

---

# **Use of Copper and Acrolein To Control Aquatic Vegetation In Canals, Laterals, and Basins**

---

## **California Environmental Quality Act Initial Study And Mitigated Negative Declaration**

---

**April 3, 2014**

**James Irrigation District  
8749 9<sup>th</sup> Street  
P.O. Box 757  
San Joaquin, CA 93660  
Contact: John Mallyon  
(559) 693-4653**

Prepared by:  
**Blankinship & Associates, Inc.  
1590 Drew Avenue, Suite 120  
Davis, CA 95618  
Contact: Stephen Burkholder  
(530) 757-0941**

Submitted to:  
**State Water Resources Control Board  
1001 I Street  
Sacramento, CA 95814  
Contact: Russell Norman  
(916) 323-5598**

# Use of Copper and Acrolein To Control Aquatic Vegetation In Water Canals, Laterals, and Basins

## CEQA Initial Study & Mitigated Negative Declaration

<b>Table of Contents</b>	<b>Page</b>
1.0 PROJECT DESCRIPTION .....	4
1.1 Introduction.....	4
1.2 Regulatory Setting .....	6
1.3 Required Approvals.....	7
1.4 Required Notifications .....	7
1.5 Standard Operating Procedures.....	8
2.0 INITIAL STUDY.....	9
2.1 CEQA Initial Study & Environmental Check List Form .....	9
2.2 Environmental Factors Potentially Affected.....	10
2.3 Determination (To be completed by lead agency).....	11
3.0 EVALUATION OF ENVIRONMENTAL IMPACTS .....	12
3.1 Aesthetics.....	12
3.2 Agriculture Resources .....	13
3.3 Air Quality .....	14
3.4 Biological Resources .....	17
3.5 Cultural Resources .....	26
3.6 Geology and Soils .....	27
3.7 Hazards and Hazardous Materials .....	29
3.8 Hydrology and Water Quality.....	33
3.9 Land Use Planning .....	41
3.10 Mineral Resources .....	42
3.11 Noise .....	43
3.12 Population and Housing .....	45
3.13 Public Services.....	46
3.14 Recreation .....	47
3.15 Transportation/Traffic.....	48
3.16 Utilities and Service Systems .....	50
3.17 Mandatory Findings of Significance .....	52
4.0 List of Mitigation Measures .....	54
4.1 Biological Resources.....	54
4.2 Hydrology & Water Quality .....	54
5.0 REFERENCES .....	55
6.0 PERSONS AND AGENCIES CONTACTED.....	56
7.0 LIST OF PREPARERS .....	56

**List of Figures**

- Figure 1 James Irrigation District
- Figure 2 Schools within ¼ Mile of District Conveyances
- Figure 3 Historical Occurrences of Stanford's Arrowhead
- Figure 4 Copper Criteria Dependence on Hardness

**List of Tables**

- Table 1 Species & Habitat Summary
- Table 2 Anticipated Rate of Acrolein Degradation and Dissipation
- Table 3 Anticipated Rate of Copper Dissipation

**List of Appendices**

- Appendix A Species Descriptions
- Appendix B Herbicide and Ecological Toxicity Data
- Appendix C Copper Speciation Graphs from the Biotic Ligand Model
- Appendix D DPR PCA Recommendations
- Appendix E Example Product Labels and MSDS Sheets
- Appendix F CEQA Documentation

## 1.0 PROJECT DESCRIPTION

### 1.1 Introduction

James Irrigation District (herein referred to as “the District”) is located in western Fresno County and includes the town of San Joaquin. The District was formed in 1920 and services about 25,000 acres. Crops grown within the District include cotton, alfalfa, various vegetable crops, wheat, pomegranates, almonds, and grapes. The District typically delivers approximately 80,000 acre-feet per year of which about 33% comes from deep wells. The District may receive up to 45,000 acre-feet in surface water from the Central Valley Project (CVP) and the rest of grower demand for water is met by groundwater wells, water supplies from the Kings River by way of the Fresno Slough Bypass, or riparian rights from the San Joaquin River. The District may also receive water from Fresno Irrigation District.

The District owns and maintains approximately 100 miles of canals and laterals that convey irrigation water. With the exception of the main canal and a few miles of laterals, most of the canals are unlined. Both the lined and unlined canals are prone to infestation by algae and aquatic weeds. The District also owns and maintains basins within the District footprint and in the James Bypass. The District basins allow for groundwater recharge for the Kings River, regulate water levels when irrigation demand is variable, and are used to store irrigation and flood water. Refer to **Figure 1**.

