injection pipeline must contain a functional, normally closed, solenoid-operated valve located on the intake side of the injection pump and connected to the system interlock to prevent fluid from being withdrawn from the supply tank when the irrigation system is either automatically or manually shut down. See Treatment Instructions, below.

SPRINKLER CHEMIGATION:

The system must contain functional interlocking controls to automatically shut off the pesticide injection pump when the water pump motor stops, or in cases where there is no water pump, when the water pressure decreases to the point where pesticide distribution is adversely affected. Systems must use a metering pump, such as a positive displacement

injection pump (e.g., diaphragm pump) effectively designed and constructed of materials that are compatible with pesticides and capable of being fitted with a system interlock. The system must contain a functional check valve, vacuum relief valve, and low pressure drain approximately located on the irrigation pipeline to prevent water source contamination from backflow. The pesticide injection pipeline must contain a functional, automatic, quick-closing check valve to prevent the flow of fluid back toward the injection pump. This pipeline must also contain a functional, normally closed, solenoid-operated valve located on the intake side of the injection pump and connected to the system interlock to prevent fluid from being withdrawn from the supply tank when the irrigation system is either automatically or manually shut down. The system must contain functional interlocking controls to automatically shut off the pesticide injection pump when the water pump motor stops. The irrigation line or water pump must include a functional pressure switch which will stop the water pump motor when the water pressure decreases to the point where pesticide distribution is adversely affected. Systems must use a metering pump, such as a positive displacement injection pump (e.g., diaphragm pump) effectively designed and constructed of materials that are compatible with pesticides and capable of being fitted with a system interlock.

TREATMENT INSTRUCTIONS:

Do not apply when wind speed favors drift beyond the area intended for treatment. When mixing, fill nurse tank half full with water. Add Copper Sulfate Crystals slowly to tank while hydraulic or mechanical agitation is operating and continue filling with water. Stickers, spreaders, insecticides, nutrients, etc. should be added last. If compatibility is in question, use the compatibility jar test before mixing a whole tank. Because of the wide variety of possible combinations which can be encountered, observe all cautions and limitations on the label of all products used in mixtures. Copper Sulfate Crystals should be added through a traveling irrigation system continuously or at the last 30 minutes of solid set or hand moved irrigation systems. Agitation is recommended.

NOTICE: CHEM ONE LTD. warrants that this product in its unopened package conforms to the chemical description on the label. THERE ARE NO OTHER WARRANTIES EXPRESS OR IMPLIED, INCLUDING A WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE. This warranty does not extend to the handling or use of this product contrary to label instructions or under abnormal conditions or under conditions not reasonably foreseeable to seller and buyer assumes all risk of any such use.

CHEM ONE LTD.

8017 Pinemont Drive, Suite 100
HOUSTON, TEXAS 77040-6519
TEL: (713) 896-9966

ENVIRONMENTALLY HAZARDOUS SUBSTANCES
SOLID, N.O.S. (CUPRIC SULFATE) UN3077, RQ

APPENDIX 2

Copper Carbonate Liquid

Note: The following two labels (Captain® and Natrix®) are good examples of 24(c) Special Local Need labels. The Section 3 Federal label is for Captain ® (active ingredient: copper carbonate). Sites where it can be used for algae control include “potable water sources, lakes, rivers, reservoirs, ponds, slow-flowing or quiescent water bodies, crop and non-crop irrigation systems (canals, laterals and ditches), fish, golf course, ornamental, swimming and fire ponds, and fish hatcheries.” Because Captain® can be used at up to 1 ppm for hydrilla control under the 2(ee) provision of FIFRA, the maximum use rate of Captain® to control an unnamed pest (e.g., mussels) is also 1 ppm. However, the registrant applied for a 24(c) label for Natrix® to allow its use at up to 2.5 ppm in non-potable waters. This was approved by the US EPA and the pesticide regulating agency of Idaho for dreissenid mussel control in Idaho.

Captain® and Natrix® are registered trademarks of SePRO Corporation, Carmel, Indiana.

Specimen Label

Captain*

Liquid Copper Algaecide



For control of planktonic and filamentous algae and certain vascular plants in potable water sources, lakes, rivers, reservoirs, and ponds, slow-flowing or quiescent water bodies, crop and non-crop irrigation systems (canals, laterals, and ditches), fish, golf course, ornamental, swimming, and fire ponds, and fish hatcheries.

Active Ingredient

Copper Carbonate†	15.9%
Other Ingredients	84.1%
TOTAL	100.0%

†Metallic copper equivalent, 9.1%.

Keep Out of Reach of Children DANGER / PELIGRO

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand the label, find someone to explain it to you in detail.)

Precautionary Statements

Hazards to Humans and Domestic Animals

DANGER: Corrosive. Causes irreversible eye damage and skin irritation. Due to corrosive nature, may be harmful or fatal if swallowed. Do not get in eyes, on skin, or on clothing. Wear goggles, face shield or safety glasses, protective clothing and rubber gloves when handling. Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals. Wash thoroughly with soap and water after handling. Remove contaminated clothing and wash before reuse.

Environmental Hazards

Fish toxicity is dependent on the hardness of the water. In soft water, trout and other species of fish may be killed at application rates recommended on this label. Do not use in water containing trout or other sensitive species if the carbonate hardness of water is less than 50 ppm. Fish toxicity generally decreases when the hardness of water increases. Consult State Fish and Game

Agency or other responsible Agency before applying this product to public waters. Do not treat more than one-half of lake or pond at one time to avoid depletion of oxygen levels due to decaying vegetation.

Do not apply undiluted solution of this product directly to, or otherwise permit it to come into contact with any desirable plants as injury may result. Wash spray equipment thoroughly before and after each application.

FIRST AID	
If in eyes	<ul style="list-style-type: none"> • Hold eye open and rinse slowly and gently with water for 15 - 20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. • Call a poison control center or doctor for treatment advice.
If on skin or clothing	<ul style="list-style-type: none"> • Take off contaminated clothing. • Rinse skin immediately with plenty of water for 15 - 20 minutes. • Call a poison control center or doctor for treatment advice.
If swallowed	<ul style="list-style-type: none"> • Call a poison control center or doctor immediately for treatment advice. • Have person sip a glass of water if able to swallow. • Do not induce vomiting unless told to do so by a poison control center or doctor. • Do not give anything by mouth to an unconscious person.
If inhaled	<ul style="list-style-type: none"> • Move person to fresh air. • If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible. • Call a poison control center or doctor for further treatment advice.
<p>Have the product container or label with you when calling a poison control center or doctor, or going for treatment. In case of emergency endangering health or the environment involving this product, call INFOTRAC at 1-800-535-5053.</p>	

Note to Physician: Probable mucosal damage may contraindicate the use of gastric lavage.

Refer to inside of label booklet for additional precautionary information and Directions for Use.

Notice: Read the entire label before using. Use only according to label directions. **Before buying or using this product, read "Warranty Disclaimer," "Inherent Risks of Use" and "Limitation of Remedies" inside label booklet.**

For product information, visit our web site at www.sepro.com.

EPA Reg. No. 67690-9
FPL 022808

*Trademark of SePRO Corporation. **SePRO Corporation** 11550 North Meridian Street, Suite 600, Carmel, IN 46032 U.S.A.

Directions for Use

It is a violation of Federal Law to use this product in a manner inconsistent with its label directions.

GENERAL INFORMATION

Captain Aquatic Algaecide is a double chelated copper formulation that is effective in controlling a broad range of algae.

This product has also been proven effective in controlling the rooted aquatic plant, *Hydrilla verticillata*. The ethanolamines in this product prevent the precipitation of copper with carbonates and bicarbonates in the water. The application site is defined by this label as the specific location where Captain is applied. In slow moving and flowing canals and rivers, the application site is defined by this label as the target location for plant control. Use the lower recommended rate in Soft water (less than 50 ppm alkalinity) and the higher concentration in hard water (above 50 ppm alkalinity).

Water Use Restrictions

If treated water is a source of potable water, the residue of copper must not exceed 1 ppm. Waters treated with this product may be used for swimming, fishing, drinking, livestock watering or irrigating turf, ornamental plants or crops immediately after treatment. Always consult your State Fish and Game Agency or other responsible agency before applying this product to public waters.

Surface Spray/Injection Algaecide Application

For effective control, proper chemical concentration should be maintained for a minimum of three hours contact time. The application rates in the chart are based on static or minimal flow situations. Where significant dilution or loss of water from unregulated inflows or outflows occur (raceways) within a three-hour period, chemical may have to be metered in.

Identify the algae growth present as one of the following types: Planktonic (suspended), Filamentous (mat-forming), or Chara/Nitella.