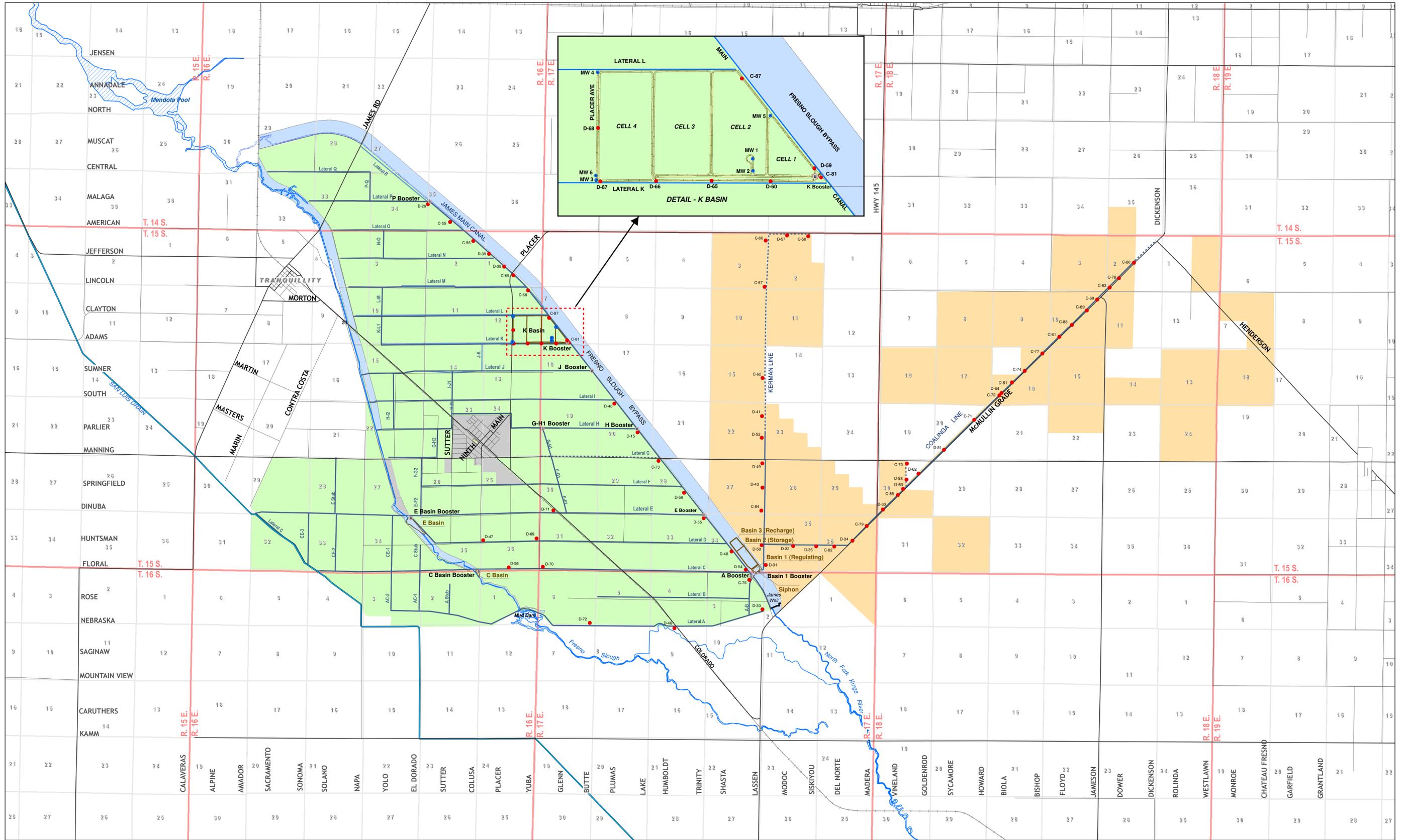
Efficient canal and lateral conveyance of irrigation water is critical to the functions of the District. However, the District’s canals and basins are prone to infestation by several floating and submersed aquatic weeds including, but not limited to pondweeds (sago, American), cattails, and bulrush. The basins are prone to infestation by emergent vegetation, primarily cattails. The presence of this vegetation can slow or stop the flow of water in a canal, reducing its irrigation and flood control capacity.

To maintain acceptable rates of flow in its canals, the District uses Integrated Pest Management (IPM) techniques. As part of this approach, the District plans to use a variety of aquatic herbicides including copper and/or acrolein on an “as-needed” basis to achieve aquatic weed control necessary to efficiently convey water through canals, laterals, and basins.

Depending on weed presence and density, aquatic herbicides containing copper and/or acrolein may be applied at locations throughout the District. Applications may be made if the District’s IPM thresholds are met, or expected to be met based on the weather, weed density, weed growth or predicted growth, water demand, or water level in the system. Some years, aquatic herbicides may be very limited if thresholds are not met. Applications may be made during the irrigation season, or on an as needed basis other times of the year. Applications may be made in any canal within the District.

The “Project” is defined as the District’s applications of aquatic herbicides to canals, laterals and basins to control a variety of aquatic vegetation as needed for the efficient delivery of irrigation water.

Figure 1.



	286 W. Cromwell Ave. Fresno, CA 93711-6162 (559) 449-2700	MAJOR ROAD	CITY OF SAN JOAQUIN	CANAL	BOOSTER
		STREET	CITY OF SAN JOAQUIN/JID OVERLAP	PIPELINE	MONITOR WELL
RAILROAD	RECLAMATION DISTRICT 1606	BASIN	PRODUCTION WELL		
TOWNSHIP/RANGE	JAMES ID WELL FIELD	KINGS RIVER			

**James Irrigation District**  
Fresno County, CA

October 2012

10/24/2012 \\Evolution\civ\_clients\Clients\James ID-1051\GIS\Map\JID\_and\_wellfield\_24x36.mxd

## 1.2 Regulatory Setting

On June 4, 2004, the State Water Resource Control Board (SWRCB) made available the Statewide General National Pollutant Discharge Elimination System (NPDES) Permit #CAG990005 for the Discharge of Aquatic Pesticides for Aquatic Weed Control in Waters of the United States. This permit expired in May 2009, but was administratively continued until November 30, 2013. The Statewide General National Pollutant Discharge Elimination System (NPDES) Permit for Residual Aquatic Pesticide Discharges to Waters of the United States from Algae and Aquatic Weed Control Applications ("Permit") was adopted on March 5, 2013 and became available on December 1, 2013 (SWRCB 2013). The Permit requires compliance with the following:

- The Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries in California (aka the State Implementation Plan, or SIP) (SWRCB, 2005)
- The California Toxics Rule (CTR) (CTR, 2000)
- Applicable Regional Water Quality Control Board (RWQCB) Basin Plan Water Quality Objectives (WQOs) (RWQCB, 2003)

The SIP assigns effluent limitations for CTR priority pollutants, including the aquatic herbicides acrolein and copper. Further, the SIP prohibits discharges of priority pollutants in excess of applicable water quality criteria outside the mixing zone<sup>1</sup>.

The SIP does, however, allow exceptions if determined to be necessary to implement control measures either for resource or pest management conducted by public entities to fulfill statutory requirements, or regarding drinking water conducted to fulfill statutory requirements under the federal Safe Drinking Water Act or the California Health and Safety Code. Such exceptions may also be granted for draining water supply reservoirs, canals, and pipelines for maintenance, for draining municipal storm water canals and laterals during cleaning or maintenance, or for draining water treatment facilities during cleaning or maintenance. The District has concluded that they meet one or more of the criteria for gaining a SIP exception.

Permittees who elect to use a SIP exception must satisfactorily complete several steps, including preparation and submission of a California Environmental Quality Act (CEQA) document. This document must be submitted to the SWRCB for the permittee to be added to the list of SIP exception holders presented in Attachment G of the Permit, and subsequently be afforded coverage.

The SWRCB has suggested that the Permit will be re-opened for additional CEQA document submission on an as-needed basis.

---

<sup>1</sup> Mixing Zone is defined in the SIP as "a limited volume of receiving water that is allocated for mixing with a wastewater discharge where water quality criteria can be exceeded without causing adverse effects to the overall waterbody."

### **1.3 Required Approvals**

To obtain approval of an exception under Section 5.3 of the SIP to the CTR criterion for copper and acrolein, the District will submit the following documents to the SWRCB and RWQCB for acceptance:

- a. A detailed description of the proposed action,
- b. The proposed method of completing the action;
- c. A time schedule;
- d. A discharge and receiving water quality monitoring plan (before project initiation, during project implementation, and after project completion, with the appropriate quality assurance and quality control procedures);
- e. Contingency plans (to the extent applicable);
- f. CEQA documentation and notification of potentially affected agencies; and
- g. Upon completion of the project, the discharger shall provide certification by a qualified biologist that the receiving water beneficial uses have been restored.

### **1.4 Required Notifications**

#### **1.4.1 California Department of Fish and Wildlife**

At the beginning of each summer, prior to application of copper and/or acrolein, the District will send a written notification of intent to use acrolein and/or copper to the California Department of Fish and Wildlife (CDFW).

#### **1.4.2 Fresno County Agricultural Commissioner**

Prior to the start of every season, the District obtains a Restricted Materials permit from the County Agricultural Commissioner (CAC) as needed.

#### **1.4.3 NPDES Aquatic Pesticide Permit Notifications**

Every calendar year, at least 15 days prior to the first application of acrolein or copper-containing aquatic herbicide, the Discharger notifies potentially affected public agencies. The District may post the notification on its website if possible. The notification includes the following information:

1. A statement of the District's intent to apply algaecide or aquatic herbicide(s);
2. Name of algaecide and aquatic herbicide(s);
3. Purpose of use;
4. General time period and locations of expected use;
5. Any water use restrictions or precautions during treatment; and
6. A phone number that interested persons may call to obtain additional information from the District.

## 1.5 Standard Operating Procedures

Water is typically delivered and used by growers within the District. Regulation and recharge basins are used to regulate flow and minimize spills. Water may leave the District through water control structures that lead to drainage channels and eventually end up in the Fresno Slough. Water in Fresno Slough may be picked up for re-use by Tranquility Irrigation District. Water released from the end of the District's northern laterals flows to Fresno Slough, then to the Mendota Pool. At the Mendota pool, water is distributed for re-use by various irrigation districts. All spills and discharges are minimized during periods of treatment.

Irrigation canals, laterals, and basins will be treated as needed depending weed or algae pressure, delivery needs, and IPM threshold.