Determine the surface acreage (1 acre = 43,560 sq. ft.) and average depth of infested area. Refer to chart (next column) to determine gallons of this product to apply per surface acre.

Application Rates (Gallons per Surface Acre)

Algae Type or species	Dosage	Rates	Treatment Comments
	PPM Copper	Gallons/acre foot	
Planktonic	0.2	0.6 - 1.5	Apply lower dosage rates on light infestations. Use higher rates on heavy blooms and where algae masses are clumped and accumulated.
Filamentous	0.2 - 0.6	0.6 - 1.8	Apply lower dosage rates on early season, light infestations or treatment of regrowth. Apply higher rates on surface mats and species such as Pithophora, Cladophora, Lyngbya, and Hydrodictyon.
Chara/Nitella	0.4 - 0.8	1.2 - 2.4	Apply lower dosage rates on new infestations or early season growth. Apply higher rates on older, established calcified plants. Apply as close to top of plant growth as possible.

For dense infestations of filamentous algae or where the species of hydrodictyon, cladophora or pithophora are present, use the highest rate in the rate range.

For planktonic (suspended) algae and free-floating filamentous algae mats, application rates should be based on treating only the upper 3 to 4 feet of water where algae is growing. Under conditions of heavy infestation treat only 1/3 to 1/2 of the water body at a time to avoid fish suffocation caused by oxygen depletion from decaying algae. Before applying, dilute the required amount of this product with enough water to ensure even distribution with the type of equipment being used. For most effective results apply under calm and sunny conditions when water temperature is at least 60° F. Break up floating algae mats before spraying or while application is being made. Use hand or power sprayer adjusted to rain-sized droplets. Spray shoreline areas to avoid trapping fish.

Herbicide Application (for Hydrilla Control)

Control of *Hydrilla verticillata* can be obtained from copper concentrations of 0.4 to 1.0 ppm resulting from this product's treatment. Choose the application rate based upon stage and density of *Hydrilla* growth and respective water depth from the chart below.

Application Rates (Gallons per Surface Acre)

Growth Stage/ Relative Density	ppm Copper	Depth in Feet					
		1	2	3	4	5	6
Early Season/ Low Density	0.4	1.2	2.4	3.6	4.8	6.0	7.2
	0.5	1.5	3.0	4.5	6.0	7.5	9.0
	0.6	1.8	3.6	5.4	7.2	9.0	10.8
Midseason/ Moderate Density	0.7	2.1	4.2	6.3	8.4	10.5	12.6
	0.8	2.4	4.8	7.3	9.6	12.0	14.4
Late Season/ High Density	0.9	2.7	5.4	8.1	10.8	13.5	16.2
	1.0	3.0	6.0	9.0	12.0	15.0	18.0

Application rates for depths greater than six feet may be obtained by adding the rates given for the appropriate combination of depths. Application rates must not result in excess of 1.0 ppm copper concentration within treated water.

Diquat Tank-Mix

On waters where enforcement of use restrictions for recreational, domestic and irrigation use are acceptable, the following mixture can be used as an alternative Hydrilla control method.

Tank-mix 3 - 1/3 gallons of this product with 2 gallons of Diquat. Apply mixture at the rate of 5 - 1/3 gallons per surface acre. Dilute with at least 9 parts water and apply as a surface or underwater injection. Observe all cautions and restrictions on the labels of both products used in this mixture.

DRIP SYSTEM APPLICATION

For Use in Potable Water and Irrigation Conveyance Systems

This product should be applied as soon as algae or Hydrilla begins to interfere noticeably with normal delivery of water (clogging of lateral headgates, suction screens, weed screens, and siphon tubes). Delaying treatment could perpetuate the problem causing massing and compacting of plants. Heavy infestations and low flow may cause poor chemical distribution resulting in unsatisfactory control. Under these conditions increasing water flow rate during application may be necessary.

Prior to treatment it is important to accurately determine water flow rates. In the absence of weirs, orifices, or similar devices, which give accurate waterflow measurements, volume of flow may be estimated by the following formula:

$$\text{Average Width (feet) x Average Depth x Velocity*} \\ \text{(feet/second) x 0.9 = Cubic Feet per Second (C.F.S.)}$$

*Velocity is the time it takes a floating object to travel a given distance. Dividing the distance traveled (feet) by the time (seconds) will yield velocity (feet/second). This measurement should be repeated at least three times at the intended application site and then averaged.

After accurately determining the water flow rate in C.F.S. or gallons/minute, find the corresponding drip rate in the chart below.

Water Flow Rate		Chemical Drip Rate		
C.F.S.	Gallon/Minute	Quart/Hour	MI/Minute	Fl. Oz./Minute
1	450	1	16	0.5
2	900	2	32	1.1
3	1350	3	47	1.6
4	1800	4	63	2.1
5	2250	5	79	2.7

Calculate the amount of product needed to maintain the drip rate for a treatment period of 3 or more hours by multiplying quart/hr. x 3; ml / min. by 180; or fl. oz. / min. x 180. Dosage will maintain 1.0 ppm copper concentration in the treated water for the treatment period. Introduction of the chemical should be made in the channel at weirs or other turbulence-creating structures to promote the dispersion of the chemical.

Pour the required amount of this product into a drum or tank equipped with a brass needle valve and constructed to maintain a constant drip rate. Use a stopwatch and appropriate measuring container to set the desired drip rate. Readjust accordingly if the canal flow rate changes during the treatment period. This product can also be applied by using metering pumps that adjust to flow rates in the canal.

Results can vary depending upon species and density of algae and vegetation, desired distance of control and flow rate, and impact of water quality on copper residues and efficacy. Consult an Aquatic Specialist to determine optimal use rate and treatment period under local conditions. Periodic maintenance treatments may be required to maintain seasonal control.

General Treatment Notes

The following suggestions apply to the use of this product as an algaecide or herbicide in all approved use sites. For optimum effectiveness:

- Apply early in the day under calm, sunny conditions when water temperatures are at least 60° F.
- Treat when growth first begins to appear or create a nuisance, if possible.
- Apply in a manner that will ensure even distribution of the chemical within the treatment area.
- Re-treat areas if regrowth begins to appear and seasonal control is desired. Allow one to two weeks between consecutive treatments.
- Allow seven to ten days to observe the effects of treatment (bleaching and breaking apart of plant material).
- Use a high-pressure surface spray application to break up dense floating algal mats.

Notice

Read and follow label directions carefully.

Contents may cause bluing where marcite has been etched.

Permits

Some states may require permits for the application of this product to public waters. Check with your local authorities.

Storage and Disposal

Do not contaminate water, food or feed by storage or disposal.

Storage Instructions: This product should be stored only in the original container and placed in a cool and dry locked storage area. Keep away from other pesticides, fertilizer, food, and feed to prevent cross-contamination. In case of spillage, dilute with water and wash up with water.

Container Disposal: Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide spray mixture, or rinsate is a violation of Federal Law. If these wastes cannot be disposed of by use according to label instructions, contact your local State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

Pesticide Disposal: Do not reuse empty container. Triple rinse. Then offer for recycling, or reconditioning, or puncture and dispose of in a sanitary landfill, or incinerate, or if allowed by state and local authorities, by burning. If burned, stay out of smoke.

Warranty Disclaimer

SePRO Corporation warrants that the product conforms to the chemical description on the label and is reasonably fit for the purposes stated on the label when used in strict accordance with the directions, subject to the inherent risks set forth below. SEPRO CORPORATION MAKES NO OTHER EXPRESS OR IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY OTHER EXPRESS OR IMPLIED WARRANTY.

Inherent Risks of Use

It is impossible to eliminate all risks associated with use of this product. Plant injury, lack of performance, or other unintended consequences may result because of such factors as use of the product contrary to label instructions (including conditions noted on the label, such as unfavorable temperatures, soil conditions, etc.), abnormal conditions (such as excessive rainfall, drought, tornadoes, hurricanes), presence of other materials, the manner of application, or other factors, all of which are beyond the control of SePRO Corporation as the seller. All such risks shall be assumed by the buyer.

Limitation of Remedies

The exclusive remedy for losses or damages resulting from this product (including claims based on contract, negligence, strict liability, or other legal theories) shall be limited to, at SePRO Corporation's election, one of the following:

1. Refund of purchase price paid by buyer or user for product bought, or
2. Replacement of amount of product used.

SePRO Corporation shall not be liable for losses or damages resulting from handling or use of this product unless SePRO Corporation is promptly notified of such losses or damages in writing. In no case shall SePRO Corporation be liable for consequential or incidental damages or losses.

The terms of the *Warranty Disclaimer* above and this Limitation of Remedies can not be varied by any written or verbal statements or agreements. No employee or sales agent of SePRO Corporation or the seller is authorized to vary or exceed the terms of the *Warranty Disclaimer* or *Limitations of Remedies* in any manner.



FIFRA 24(C) SPECIAL LOCAL NEED (SLN) LABEL

SePRO Corporation 11550 N. Meridian St., Suite 600, Carmel, IN 46032 USA

(FOR DISTRIBUTION AND USE ONLY IN THE STATE OF IDAHO)

This SLN label for Natrix expires and must not be used or distributed after December 31, 2016

Natrix*

For Use to Control Invasive/Exotic Aquatic Mussels, Snails, Oysters or Clams

Active Ingredient

Copper Carbonate† 15.9%

Other Ingredients 84.1%

TOTAL 100.0%

†Metallic Copper equivalent = 9.1%

EPA Reg. No. 67690-9

EPA SLN No. ID-110007a

ATTENTION

- It is a violation of Federal law to use this product in a manner inconsistent with its labeling.
- This labeling must be in the possession of the user at the time of application when applying this product to control invasive/exotic aquatic mussels, snails, oysters or clams.
- Read the label affixed to the container before applying. Carefully follow all precautionary statements and applicable use directions except as specified here.

DIRECTIONS FOR USE

Natrix may be applied to control invasive/exotic aquatic mussel, snail, oyster or clam species, such as: zebra mussels (*Dreissena polymorpha*), quagga mussels (*Dreissena rostriformis bugensis*), Asian clams (*Corbicula fluminea*), and island applesnails (*Pomacea insularum*). Apply at a concentration up to 1.0 ppm of copper in areas containing an active potable water intake; and up to 2.5 ppm of copper in non-potable water or in areas containing potable water intakes that can be turned off until copper concentrations are less than 1.0 ppm at the intake.

Rates and exposure times will vary based on the species and life stage of the species being controlled, as well as treatment conditions. Use the lowest rate and frequency of application necessary to control the target invasive/exotic species. For effective control of adult life stages and depending on site conditions, repeat applications may be necessary. For best results in flowing water, maintain an injection rate for a minimum of 24 hours. Do not treat more than one-half of the lake or pond at one time to avoid depletion of oxygen levels.

- In potable water with an active water intake in the treated area, apply Natrix at a rate up to 3 gallons per acre foot in static water or at a rate up to 32 fluid ounces per cubic feet per second (cfs) per hour in flowing water.

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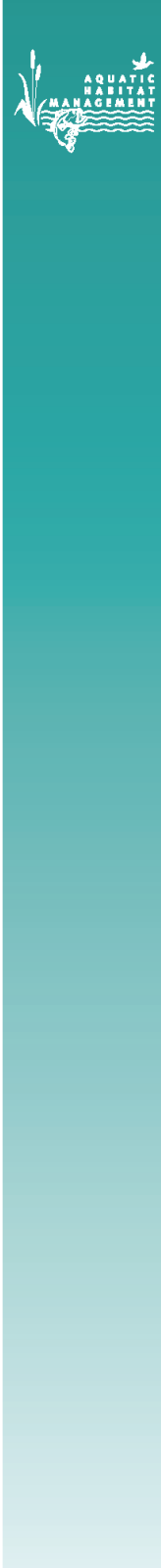
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APPENDIX 3

Endothall

This Appendix contains three Federal Section 3 labels for use of endothall in water. The active ingredient in all of these products is the amine salt of endothall. Hydrothol 191 has been used for over 40 years for aquatic weed control, but was only recently granted unrestricted use in irrigation canals. The registrant has been conducting research on endothall residues in food crops and has received permission from the EPA to add irrigation canals to their labels. The older Hydrothol 191 label prohibited the use of treated water for irrigation for up to 21 days after application. Now, both Teton and Hydrothol 191 have similar labels and approved application sites include irrigation canals. Pesticide labels change over time as new data are submitted to the EPA or as a result of re-registration, etc. The label date is found on the last page of pesticide labels; the label dates for both Hydrothol 191 and Teton are September 15, 2011. The third Federal Section 3 label for endothall in this appendix is for TD2335 Industrial Biocide and Molluscicide, which can only be used in “recirculating and once-through cooling water systems”; clearly, the label for TD2335 precludes its use for mussel control in natural waters such as ponds, lakes and canals.

Hydrothol® 191 and Teton® are registered trademarks of United Phosphorus Incorporated, King of Prussia, Pennsylvania.



HYDROTHOL® 191

AQUATIC ALGICIDE AND HERBICIDE

For algae and aquatic plant control in quiescent, slow moving, and flowing water aquatic sites.

ACTIVE INGREDIENT:

Mono(N,N-dimethylalkylamine) salt of endothall* 53.0%

OTHER INGREDIENTS: 47.0%

TOTAL 100.0%

*7-oxabicyclo [2.2.1] heptane-2,3-dicarboxylic acid equivalent 23.36%

Contains 2 lbs. endothall acid per gallon

**KEEP OUT OF REACH OF CHILDREN
DANGER PELIGRO**

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle.
(If you do not understand the label, find someone to explain it to you in detail.)

FIRST AID

IF IN EYES:

- Hold eye open and rinse slowly and gently with water for 15-20 minutes.
- Remove contact lenses, if present, after the first 5 minutes, then continue rinsing.
- Call a poison control center or doctor for treatment advice.

IF ON SKIN OR CLOTHING:

- Take off contaminated clothing.
- Rinse skin immediately with plenty of water for 15-20 minutes.
- Call a poison control center or doctor for treatment advice.

IF SWALLOWED:

- Call a poison control center or doctor immediately for treatment advice.
- Have person sip a glass of water if able to swallow.
- Do not induce vomiting unless told by a poison control center or doctor.
- Do not give anything by mouth to an unconscious person.

IF INHALED:

- Move person to fresh air.
- If person is not breathing, call 911 or ambulance, then give artificial respiration, preferably mouth-to-mouth if possible.
- Call a poison control center or doctor for treatment advice.

HOT LINE NUMBER: Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact 866-673-6671 (Rocky Mountain Poison Control Center) for emergency medical treatment information.

See inside for additional precautionary statements.

NOTE TO PHYSICIAN: Probable mucosal damage may contraindicate the use of gastric lavage. Measures against circulatory shock, respiratory depression and convulsion may be needed.

EPA Registration No. 70506-175

Batch/Lot No. _____

Net Contents: _____



UPI

United Phosphorus, Inc.
630 Freedom Business Center, Suite 402
King of Prussia, PA 19406
1-800-438-6071

PRODUCT INFORMATION

Hydrothol 191 is a liquid concentrate soluble in water and is a highly effective aquatic algicide and herbicide. Apply when target algae and plants are actively growing. Note: Susceptibility of algae may vary due to subspecies, strains or environmental conditions. Dosage rates are measured in parts per million (ppm) endothall acid.

PRECAUTIONARY STATEMENTS HAZARDS TO HUMANS AND DOMESTIC ANIMALS DANGER

CORROSIVE. CAUSES IRREVERSIBLE EYE DAMAGE AND SKIN BURNS. MAY BE FATAL IF SWALLOWED, OR ABSORBED THROUGH SKIN. HARMFUL IF INHALED. DO NOT GET IN EYES, ON SKIN OR ON CLOTHING. AVOID BREATHING VAPOR OR SPRAY MIST.

Personal Protective Equipment (PPE)

Mixers, loaders, applicators and other handlers must wear:

- Coveralls over long-sleeved shirt and long pants,
Exception: When the product is applied in a manner in which the applicator will have no contact with the pesticide (such as direct metering or subsurface injection), coveralls need not be worn.
- Chemical-resistant footwear plus socks,
- Chemical-resistant gloves made of any waterproof material,
- Chemical-resistant headgear for overhead exposure,
- Protective eyewear,
- Chemical-resistant apron when mixing, loading, or cleaning equipment,
- NIOSH-approved respirator with a dust/mist filter with MSHA/NIOSH approval number prefix TC-21C or any N, R, P, or HE filter.

Exception: During application, the respirator need not be worn, provided that the pesticide is applied in a manner (such as direct metering or subsurface release from the rear of a vessel that is moving into the wind) such that the applicator will have no contact with the pesticide.

See Engineering Controls for additional requirements.

User Safety Requirements:

Follow the manufacturers' instructions for cleaning/maintaining PPE. If no such instructions for washables exist, use detergent and hot water. Keep and wash PPE separately from other laundry.

Discard clothing or other absorbent materials that have been drenched or heavily contaminated with this product's concentrate. Do not reuse them.

Engineering Controls:

When mixers and loaders use a closed system designed by the manufacturer to enclose the pesticide to prevent it from contacting handlers or other people AND the system is functioning properly and is used and maintained in accordance with the manufacturers written operating instructions, the handlers need not wear a respirator, provided the required respirator is immediately available for use in an emergency such as a spill or equipment breakdown.