The District implements an Integrated Pest Management (IPM) program for aquatic weed control. The IPM program involves the scouting of aquatic weed locations and densities, establishment of thresholds above which control is needed, and making applications of aquatic herbicides on an "as-needed" basis to achieve the aquatic weed control necessary to convey water. Prior to application, the following tasks are accomplished:

1. A written recommendation is prepared by a DPR-licensed Pest Control Advisor (PCA). A PCA undergoes 40 hours of training every 2 years on issues including health and safety and prevention of exposure to sensitive receptors. The written recommendation prepared by the PCA must evaluate proximity of occupied buildings and people, health and environmental hazards and restrictions, and a certification that alternatives and mitigation measures that substantially lessen any significant adverse impact on the environment have been considered, and if feasible, adopted. Refer to **Appendix D**.
2. All District personnel review and strictly adhere to the aquatic herbicide product label that has clear and specific warnings that alert users to hazards that may exist. Examples of aquatic herbicide product labels are included in **Appendix E**.
3. All District personnel review and consult the aquatic herbicide Material Safety Data Sheet (MSDS) in **Appendix E**, and the DPR Worker Health and Safety Branch Pesticide Safety Information Series (PSIS). The PSIS and the MSDS have specific information that describes precautions to be taken during the use of the aquatic herbicide. If acrolein is to be used, District personnel obtain annual training on its use as described in the Magnacide H Herbicide Application and Safety Manual.
4. The condition of the canals and lateral(s) being treated is field evaluated to ensure that the application is necessary, feasible, and can be conducted safely and according to label. This evaluation considers target weed species, level of infestation, water and flow conditions, alternate control methods, and amount of aquatic herbicide to be applied.
5. Notifications, as needed, are sent to the County Agricultural Commissioner (CAC) and the California Department of Fish and Wildlife (CDFW).
6. Growers requesting notification are contacted and given the opportunity to postpone water deliveries in case of sensitivities, such as pastures with lactating cows or organic crops.

7. Prior to an aquatic herbicide application, District personnel inspect and seal as necessary any spill structures leaving the District.
8. Water treated with acrolein is only used for irrigation of fields (crop bearing, fallow, or pasture) where the treated water remains on the field.

During and after an aquatic herbicide application, the District accomplishes the following:

1. Do not allow water to be released from canals, laterals, regulation and recharge basins before the label-prescribed 6 day hold time for acrolein applications.
2. Control small leaks (< 1 gallon per minute) that may develop at gates or weir structures with sand bags, installation of additional plastic around boards, temporary dikes, pumps, or by lowering the level of treated water below the elevation of the leak. All these actions effectively prevent the release of water treated with aquatic herbicide from leaving a canal or lateral.

## **2.0 INITIAL STUDY**

This document was prepared in a manner consistent with Section 21064.5 of the California Public Resources Code and Article 6 of the State CEQA Guidelines (14 California Code of Regulations).

This Initial Study, Environmental Checklist, and evaluation of potential environmental effects were completed in accordance with Section 15063(d) of the *State CEQA Guidelines* to determine if the proposed Project could have any potentially significant effect on the physical environment, and if so, what mitigation measures would be imposed to reduce such impacts to less-than-significant levels.

An explanation is provided for all determinations, including the citation of sources as listed in Section 5. A “No Impact” or a “Less-than-Significant Impact” determination indicates that the proposed Project would not have a significant effect on the physical environment for that specific environmental category.

Mitigation measures will be implemented to reduce the potentially significant impacts to a less-than-significant levels. No other environmental categories for this evaluation were found to be potentially affected in a significant manner by the proposed Project.

### **2.1 CEQA Initial Study & Environmental Check List Form**

- |   |   |
|---|---|
| <b>1. Project Title:</b>                | Use of Copper and Acrolein to Control Aquatic Vegetation in Water Canals, Laterals, and Basins            |
| <b>2. Lead Agency Name and Address:</b> | James Irrigation District<br>8749 9 <sup>th</sup> Street<br>P.O. Box 757<br>San Joaquin, California 93660 |

- 3. **Contact Person & Phone Number:** John Mallyon  
(559) 693-4653
- 4. **Project Location:** Fresno County, California
- 5. **Project Sponsor’s Name and Address:** See #2. above
- 6. **General Plan Land Use Designation:** Agriculture and Urban
- 7. **Zoning:** Agriculture and Urban
- 8. **Description of Project:** See Section 1.5
- 9. **Surrounding Land Uses and Setting:** Agriculture/Designated Floodway/Commercial  
Residential/Industrial/Public Services
- 10. **Other Agencies Whose Approval is Required:** As Listed in Section 1

## 2.2 Environmental Factors Potentially Affected

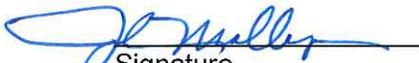
The environmental factor checked below would be potentially affected by the proposed Project, involving at least one impact that is a ‘Potentially Significant Impact’ as indicated by the checklist on the following pages:

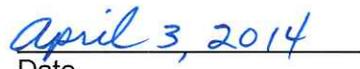
- |  |  |   |
|--|--|---|
| <input type="checkbox"/> Aesthetics                      | <input type="checkbox"/> Agriculture Resources                         | <input type="checkbox"/> Air Quality            |
| <input checked="" type="checkbox"/> Biological Resources | <input type="checkbox"/> Cultural Resources                            | <input type="checkbox"/> Geology/Soils          |
| <input type="checkbox"/> Hazards & Hazardous Materials   | <input checked="" type="checkbox"/> Hydrology/Water Quality            | <input type="checkbox"/> Land Use/Planning      |
| <input type="checkbox"/> Mineral Resources               | <input type="checkbox"/> Noise   | <input type="checkbox"/> Population/Housing     |
| <input type="checkbox"/> Public Services                 | <input type="checkbox"/> Recreation                                    | <input type="checkbox"/> Transportation/Traffic |
| <input type="checkbox"/> Utilities/Service Systems       | <input checked="" type="checkbox"/> Mandatory Findings of Significance |   |

**2.3 Determination (To be completed by lead agency)**

On the basis of this initial evaluation:

- I find that the proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.
- I find that although the proposed Project could have a significant effect on the environment, there will not be a significant effect because appropriate mitigation measures are in place. A MITIGATED NEGATIVE DECLARATION will be prepared.
- I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT (EIR) is required.
- I find that the proposed project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An EIR is required, but it must analyze only the effects that remain to be addressed.
- I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required.

  
Signature

  
Date

John Mallyon  
Printed Name

James Irrigation District  
Organization

### 3.0 EVALUATION OF ENVIRONMENTAL IMPACTS

#### 3.1 Aesthetics

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
--	--------------------------------	--	------------------------------	-----------

**Would the Project:**

a) Have a substantial adverse effect on a scenic vista?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) Substantially degrade the existing visual character or quality of the site and its surrounding?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

#### Discussion

Items a) & b): **No Impact.** No designated scenic vistas or state scenic highways overlook any of the project sites, therefore no impact would occur.

Item c): **No Impact.** The Project involves the application of aquatic herbicides to canals in the District to control a variety of aquatic vegetation. These weeds are typically at or below the water surface. Upon control, the removal of these weeds would be unnoticed and as a result not degrade the visual character of a project site.

Item d): **No Impact.** The Project is done during the daylight hours, therefore no light sources are needed and no light or glare is produced.

### 3.2 Agriculture Resources

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
--	--------------------------------	--	------------------------------	-----------

**Would the Project:**

a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

#### Discussion

Items a) through c): **No Impact.** On the contrary, the Project accomplishes objectives that maintain and enhance agricultural land use.

### 3.3 Air Quality

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
--	--------------------------------	--	------------------------------	-----------

**Would the Project:**

a)	Conflict with or obstruct implementation of the applicable air quality plan?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b)	Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c)	Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal and state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d)	Expose sensitive receptors to substantial pollutant concentrations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
e)	Create objectionable odors affecting a substantial number of people?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

### Discussion

Items a) & b): **No Impact.** The Project requires the use of pick-up or flatbed trucks for purposes of transporting aquatic herbicides to locations where they are needed. Pick-up trucks are also used for purposes of site reconnaissance before, during, and after application of aquatic herbicides. Short-term vehicle emissions will be generated during aquatic herbicide application; however, they will be minor and only be applied on an “as-needed” basis throughout the year. To minimize impacts, all equipment will be properly tuned and muffled and unnecessary idling will be minimized.

The District is located in the San Joaquin Valley Air Basin, which is managed by the San Joaquin Valley Air Pollution Control District (SJVAPCD) and includes the following counties: Fresno, Kern, Kings, Madera, Merced, San Joaquin, Stanislaus, and Tulare. The application of aquatic herbicides does not conflict with any of the SJVAPCD Air Quality Attainment Plans, violate any air quality standards, or contribute to an existing or projected violation. The San Joaquin Valley is designated as a State and Federal non-attainment area for ozone and particulate matter. The proposed project would not interfere with the implementation of any air quality management plan.

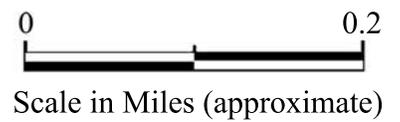
Item c): **No Impact.** Levels of ozone and particulate matter (PM<sub>2.5</sub> and PM<sub>10</sub>) in the San Joaquin Valley have exceeded California Clean Air standards, and therefore the area has been considered a “nonattainment” area for these pollutants. Although the area is not in attainment for PM<sub>2.5</sub>, PM<sub>10</sub> and ozone California Clean Air standards, the Project will not increase any of these criteria pollutants.

Items d) & e): **Less Than Significant Impact.** Aquatic herbicides are applied by District personnel in agricultural areas. Treated canal water does not flow through the City of San Joaquin. Best Management Practices (BMPs) for acrolein applications include not having injection (application) points located near schools, playgrounds, health care facilities, day care facilities or athletic facilities. The District does not allow any swimming, fishing, playing, or other recreational activities in and around canals. These BMPs significantly reduce or eliminate sensitive receptor exposure and result in less than a significant impact. See **Figure 2** for a map of schools within ¼ mile of District conveyances.