When handlers use closed systems, enclosed cabs or aircraft in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240(d) (4-6)], the handler PPE requirements may be reduced or modified as specified in the WPS.

User Safety Recommendations

User should:

- Wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet.
- Remove clothing/PPE immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.
- Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

ENVIRONMENTAL HAZARDS

Do not contaminate water by cleaning of equipment or disposal of equipment washwaters.

This pesticide is highly toxic to fish and aquatic invertebrates. This pesticide is toxic to wildlife.

Treatment of algae and aquatic plants can result in oxygen loss from decomposition of dead algae and plants. This loss can cause fish suffocation. Water bodies containing very high algae or plant density should be treated in sections to prevent suffocation of fish.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

Do not apply this product in a way that will contact workers or other persons, either directly or through drift.

- For quiescent or slow moving water treatments: Waters treated with Hydrothol 191 may be used for swimming, fishing, and irrigating turf, ornamental plants and crops immediately after treatment with the following exceptions: Do not use the Hydrothol 191 treated water to irrigate the following for 7 days after the treatment: annual nursery or greenhouse crops including hydroponics and newly seeded or transplanted annual crops, newly seeded or transplanted ornamentals, and newly sodded or seeded turf. Do not use treated water for animal consumption within the following periods:
0.3 ppm – 7 days after application
3.0 ppm – 14 days after application
5.0 ppm – 25 days after application
- For flowing water treatments: Waters treated with Hydrothol 191 may be used for swimming, fishing, livestock watering, and irrigating turf, ornamental plants and crops immediately after treatment with the following exceptions: Do not use the Hydrothol 191 treated water to irrigate the following: annual nursery or greenhouse crops including hydroponics and newly seeded or transplanted annual crops, newly seeded or transplanted ornamentals, and newly sodded or seeded turf.
- Phytotoxicity is not expected on plants or crops irrigated with Hydrothol 191 treated water, however, all species and cultivars (varieties) have not been tested.
- Undiluted Hydrothol 191 may be injurious to crops, grass, ornamentals or other foliage.
- Do not use Hydrothol 191 treated water for chemigation as interactions between Hydrothol 191 and other pesticides and fertilizers are not known.
- Do not use Hydrothol 191 in waters containing Koi or hybrid goldfish. Hydrothol 191 is not intended for use in small volume garden pond systems.
- Fish may be killed by dosages in excess of 0.3 parts per million (ppm).
- Do not use Hydrothol 191 in brackish or saltwater.
- Wash out spray equipment with water after each operation.
- Avoid contact of spray concentrate (product) directly or by drift with non-target plants or crops as injury may result.
- Do not treat more than 10% of the area at one time with doses in excess of 1 ppm.

HOW TO APPLY:

Hydrothol 191 is a contact algicide and herbicide. Apply when target algae and plants are present. Hydrothol 191 should be sprayed on the water or injected below the water surface. It may be applied as a concentrate or diluted with water depending on the equipment. Hydrothol 191 can be applied to floating algae mats as a surface application. In instances where the algae or plant(s) to be controlled is an exposed surface problem (i.e. some of the broad-leaved pond weeds) coverage is important. For best results, apply the concentrate with the least amount of water compatible with the application equipment.

Drinking Water (Potable Water)

Consult with appropriate state or local water authorities before applying this product to public waters. State or local agencies may require permits.

The drinking water (potable water) restrictions on this label are to ensure that consumption of water by the public is allowed only when the concentration of endothall acid in the water is less than the MCL (Maximum Contamination Level) of 0.1 ppm. Applicators should consider the unique characteristics of the treated waters to assure that endothall acid concentrations in potable drinking water do not exceed 0.1 ppm at the time of consumption.

For Lakes, Ponds, and other Quiescent Water Bodies:

- For Hydrothol 191 applications, the drinking water setback distance from functioning potable water intakes in the treated water body must be greater than or equal to 600 feet.
- Note: Existing potable water intakes that are no longer in use, such as those replaced by a connection to a municipal water system or a potable water well, are not considered to be functioning potable water intakes.

For Irrigation Canals and other Flowing Water Bodies:

- Applicator is responsible to assure that treated water does not enter potable water intakes. For Hydrothol 191 applications, potable water intakes must be closed when treated water is present at the intake. In the event the water intake cannot be closed, treatments must only be made downstream from the intake in order to assure Hydrothol 191 treated water does not enter the potable water system.

QUIESCENT OR SLOW MOVING WATER TREATMENTS: SURFACE OR INJECTED APPLICATIONS

Hydrothol 191 use is limited to algae and the following plants: Hygrophila*, Vallisneria, Hydrilla, Cabomba*, Bur Reed*, *Elodea canadensis*, and Brazilian Elodea. (* Not for this use in California.)

ALGAE CONTROL: Hydrothol 191 is effective on a broad range of planktonic, filamentous, and branched algae. Note: Susceptibility of algae may vary due to subspecies, strains or environmental conditions. Generally rates of 0.05 to 0.3 ppm (0.6-3.6 pints per acre foot) are effective for the control of algae. Repeat applications when algae reappear and reach treatment levels. Dosages may be increased (from 0.3 to 3.0 ppm) where greater longevity of control is desired or to improve efficacy on species that prove difficult to control. Due to the potential for fish toxicity at higher rates, it is suggested that applications above 0.3 ppm be made only by commercial applicators as marginal or sectional treatments.

SUBMERGED AQUATIC PLANTS: Apply Hydrothol 191 at 1 to 5 ppm (1.4 gallons to 6.8 gallons per acre foot) for control of aquatic plants. Hydrothol 191 is for use on the following aquatic plants: Hygrophila*, Vallisneria, Hydrilla, Cabomba*, Bur Reed*, *Elodea canadensis*, and Brazilian Elodea. (* Not for this use in California.) Due to potential fish toxicity, Hydrothol 191 use for submerged aquatic plant control is suggested to be made only by commercial applicators as marginal or sectional treatments. Use application rates over 1.0 ppm only on very narrow margins or in areas where some fish kill is not objectionable.

RATE OF APPLICATION:

Algae or Plant	Rate ppm endothall acid	Amount of Hydrothol 191 per Acre Ft.
Algae Planktonic, Filamentous, Branched (Use in California limited to Cladophora, Pithophora, Spirogyra, Chara)	0.05-3.0	0.6-36 pints
Aquatic Plants		
Bur Reed*	2-5	2.7-6.8 gals.
Cabomba*†	2-5	2.7-6.8 gals.
Brazilian Elodea	2-5	2.7-6.8 gals.
Elodea Canadensis	2-5	2.7-6.8 gals.
Hydrilla	1-5	1.4-6.8 gals.
Hygrophila*†	2-5	2.7-6.8 gals.
Vallisneria	2-5	2.7-6.8 gals.

* Not for this use in California

† Suppression only

FLOWING WATER TREATMENTS
(WITH THE EXCEPTION OF IRRIGATION CANALS):
DRIP OR METERING SYSTEMS

For algae and aquatic plant control in flowing water, Hydrothol 191 recommended use rates can be found in the following chart. Apply Hydrothol 191 in a manner to achieve the desired rate and adequate mixing so Hydrothol 191 is distributed throughout the entire water column. Adequate concentration (rate) and exposure time (length of treatment) will impact Hydrothol 191 efficacy on the target algae and plant species. Although Hydrothol 191 is a contact algicide and herbicide, adequate exposure time is critical. The rates and the length of treatment are guidelines to control the target species. The following rate chart has been developed based on Concentration Exposure Time (CET) data for Hydrothol 191. The CET concept allows rates and the length of exposure to be adjusted for different treatment scenarios.

RATE OF APPLICATION:

Target Species	Rate ppm endothall acid	Duration	Restrictions
Algae: Planktonic, Filamentous, Branched (Use in California limited to Cladophora, Pithophora, Spirogyra, Chara)	0.05 – 3.0	6 – 120 hours	A maximum of 30 ppm per growing season, not to exceed 5 ppm per application.
Plants: Bur Reed* Cabomba*† Coontail Elodea Canadensis Hydrilla Hygrophila*† Milfoil (Myriophyllum spp.) Naiad (Najas spp.) Pondweed (Potamogeton spp.) Water Stargrass* Vallisneria Zannichellia	0.2 – 5	6 – 120 hours	Do not apply more than a total of 5 ppm within a 7-day interval. There is no Pre-harvest Interval (PHI) for crops irrigated with treated water.

* Not for this use in California

† Suppression only

To calculate the amount of Hydrothol 191 required for a particular treatment use the following formula:

$$[\text{Cubic Feet per Second (CFS)} \times \text{Length of Treatment (hrs.)} \times \text{Rate (ppm)}] \times 0.11196 = \text{Gallons of Hydrothol 191 Needed for Treatment}$$

To calculate the amount of Hydrothol 191 to be applied per hour use the following formula:

$$\text{Gallons of Hydrothol 191 per hour} = \frac{\text{Total Gallons of Hydrothol 191}}{\text{Length of Treatment (hrs.)}}$$

STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage and disposal.

Pesticide Storage: Store in the original container. Do not store in a manner where cross-contamination with other pesticides, fertilizers, food or feed could occur. In the event of a spill during handling or storage, absorb with sand or other inert material and dispose of absorbent in accordance with the Pesticide Disposal instructions listed below.

Pesticide Disposal: Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

Container Handling:

(for Nonrefillable containers)

Nonrefillable container. Do not reuse or refill this container.

Triple rinse or pressure rinse container promptly after emptying.

For containers 5 gallons or less:

Triple rinse as follows: Empty the remaining contents into application equipment or a mix tank and drain for 10 seconds after the flow begins to drip. Fill the container 1/4 full with water and recap. Shake for 10 seconds. Pour rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Drain for 10 seconds after the flow begins to drip. Repeat this procedure two more times.

Or

Pressure rinse as follows: Empty the remaining contents into application equipment or a mix tank and continue to drain for 10 seconds after the flow begins to drip. Hold container upside down over application equipment or mix tank or collect rinsate for later use or disposal. Insert pressure rinsing nozzle in the side of the container, and rinse at about 40 PSI for at least 30 seconds. Drain for 10 seconds after the flow begins to drip.

For containers more than 5 gallons:

Triple rinse as follows: Empty the remaining contents into application equipment or a mix tank. Fill the container 1/4 full with water. Replace and tighten closures. Tip container on its side and roll it back and forth, ensuring at least one complete revolution, for 30 seconds. Stand container on its end and tip it back and forth several times. Turn the container over onto its other end and tip it back and forth several times. Empty the rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Repeat this procedure two more times.

Or

Pressure rinse as follows: Empty the remaining contents into application equipment or a mix tank. Insert pressure rinsing nozzle in the side of the container, and rinse at about 40 PSI for at least 30 seconds. Pour or pump rinsate into application equipment or rinsate collection system. Drain for 10 seconds after the flow begins to drip.

Then offer for recycling if available or puncture and dispose of in a sanitary landfill, or by incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

(for Refillable containers)

Refillable container. Refill this container with pesticide only.

Do not use this container for any other purpose. Cleaning the container before final disposal is the responsibility of the person disposing of the container. Cleaning before refilling is the responsibility of the refiller. To clean the container before final disposal empty the remaining contents from this container into application equipment or mix tank. Fill the container about 10 percent full with water. Agitate vigorously or recirculate water with the pump for 2 minutes. Pour or pump rinsate into application equipment or rinsate collection system. Repeat this rinsing procedure two more times. Then offer for recycling if available or reconditioning if appropriate or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities.

EMERGENCY TELEPHONE NUMBERS

CHEMTREC: (800) 424-9300

MEDICAL: (866) 673-6671

Rocky Mountain Poison Control Center

IMPORTANT INFORMATION

READ BEFORE USING PRODUCT

CONDITIONS OF SALE AND LIMITATION OF WARRANTY AND LIABILITY

NOTICE: Read the entire Directions for Use and Conditions of Sale and Limitation of Warranty and Liability before buying or using this product. If the terms are not acceptable, return the product at once, unopened, and the purchase price will be refunded.

The Directions for Use of this product reflect the opinion of experts based on field use and tests, and must be followed carefully. It is impossible to eliminate all risks associated with the use of this product. Crop injury, ineffectiveness or other unintended consequences may result because of such factors as manner of use or application, weather or crop conditions, presence of other materials or other influencing factors in the use of the product, which are beyond the control of United Phosphorus, Inc. or Seller. Handling, storage, and use of the product by Buyer or User are beyond the control of United Phosphorus, Inc. and Seller. All such risks shall be assumed by Buyer and User, and Buyer and User agree to hold United Phosphorus, Inc. and Seller harmless for any claims relating to such factors.

TO THE EXTENT CONSISTENT WITH APPLICABLE LAW, UNITED PHOSPHORUS, INC. AND SELLER MAKE NO WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE NOR ANY OTHER EXPRESS OR IMPLIED WARRANTY EXCEPT AS STATED ON THIS LABEL.

To the extent consistent with applicable law, United Phosphorus, Inc. or Seller shall not be liable for any incidental, consequential or special damages resulting from the use or handling of this product and **THE EXCLUSIVE REMEDY OF THE USER OR BUYER, AND THE EXCLUSIVE LIABILITY OF UNITED PHOSPHORUS, INC. AND SELLER FOR ANY AND ALL CLAIMS, LOSSES, INJURIES OR DAMAGES (INCLUDING CLAIMS BASED ON BREACH OF WARRANTY, CONTRACT, NEGLIGENCE, TORT, STRICT LIABILITY OR OTHERWISE) RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT, SHALL BE THE RETURN OF THE PURCHASE PRICE OF THE PRODUCT OR, AT THE ELECTION OF UNITED PHOSPHORUS, INC. OR SELLER, THE REPLACEMENT OF THE PRODUCT.**

United Phosphorus, Inc. and Seller offer this product, and Buyer and User accept it, subject to the foregoing conditions of sale and limitations of warranty and of liability, which may not be modified except by written agreement signed by the duly authorized representative of United Phosphorus, Inc.

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Rev. 9/15/11

70506-175(092011-4046)



AQUATIC ALGICIDE AND HERBICIDE

For algae and aquatic plant control in irrigation systems and other flowing water aquatic sites and quiescent or slow moving waters.

ACTIVE INGREDIENT:

Mono(N,N-dimethylalkylamine) salt of endothall* 53.0%

OTHER INGREDIENTS: 47.0%

TOTAL 100.0%

*7-oxabicyclo [2.2.1] heptane-2,3-dicarboxylic acid equivalent 23.36%

Contains 2 lbs. endothall acid per gallon

KEEP OUT OF REACH OF CHILDREN DANGER PELIGRO

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle.
(If you do not understand the label, find someone to explain it to you in detail.)

FIRST AID

IF IN EYES:

- Hold eye open and rinse slowly and gently with water for 15-20 minutes.
- Remove contact lenses, if present, after the first 5 minutes, then continue rinsing.
- Call a poison control center or doctor for treatment advice.

IF ON SKIN OR CLOTHING:

- Take off contaminated clothing.
- Rinse skin immediately with plenty of water for 15-20 minutes.
- Call a poison control center or doctor for treatment advice.

IF SWALLOWED:

- Call a poison control center or doctor immediately for treatment advice.
- Have person sip a glass of water if able to swallow.
- Do not induce vomiting unless told by a poison control center or doctor.
- Do not give anything by mouth to an unconscious person.

IF INHALED:

- Move person to fresh air.
- If person is not breathing, call 911 or ambulance, then give artificial respiration, preferably mouth-to-mouth if possible.
- Call a poison control center or doctor for treatment advice.

HOT LINE NUMBER: Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact 866-673-6671 (Rocky Mountain Poison Control Center) for emergency medical treatment information. See inside for additional precautionary statements.

NOTE TO PHYSICIAN: Probable mucosal damage may contraindicate the use of gastric lavage. Measures against circulatory shock, respiratory depression and convulsion may be needed.

EPA Registration No. 70506-175

Batch/Lot No.: _____

Net Contents: _____



United Phosphorus, Inc.

630 Freedom Business Center, Suite 402

King of Prussia, PA 19406

1-800-438-6071

PRODUCT INFORMATION

Teton is a liquid concentrate soluble in water and is a highly effective aquatic algicide and herbicide. Apply when target algae and plants are actively growing. Note: Susceptibility of algae may vary due to subspecies, strains or environmental conditions. Dosage rates are measured in parts per million (ppm) endothall acid.

PRECAUTIONARY STATEMENTS HAZARDS TO HUMANS AND DOMESTIC ANIMALS DANGER

CORROSIVE. CAUSES IRREVERSIBLE EYE DAMAGE AND SKIN BURNS. MAY BE FATAL IF SWALLOWED, OR ABSORBED THROUGH SKIN. HARMFUL IF INHALED. DO NOT GET IN EYES, ON SKIN OR ON CLOTHING. AVOID BREATHING VAPOR OR SPRAY MIST.

Personal Protective Equipment (PPE)

Mixers, loaders, applicators and other handlers must wear:

- Coveralls over long-sleeved shirt and long pants,
Exception: When the product is applied in a manner in which the applicator will have no contact with the pesticide (such as direct metering or subsurface injection), coveralls need not be worn.
- Chemical-resistant footwear plus socks,
- Chemical-resistant gloves made of any waterproof material,
- Chemical-resistant headgear for overhead exposure,
- Protective eyewear,
- Chemical-resistant apron when mixing, loading, or cleaning equipment,
- NIOSH-approved respirator with a dust/mist filter with MSHA/NIOSH approval number prefix TC-21C or any N, R, P, or HE filter.