**Legend**

- San Joaquin Elementary School
- James Irrigation District Canal




**Blankinship & Associates, Inc.**  
 Agricultural & Environmental  
 Scientists & Engineers  
 1590 Drew Ave., #120, Davis, CA 95618  
 Tel. 530.757.0941 Fax 530.757.0940

**Schools within 1/4 Mile of  
 District Conveyances**  
 San Joaquin, California

Project James ID IS & MND	Figure <span style="font-size: 2em; font-weight: bold;">2</span>
Date 7 Mar. 2014	

### 3.4 Biological Resources

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
--	--------------------------------	--	------------------------------	-----------

**Would the Project:**

a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

## Discussion

Items a): **Potentially Significant Unless Mitigation Incorporated.** A list of current special status species was compiled from the California Department of Fish and Wildlife (CDFW) California Natural Diversity Database (CNDDDB), and the U.S. Fish and Wildlife Service (USFWS), Sacramento Office. Once this list was compiled, a preliminary assessment of the project area was performed to characterize the actual habitats present on-site and the likelihood of special status species occurrence.

A summary of the listed species, their designation, and whether or not they were considered for evaluation of potential impact is presented in **Table 1**. Species habitat and rationale for removal from further consideration is presented in **Table 1** and more detailed species life history information can be found in **Appendix A**. Physical, chemical and toxicological data on copper and acrolein is presented in **Appendix B**.

With one exception, no special status species has habitat in or near, or is otherwise expected to be exposed to aquatic herbicides used at project sites.

The one species that may potentially be at risk is Sanford's arrowhead (*Sagittaria sanfordii*). Sanford's arrowhead is a member of the water plantain family and typically grows at the margins of wetlands or riparian areas. Its habitat includes the margins of wetland areas such as streams, rivers, ponds, drainage channels, or irrigation canals. It is perennial herb that is native to California and is endemic (limited) to California alone. It is included in the CNPS Inventory of Rare and Endangered Plants on list 1B.2 (rare, threatened, or endangered in CA and elsewhere)

Table 1. Species and Habitat Summary

Common Name	Scientific Name	Status	Habitat	Habitat is not Present in Project Area; Species Eliminated from Further Consideration	Habitat is Present in Project Area; Species Eliminated from Further Consideration for Reasons Given (see numbered notes)	Potential Risk is Present from Project Activities
<b>AMPHIBIAN</b>						
California tiger salamander	<i>Ambystoma californiense</i>	FT, SCSC	Herbaceous wetland, temporary pool; Grassland/herbaceous, Savanna, Woodland - Hardwood		X (1)	
western spadefoot toad	<i>Spea hammondi</i>	SCSC	Lowlands to foothills; grasslands, open chaparral, pine-oak woodlands. Prefers shortgrass plains, sandy or gravelly soil		X (2)	
<b>BIRD</b>						
tricolored blackbird	<i>Agelaius tricolor</i>	SCSC	Fresh-water marshes of cattails, tule, bulrushes and sedges; Cropland/hedgerow, Grassland/herbaceous		X (3)	
Short-eared owl	<i>Asio flammeus</i>	SCSC	Swamp lands, both fresh and salt; lowland meadows; irrigated alfalfa fields		X (3)	
burrowing owl	<i>Athene cunicularia</i>	SCSC	Agriculture/Rangeland, Grassland		X (3)	
Swainson's hawk	<i>Buteo swainsoni</i>	ST	Cropland/hedgerow, Desert, Grassland/herbaceous, Savanna, Woodland - Mixed	X		
mountain plover	<i>Charadrius montanus</i>	SCSC	Recently plowed fields, sparsely vegetated fields, and pastureland with little to no vegetative growth	X		
western yellow-billed cuckoo	<i>Coccyzus americanus occidentalis</i>	SE	Open woodland (especially where undergrowth is thick), parks, deciduous riparian woodland; requires patches of at least 10 hectares (25 acres) of dense riparian forest with a canopy cover of at least 50 percent in both the understory and overstory	X		
merlin	<i>Falco columbarius</i>	None	Seacoast, tidal estuaries, open woodlands, savannahs, edges of grasslands & deserts, farms & ranches.	X		
Prairie falcon	<i>Falco mexicanus</i>	None	Inhabits dry, open terrain, either level or hilly. Breeding sites located on cliffs. Forages far afield, even to marshlands and ocean shores.	X		
California horned lark	<i>Eremophila alpestris actia</i>	None	Coastal regions, chiefly from Sonoma County to San Diego County; also main part of San Joaquin Valley and east to foothills	X		
White-faced ibis	<i>Plegadis chihi</i>	None	Shallow fresh-water marsh; dense tule thickets for nesting in interspersed with areas of shallow water for foraging	X		