Exception: During application, the respirator need not be worn, provided that the pesticide is applied in a manner (such as direct metering or subsurface release from the rear of a vessel that is moving into the wind) such that the applicator will have no contact with the pesticide.

See Engineering Controls for additional requirements.

User Safety Requirements:

Follow the manufacturers' instructions for cleaning/maintaining PPE. If no such instructions for washables exist, use detergent and hot water. Keep and wash PPE separately from other laundry.

Discard clothing or other absorbent materials that have been drenched or heavily contaminated with this product's concentrate. Do not reuse them.

Engineering Controls:

When mixers and loaders use a closed system designed by the manufacturer to enclose the pesticide to prevent it from contacting handlers or other people AND the system is functioning properly and is used and maintained in accordance with the manufacturers written operating instructions, the handlers need not wear a respirator, provided the required respirator is immediately available for use in an emergency such as a spill or equipment breakdown.

When handlers use closed systems, enclosed cabs or aircraft in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240(d) (4-6)], the handler PPE requirements may be reduced or modified as specified in the WPS.

User Safety Recommendations:

User should:

- Wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet.
- Remove clothing/PPE immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.
- Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

ENVIRONMENTAL HAZARDS

Do not contaminate water by cleaning of equipment or disposal of equipment washwaters.

This pesticide is highly toxic to fish and aquatic invertebrates. This pesticide is toxic to wildlife.

Treatment of algae and aquatic plants can result in oxygen loss from decomposition of dead algae and plants. This loss can cause fish suffocation. Water bodies containing very high algae or plant density should be treated in sections to prevent suffocation of fish.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

Do not apply this product in a way that will contact workers or other persons, either directly or through drift.

- For quiescent or slow moving water treatments: Waters treated with Teton may be used for swimming, fishing, and irrigating turf, ornamental plants and crops immediately after treatment with the following exceptions: Do not use the Teton treated water to irrigate the following for 7 days after the treatment: annual nursery or greenhouse crops including hydroponics and newly seeded or transplanted annual crops, newly seeded or transplanted ornamentals, and newly sodded or seeded turf. Do not use treated water for animal consumption within the following periods:
0.3 ppm – 7 days after application
3.0 ppm – 14 days after application
5.0 ppm – 25 days after application
- For flowing water treatments: Waters treated with Teton may be used for swimming, fishing, livestock watering, and irrigating turf, ornamental plants and crops immediately after treatment with the following exceptions: Do not use the Teton treated water to irrigate the following: annual nursery or greenhouse crops including hydroponics and newly seeded or transplanted annual crops, newly seeded or transplanted ornamentals, and newly sodded or seeded turf.
- Phytotoxicity is not expected on plants or crops irrigated with Teton treated water, however, all species and cultivars (varieties) have not been tested.
- Undiluted Teton may be injurious to crops, grass, ornamentals or other foliage.
- Do not use Teton treated water for chemigation as interactions between Teton and other pesticides and fertilizers are not known.
- Do not use Teton in waters containing Koi or hybrid goldfish. Teton is not intended for use in small volume garden pond systems.
- Fish may be killed by dosages in excess of 0.3 parts per million (ppm).
- Do not use Teton in brackish or saltwater.
- Wash out spray equipment with water after each operation.
- Avoid contact of spray concentrate (product) directly or by drift with non-target plants or crops as injury may result.
- Do not treat more than 10% of the area at one time with doses in excess of 1 ppm.

HOW TO APPLY:

Teton is a contact algicide and herbicide. Apply when target algae and plants are present. Teton should be sprayed on the water or injected below the water surface. It may be applied as a concentrate or diluted with water depending on the equipment. Teton can be applied to floating algae mats as a surface application. In instances where the algae or plant(s) to be controlled is an exposed surface problem (i.e. some of the broad-leaved pond weeds) coverage is important. For best results, apply the concentrate with the least amount of water compatible with the application equipment.

Drinking Water (Potable Water)

Consult with appropriate state or local water authorities before applying this product to public waters. State or local agencies may require permits.

The drinking water (potable water) restrictions on this label are to ensure that consumption of water by the public is allowed only when the concentration of endothall acid in the water is less than the MCL (Maximum Contamination Level) of 0.1 ppm. Applicators should consider the unique characteristics of the treated waters to assure that endothall acid concentrations in potable drinking water do not exceed 0.1 ppm at the time of consumption.

For Lakes, Ponds, and other Quiescent Water Bodies:

- For Teton applications, the drinking water setback distance from functioning potable water intakes in the treated water body must be greater than or equal to 600 feet.
- Note: Existing potable water intakes that are no longer in use, such as those replaced by a connection to a municipal water system or a potable water well, are not considered to be functioning potable water intakes.

For Irrigation Canals and other Flowing Water Bodies:

- Applicator is responsible to assure that treated water does not enter potable water intakes. For Teton applications, potable water intakes must be closed when treated water is present at the intake. In the event the water intake cannot be closed, treatments must only be made downstream from the intake in order to assure Teton treated water does not enter the potable water system.

QUIESCENT OR SLOW MOVING

WATER TREATMENTS:

SURFACE OR INJECTED APPLICATIONS

Teton use is limited to algae and the following plants: Hygrophila*, Vallisneria, Hydrilla, Cabomba*, Bur Reed*, *Elodea canadensis*, and Brazilian Elodea. (* Not for this use in California.)

ALGAE CONTROL: Teton is effective on a broad range of planktonic, filamentous, and branched algae. Note: Susceptibility of algae may vary due to subspecies, strains or environmental conditions. Generally rates of 0.05 to 0.3 ppm (0.6-3.6 pints per acre foot) are effective for the control of algae. Repeat applications when algae reappear and reach treatment levels. Dosages may be increased (from 0.3 to 3.0 ppm) where greater longevity of control is desired or to improve efficacy on species that prove difficult to control. Due to the potential for fish toxicity at higher rates, it is suggested that applications above 0.3 ppm be made only by commercial applicators as marginal or sectional treatments.

SUBMERGED AQUATIC PLANTS: Apply Teton at 1 to 5 ppm (1.4 gallons to 6.8 gallons per acre foot) for control of aquatic plants. Teton is for use on the following aquatic plants: Hygrophila*, Vallisneria, Hydrilla, Cabomba*, Bur Reed*, *Elodea canadensis*, and Brazilian Elodea. (* Not for this use in California.) Due to potential fish toxicity, Teton use for submerged aquatic plant control is suggested to be made only by commercial applicators as marginal or sectional treatments. Use application rates over 1.0 ppm only on very narrow margins or in areas where some fish kill is not objectionable.

RATE OF APPLICATION:

Algae or Plant	Rate ppm endothall acid	Amount of Teton per Acre Ft.
Algae Planktonic, Filamentous, Branched (Use in California limited to Cladophora, Pithophora, Spirogyra, Chara)	0.05-3.0	0.6-36 pints
Bur Reed*	2-5	2.7-6.8 gals.
Cabomba*†	2-5	2.7-6.8 gals.
Brazilian Elodea	2-5	2.7-6.8 gals.
Elodea Canadensis	2-5	2.7-6.8 gals.
Hydrilla	1-5	1.4-6.8 gals.
Hygrophila*†	2-5	2.7-6.8 gals.
Vallisneria	2-5	2.7-6.8 gals.

* Not for this use in California

† Suppression only

**FLOWING WATER TREATMENTS:
DRIP OR METERING SYSTEMS**

For algae and aquatic plant control in flowing water, Teton recommended use rates can be found in the following chart. Apply Teton in a manner to achieve the desired rate and adequate mixing so Teton is distributed throughout the entire water column. Adequate concentration (rate) and exposure time (length of treatment) will impact Teton efficacy on the target algae and plant species. Although Teton is a contact algicide and herbicide, adequate exposure time is critical. The rates and the length of treatment are guidelines to control the target species. The following rate chart has been developed based on Concentration Exposure Time (CET) data for Teton. The CET concept allows rates and the length of exposure to be adjusted for different treatment scenarios.

For irrigation systems, because of potential fish toxicity, rates of more than 0.3 ppm are to be used only in irrigation systems without return flows, or for making partial treatments to treat sections of the irrigation system where dilution of the treated water will result in concentrations of 0.3 ppm or less in return water.

RATE OF APPLICATION:

Target Species	Rate ppm endothall acid	Duration	Restrictions
Algae: Planktonic, Filamentous, Branched (Use in California limited to Cladophora, Pithophora, Spirogyra, Chara)	0.05 – 3.0 ppm	6 – 120 hours	A maximum of 30 ppm per growing season, not to exceed 5 ppm per application.
Plants: Bur Reed* Cabomba*† Coontail Elodea Canadensis Hydrilla Hygrophila*† Milfoil (Myriophyllum spp.) Naiad (Najas spp.) Pondweed (Potamogeton spp.) Water Stargrass* Vallisneria Zannichellia	0.2 – 5 ppm	6 – 120 hours	Do not apply more than a total of 5 ppm within a 7-day interval. There is no Pre-harvest Interval (PHI) for crops irrigated with treated water.

* Not for this use in California

† Suppression only

To calculate the amount of Teton required for a particular treatment use the following formula:

$$\text{[Cubic Feet per Second (CFS) X Length of Treatment (hrs.) X Rate (ppm)] x 0.11198 = Gallons of Teton Needed for Treatment}$$

To calculate the amount of Teton to be applied per hour use the following formula:

$$\text{Gallons of Teton per hour} = \text{Total Gallons of Teton} / \text{Length of Treatment (hrs.)}$$

STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage and disposal.

Pesticide Storage: Store in the original container. Do not store in a manner where cross-contamination with other pesticides, fertilizers, food or feed could occur. In the event of a spill during handling or storage, absorb with sand or other inert material and dispose of absorbent in accordance with the Pesticide Disposal instructions listed below.

Pesticide Disposal: Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

Container Handling:

(for Nonrefillable containers)

Nonrefillable container. Do not reuse or refill this container. Triple rinse or pressure rinse container promptly after emptying.

For containers 5 gallons or less:

Triple rinse as follows: Empty the remaining contents into application equipment or a mix tank and drain for 10 seconds after the flow begins to drip. Fill the container 1/4 full with water and recap. Shake for 10 seconds. Pour rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Drain for 10 seconds after the flow begins to drip. Repeat this procedure two more times.

Or

Pressure rinse as follows: Empty the remaining contents into application equipment or a mix tank and continue to drain for 10 seconds after the flow begins to drip. Hold container upside down over application equipment or mix tank or collect rinsate for later use or disposal. Insert pressure rinsing nozzle in the side of the container, and rinse at about 40 PSI for at least 30 seconds. Drain for 10 seconds after the flow begins to drip.

For containers more than 5 gallons:

Triple rinse as follows: Empty the remaining contents into application equipment or a mix tank. Fill the container 1/4 full with water. Replace and tighten closures. Tip container on its side and roll it back and forth, ensuring at least one complete revolution, for 30 seconds. Stand container on its end and tip it back and forth several times. Turn the container over onto its other end and tip it back and forth several times. Empty the rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Repeat this procedure two more times.

Or

Pressure rinse as follows: Empty the remaining contents into application equipment or a mix tank. Insert pressure rinsing nozzle in the side of the container, and rinse at about 40 PSI for at least 30 seconds. Pour or pump rinsate into application equipment or rinsate collection system. Drain for 10 seconds after the flow begins to drip.

Then offer for recycling if available or puncture and dispose of in a sanitary landfill, or by incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

(for Refillable containers)

Refillable container. Refill this container with pesticide only. Do not use this container for any other purpose. Cleaning the container before final disposal is the responsibility of the person disposing of the container. Cleaning before refilling is the responsibility of the refiller. To clean the container before final disposal empty the remaining contents from this container into application equipment or mix tank. Fill the container about 10 percent full with water. Agitate vigorously or recirculate water with the pump for 2 minutes. Pour or pump rinsate into application equipment or rinsate collection system. Repeat this rinsing procedure two more times. Then offer for recycling if available or reconditioning if appropriate or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities.

EMERGENCY TELEPHONE NUMBERS

CHEMTREC: (800) 424-9300

MEDICAL: (866) 673-6671

Rocky Mountain Poison Control Center

IMPORTANT INFORMATION

READ BEFORE USING PRODUCT

CONDITIONS OF SALE AND LIMITATION OF WARRANTY AND LIABILITY

NOTICE: Read the entire Directions for Use and Conditions of Sale and Limitation of Warranty and Liability before buying or using this product. If the terms are not acceptable, return the product at once, unopened, and the purchase price will be refunded.

The Directions for Use of this product reflect the opinion of experts based on field use and tests, and must be followed carefully. It is impossible to eliminate all risks associated with the use of this product. Crop injury, ineffectiveness or other unintended consequences may result because of such factors as manner of use or application, weather or crop conditions, presence of other materials or other influencing factors in the use of the product, which are beyond the control of United Phosphorus, Inc. or Seller. Handling, storage, and use of the product by Buyer or User are beyond the control of United Phosphorus, Inc. and Seller. All such risks shall be assumed by Buyer and User, and Buyer and User agree to hold United Phosphorus, Inc. and Seller harmless for any claims relating to such factors.

TO THE EXTENT CONSISTENT WITH APPLICABLE LAW, UNITED PHOSPHORUS, INC. AND SELLER MAKE NO WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE NOR ANY OTHER EXPRESS OR IMPLIED WARRANTY EXCEPT AS STATED ON THIS LABEL.

To the extent consistent with applicable law, United Phosphorus, Inc. or Seller shall not be liable for any incidental, consequential or special damages resulting from the use or handling of this product and **THE EXCLUSIVE REMEDY OF THE USER OR BUYER, AND THE EXCLUSIVE LIABILITY OF UNITED PHOSPHORUS, INC. AND SELLER FOR ANY AND ALL CLAIMS, LOSSES, INJURIES OR DAMAGES (INCLUDING CLAIMS BASED ON BREACH OF WARRANTY, CONTRACT, NEGLIGENCE, TORT, STRICT LIABILITY OR OTHERWISE) RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT, SHALL BE THE RETURN OF THE PURCHASE PRICE OF THE PRODUCT OR, AT THE ELECTION OF UNITED PHOSPHORUS, INC. OR SELLER, THE REPLACEMENT OF THE PRODUCT.**

United Phosphorus, Inc. and Seller offer this product, and Buyer and User accept it, subject to the foregoing conditions of sale and limitations of warranty and of liability, which may not be modified except by written agreement signed by the duly authorized representative of United Phosphorus, Inc.

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Rev. 9/15/11

70506-175(092011-4050)

TD2335 Industrial Biocide-Molluscicide

ACTIVE INGREDIENT:

Mono(N,N-dimethylalkylamine**) salt of endothall* 53.0%

OTHER INGREDIENTS: 47.0%

TOTAL: 100.0%

Contains 2 lb. Technical endothall* per gallon

*7-oxabicyclo [2.2.1] heptane-2,3-dicarboxylic acid equivalent 23.36%

** Alkyl as in fatty acids of coconut oil

KEEP OUT OF REACH OF CHILDREN DANGER

FIRST AID

IF IN EYES:

- Hold eye open and rinse slowly and gently with water for 15-20 minutes.
- Remove contact lenses, if present, after the first 5 minutes, then continue rinsing.
- Call a poison control center or doctor for treatment advice.

IF ON SKIN:

- Take off contaminated clothing.
- Rinse skin immediately with plenty of water for 15-20 minutes.
- Call a poison control center or doctor for treatment advice.

IF INHALED:

- Move person to fresh air. If person is not breathing, call 911 or ambulance, then give artificial respiration, preferably mouth-to-mouth if possible.
- Call a poison control center or doctor for treatment advice.

IF SWALLOWED:

- Call a poison control center or doctor immediately for treatment advice.
- Have person sip a glass of water if able to swallow. Do not induce vomiting unless told by a poison control center or doctor.

NOTE TO PHYSICIAN: Probable mucosal damage may contraindicate the use of gastric lavage. Measures against circulatory shock, respiratory depression and convulsion may be needed.

EPA Registration No. 70506-189

EPA Establishment No. 62171-MS-003

Net Contents 30 Gallons/113.5 Liters

United Phosphorus, Inc.
630 Freedom Business Center, Suite 402
King of Prussia, PA 19406

**PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS AND DOMESTIC ANIMALS
DANGER**

CORROSIVE. CAUSES IRREVERSIBLE EYE DAMAGE AND SKIN BURNS. MAY BE FATAL IF SWALLOWED OR ABSORBED THROUGH SKIN. HARMFUL IF INHALED. DO NOT GET IN EYES, ON SKIN OR ON CLOTHING. AVOID BREATHING VAPOR OR SPRAY MIST. WEAR PROTECTIVE CLOTHING, RUBBER GLOVES, AND GOGGLES OR FACE SHIELD WHEN HANDLING. Wash thoroughly with soap and water after handling and before eating or smoking. Remove contaminated clothing and wash before reuse.