Common Name	Scientific Name	Status	Habitat	Habitat is not Present in Project Area; Species Eliminated from Further Consideration	Habitat is Present in Project Area; Species Eliminated from Further Consideration for Reasons Given (see numbered notes)	Potential Risk is Present from Project Activities
bank swallow	<i>Riparia riparia</i>	ST	Riparian and other lowland habitats; requires vertical banks/cliffs with fine soils		X (4)	
<b>MAMMAL</b>						
pallid bat	<i>Antrozous pallidus</i>	SCSC	Deserts, grasslands, shrublands, woodlands & forests. Most common in open, dry habitats with rocky areas for roosting		X(3)	
Giant kangaroo rat	<i>Dipodomys ingens</i>	FE, SE	Annual grasslands on the western side of the San Joaquin Valley, marginal habitat in alkali scrub	X		
western red bat	<i>Lasiurus blossevillii</i>	SCSC	Along riparian and agricultural areas in broadleaf tree communities throughout the Central Valley		X(3)	
Nelson's antelope squirrel	<i>Ammospermophilus nelsoni</i>	ST	Western San Joaquin Valley from 200-1200 ft elevation, dry, sparsely vegetated loam soils	X		
Fresno kangaroo rat	<i>Dipodomys nitratooides exilis</i>	FE, SE	Alkali sink-open grassland habitats in Western Fresno County	X		
western mastiff bat	<i>Eumops perotis californicus</i>	SCSC	Open, semi-arid to arid habitats including conifer and deciduous woodlands, coastal scrub, grassland, chaparral, etc.	X		
Hoary bat	<i>Lasiurus cinereus</i>	None	Prefers open habitats or habitat mosaics, with access to trees for cover & open areas or habitat edges for feeding		X (3)	
Yuma myotis	<i>Myotis yumanensis</i>	None	Optimal habitats are open forests and woodlands with sources of water over which to feed		X (4)	
San Joaquin pocket mouse	<i>Perognathus inornatus inornatus</i>	None	Typically found in grasslands and blue oak savannas	X		
American badger	<i>Taxidea taxus</i>	SCSC	Most abundant in drier open stages of must shrub, forest, and herbaceous habitats	X		
San Joaquin kit fox	<i>Vulpes macrotis mutica</i>	FE, ST	Annual grasslands or grassy open stages with scattered shrubby vegetation	X		
<b>REPTILE</b>						
giant garter snake	<i>Thamnophis gigas</i>	FT, ST	prefers freshwater marsh and low gradient streams, has adapted to rice fields, vegetated drainage canals and irrigation ditches		X (5)	

Common Name	Scientific Name	Status	Habitat	Habitat is not Present in Project Area; Species Eliminated from Further Consideration	Habitat is Present in Project Area; Species Eliminated from Further Consideration for Reasons Given (see numbered notes)	Potential Risk is Present from Project Activities
western pond turtle	<i>Emys marmorata</i>	SCSC	Ponds, marshes, streams, rivers, irrigation ditches. Usually with aquatic vegetation.		X (6)	
San Joaquin whipsnake	<i>Masticophis flagellum ruddocki</i>	SCSC	Open, dry habitats with little or no tree cover. Found in valley grassland and saltbrush scrub in the San Joaquin Valley	X		
coast horned lizard	<i>Phrynosoma blainvillii</i>	SCSC	Lowlands along sandy washes with scattered low bushes	X		
two-striped garter snake	<i>Thamnophis hammondi</i>	SCSC	Coastal CA from vicinity of Salinas to Northwest Baja CA from sea level to about 7,000 feet	X		
silvery legless lizard	<i>Anniella pulchra pulchra</i>	SCSC	Sandy or loose loamy soils under sparse vegetation	X		
<b>INVERTEBRATE</b>						
San Joaquin dune beetle	<i>Coelus gracilis</i>	FC	Inhabits fossil dunes along the western edge of San Joaquin Valley	X		
valley elderberry longhorn beetle	<i>Desmocerus californicus dimorphus</i>	FT	Riparian, found on or near elderberry ( <i>Sambucus</i> spp.)	X		
Antioch efferian robberfly	<i>Efferia antiochi</i>	None	Known only from Contra Costa and Fresno Counties	X		
Molestan blister beetle	<i>Lytta molesta</i>	None	Inhabits the Central Valley of California, from Contra Costa to Kern and Tulare counties	X		
Hurd's metapogon robberfly	<i>Metapogon hurdi</i>	None	Known only from Antioch and Fresno	X		
<b>PLANT</b>						
heartscale	<i>Atriplex cordulata</i>	CNPS-1	Alkali Scrub or Grassland	X		
brittlescale	<i>Atriplex depressa</i>	CNPS-1	Alkali Scrub or Grassland, Vernal Pools	X		
vernal pool smallscale	<i>Atriplex persistens</i>	CNPS-2	Vernal Pools	X		
Lost Hills crownscale	<i>Atriplex coronata var. vallicola</i>	CNPS-1	Chenopod scrub, valley and foothill grassland, vernal pools	X		
lesser saltscale	<i>Atriplex minuscula</i>	CNPS-1	Chenopod scrub, playas, valley and foothill grassland	X		
subtle orache	<i>Atriplex subtilis</i>	CNPS-1	Valley and foothill grassland	X		
succulent owl's-clover	<i>Castilleja campestris ssp. succulenta</i>	FT, SE, CNPS-1	Vernal pools, valley and foothill grassland	X		
California jewel-flower	<i>Caulanthus californicus</i>	FT, SE, CNPS-1	Chenopod scrub, valley and foothill grassland, Pinyon-juniper woodland	X		
palmate-bracted bird's-beak	<i>Chloropyron palmatum</i>	FT, SE, CNPS-1	Chenopod scrub, valley and foothill grassland	X		
recurved larkspur	<i>Delphinium recurvatum</i>	CNPS-1	Chenopod scrub, valley and foothill grassland, cismontane woodland	X		
Hoover's eriastrum	<i>Eriastrum hooveri</i>	FD	Chenopod scrub, valley and foothill grassland, Pinyon-juniper woodland	X		
Hoover's eriastrum	<i>Eriastrum hooveri</i>	FD	Chenopod scrub, valley and foothill grassland, Pinyon-juniper woodland	X		