PERSONAL PROTECTIVE EQUIPMENT

Workers who will come in contact with the concentrated product must wear:

- Coveralls over long-sleeved shirt and long pants
- Waterproof gloves
- Protective eyewear
- Chemical-resistant footwear plus socks

Discard clothing and other absorbent materials that have been drenched or heavily contaminated with this product's concentrate. Do not reuse them. Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

USER SAFETY RECOMMENDATIONS:

Users should:

- Wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet.
 - Remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.
 - Remove PPE immediately after handling this product. Wash the outside of gloves before removing.
- As soon as possible, wash thoroughly and change into clean clothing.

ENVIRONMENTAL HAZARDS

This pesticide is toxic to fish. Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans or other waters unless in accordance with the requirements of a National Pollutant Discharge Elimination Systems (NPDES) permit and the permitting authority has been notified in writing prior to discharge. Do not discharge effluent containing this product to sewage systems without previously notifying the local sewage treatment authority. For guidance contact your State Water Board or Regional Office of the EPA.

GENERAL INFORMATION

TD2335 Industrial Biocide-Molluscicide is a liquid concentrate soluble in water. The active ingredient of this product is highly effective in controlling established populations of freshwater and saltwater mollusks, and in preventing settlement of the immature forms of these mollusks. TD2335 Industrial Biocide-Molluscicide has activity against various slime organisms in systems that recirculate water.

The toxicity of TD2335 Industrial Biocide-Molluscicide to freshwater and saltwater mollusks is dependent on rate of application and the time of exposure. In lab studies, treatments of TD2335 Industrial Biocide-Molluscicide at 2.3 ppm for 6-7 hours were equivalent to those at 5 ppm for 2 hours. TD2335 Industrial Biocide-Molluscicide rapidly dissipates in water. Degradation in the environment is microbial only; it does not hydrolyze or photolyze in an aquatic environment. TD2335 Industrial Biocide-Molluscicide does not require a holding period or deactivation after use.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

For control of established populations of freshwater and saltwater mollusks in recirculating and once-through cooling water systems. TD2335 Industrial Biocide-Molluscicide should be applied at 3.0 to 0.3 ppm endothall technical (equivalent to 24 to 2.4 gallons per 1,000,000 gallons of water) for six to one hundred forty hours of exposure.

TD2335 Industrial Biocide-Molluscicide can be metered directly into the system with a positive displacement pump or into a flow of dilution water for use in a distribution header. One continuous application should be made at a convenient point of uniform mixing, such as a basin area, pump area or other reservoir or collecting area from which treated water will be circulated uniformly throughout the system.

Higher rates of application and exposure times are required for heavy populations of fouling mollusks and/or with cooler water temperatures (less than 70°F).

TD2335 Industrial Biocide-Molluscicide has also shown potential for treating service water, auxiliary water, waste water, influent and fire protection water systems.

Suspension of the blow down from cooling towers for six to twelve hours after TD2335 Industrial Biocide-Molluscicide application and/or segmenting plant-wide treatments will reduce the level of product remaining in the effluent.

EMERGENCY TELEPHONE NUMBERS

CHEMTREC: (800) 424-9300

MEDICAL: (866) 673-6671

Rocky Mountain Poison Control Center

STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage or disposal.

Storage Instructions: Store in the original container. Do not store in a manner where cross-contamination with other biocides could occur. In the event of spillage during handling or storage, absorb with sand or other inert material and dispose of absorbent in accordance with the Pesticide Disposal Instructions for your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office.

Pesticide Disposal: Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

Container Disposal: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

WARRANTY AND DISCLAIMER

Cerexagri, Inc. warrants that this material conforms to the chemical description on the label and is reasonably fit for the purposes referred to in the Directions for Use, subject to the risks referred to therein. CEREXAGRI MAKES NO OTHER EXPRESS OR IMPLIED WARRANTY OF FITNESS OR MERCHANTABILITY OR ANY OTHER EXPRESS OR IMPLIED WARRANTY. IN NO CASE SHALL CEREXAGRI OR SELLER BE LIABLE FOR CONSEQUENTIAL, SPECIAL OR INDIRECT DAMAGES RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT INCLUDING, BUT NOT LIMITED TO, LOSS OF PROFITS, BUSINESS REPUTATION, OR CUSTOMERS; LABOR COST; OR OTHER EXPENSES INCURRED IN PLANTING OR HARVESTING. Cerexagri and seller offer this product and the buyer and user accept it subject to the foregoing conditions of sale and warranty which may be varied only by agreement in writing signed by a duly authorized representative of Cerexagri.

APPENDIX 4
Idaho Rapid Response Plan – DRAFT
Provided by Amy Ferriter, Idaho State Department of Agriculture

IDAHO RAPID RESPONSE PLAN
NOTE: FOR DISCUSSION PURPOSES
AMONG MAC MEMBERS ONLY
(A supplement to the CRB RR Plan)
Initially drafted 11/06/09

Objective 1: Verify

Purpose: Confirm positive identification of the Dreissenid species.

Lead entity: ISDA.

1) Confirmation includes both of the following methods:

- Microscopy.

- PCR (genetic) identification of a sample sent to a qualified subject matter expert.

Objective 2: Make Initial Notifications

Purpose: Ensure that all parties that have jurisdiction in response decisions are quickly engaged.

Lead entity: ISDA.

1) Tier 1 Contacts:

- Governor's Office
- Legislators
- IDFG
- BHS
- Northside Canal Company
- Twin Falls Canal Company
- Idaho Power
- Idaho Water Users
- DEQ
- OSC
- EPA
- BOR
- USACE
- Aquaculture

- Columbia River Basin Rapid Response Team
- Northwest Power and Conservation Council
- Impacted counties – Cassia, Minidoka, Jerome, Twin Falls, Gooding, Elmore, Owyhee

Develop cooperative agreements with relative cooperating agencies and entities.

Objective 3: Activate Appropriate Organizational Elements of the Columbia River Basin Interagency Response Plan

Purpose: Activate a response that facilitates interagency decision-making, promotes information sharing, ensures efficient resource management, and supports on-scene management.

Lead entity: ISDA and/or CRB MAC Group.

Objective 4: Define Extent

Purpose: Establish physical range of infestation

Lead entity: ISDA

- 1) Additional veliger pulls where temperature range holds
- 2) Obtain necessary permission from property owners and develop an SOP regarding obtaining permission and going onto private property
- 3) Check Existing Substrate samplers for adults
 - DEQ
 - Northside Canal Company
 - Idaho Power
- 4) Check Exposed Infrastructure for adults
 - BOR
 - Idaho Power
 - Northside Canal Company
 - Twin Falls Canal Company
 - IWU
- 5) Deploy:
 - Dive Teams

Objective 5: Establish External Communications System

Purpose: Ensure consistent and effective communication to other external stakeholders, including the media and public.

Lead Entity: ISDA.

- 1) Develop a Press Release
- 2) Coordinate with interagency PIOs
- 3) Establish POC for media
- 4) Prepare for ongoing media alerts (closures, etc.)

Objective 6: Prevent Further Spread

Purpose: Minimize all pathways.

Lead Entity: ISDA.

- 1) Inventory boat launches in affected area (including OR, WA)
- 2) Determine management authorities
- 3) Contact management authorities and advise of potential inspections or closures
- 4) Initiate inspections or closures.

Objective 7: Initiate Available/Relevant Control Measures

Purpose: Proceed with either eradication efforts or containment/mitigation activities.

Lead Entity: ISDA.

- 1) Evaluate management options given the nature of the population (veligers only, adults and veligers, isolated population vs. widespread population, etc.)
- 2) Make contact with agencies and individuals with expertise in eradication control techniques.
- 3) Convene an expert panel for consultation.
- 4) Evaluate potential feasible control methods.
- 5) Secure environmental “buy-in.”

Draft MOUs or cooperative agreements with entities participating in eradication.

APPENDIX 5

Contributors

Ricardo Deleon (ricardo_deleon@mwdh2o.com)
California Metropolitan Water District

Amy Ferriter (Amy.Ferriter@agri.idaho.gov)
Idaho Department of Agriculture

William T Haller (whaller@ufl.edu)
Professor, University of Florida
Center for Aquatic and Invasive Plants

Denise M Hosler (DHosler@usbr.gov)
US Bureau of Reclamation

Carlton R Layne (clayne1111@bellsouth.net)
Executive Director, Aquatic Ecosystem Restoration Foundation

Robert F McMahon (r.mcmahon@uta.edu)
Professor, University of Texas – Arlington

Donald Stubbs (donald271@verizon.net)
US Environmental Protection Agency (retired)
Former Director, Office of Pesticide Programs

Thomas Woolf (twoolf@agri.idaho.gov)
Idaho Department of Agriculture



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