Common Name	Scientific Name	Status	Habitat	Habitat is not Present in Project Area; Species Eliminated from Further Consideration	Habitat is Present in Project Area; Species Eliminated from Further Consideration for Reasons Given (see numbered notes)	Potential Risk is Present from Project Activities
California satintail	<i>Imperata brevifolia</i>	CNPS-2	Coastal scrub, chaparral, riparian scrub, mojavean scrub, meadows and seeps (alkali)	X		
Pale-yellow layia	<i>Layia heterotricha</i>	CNPS-1B.1	Cismontane woodland, pinyon-Juniper Woodland, valley and foothill grassland	X		
Munz's tidy-tips	<i>Layia munzii</i>	CNPS-1	Chenopod scrub, valley and foothill grassland	X		
Panoche pepper-grass	<i>Lepidium jaredii ssp. album</i>	CNPS-1	Valley and foothill grassland	X		
Madera leptosiphon	<i>Leptosiphon serrulatus</i>	CNPS-1	Cismontane woodland, lower montane coniferous forest	X		
Showy golden madia	<i>Madia radiata</i>	CNPS-1B.1	Valley and foothill grassland, cismontane woodland, chenopod scrub	X		
San Joaquin woollythreads	<i>Monolopia congdonii</i>	FE, CNPS-1	Chenopod scrub, valley and foothill grassland	X		
San Joaquin Valley Orcutt grass	<i>Orcuttia inaequalis</i>	FT, SE, CNPS-1	Vernal pools	X		
hairy Orcutt grass	<i>Orcuttia pilosa</i>	FT, SE, CNPS-1	Vernal pools	X		
Sanford's arrowhead	<i>Sagittaria sanfordii</i>	CNPS-1	Marshes and swamps			X

**Table 1 Numbered Notes:**

- (1) Species not present in water during application due to aestivation (summer-time dormancy).
- (2) This is a terrestrial species that is known to enter water only during parts of its' reproductive cycle. This period of time does not coincide with the application period of aquatic herbicides.
- (3) Species not likely to have any exposure as its target prey base consists of terrestrial species.
- (4) Species forage for emergent aquatic insects over water. These insects may bioaccumulate copper. But, given the large amount of potential foraging area, the emergent aquatic insects from treated canals would likely only contribute an insignificant percentage of the total diet. Therefore, no risk due to copper exposure is anticipated.
- (5) Locations where the giant garter snake has been found in the region are outside of the Project Area.
- (6) Locations where the western pond turtle has been found in the region are outside of the Project Area.

**Table 1 Status Abbreviation:**

FE = Federally Listed as Endangered
FT = Federally Listed as Threatened
FD = Federally Delisted as a Threatened or Endangered
FC = Federally Listed as a Candidate
SCSC = State Listed Species of Concern
SE = State Listed as Endangered
ST = State Listed as Threatened
CNPS-1 = California Native Plant Society Listed, Rare, Threatened, or Endangered in CA only
CNPS-2 = California Native Plant Society Listed Rare, Threatened, or Endangered

(Continued Item a): Discussion)

Since Sanford's arrowhead may occur at the margins of District canals, and its stems may be underwater, it could come into contact with acrolein- or copper-treated water. After an application of a copper-containing herbicide, there will likely not be sufficient contact time, or copper concentration to adversely affect the plant's stems. Following an application of acrolein, the treatment rate is such that the plant's stems may be adversely affected. As such, the impact to Sanford's arrowhead may be *potentially significant without mitigation incorporated*. Implementation of Mitigation Measure BIO-1 would reduce the impact of Project activities associated with the application of acrolein to less than significant. See **Figure 3** for a map of Sanford's arrowhead occurrences near the District.

**BIO-1.** Mitigation for potential exposure of Sanford's arrowhead to acrolein will be to have a qualified biologist, or District staff trained to recognize the Sanford's arrowhead, complete a pre-application survey the inside margins of the canals receiving treatment from the application point, continuing downstream until the herbicide is not expected to be present. The distance to be surveyed prior to an acrolein application will be the distance the acrolein-treated water would travel in approximately 24 hours.

If Sanford's arrowhead is found, the application of acrolein will be postponed until such time as the direct exposure of the plant stems to canal water can be eliminated. One way to eliminate exposure of Sanford's arrowhead to treated water is to lower the water level in the canal below the elevation of the emergent parts of the plant. Once the water will no longer contact the plant, the canal and lateral may be treated.

With this mitigation, a less than significant impact exists to these species. By regularly monitoring and reporting the presence/absence of Sanford's arrowhead in its canals, laterals, and basins, the District will be able to identify potential problems and take corrective action if necessary.

Item b): **No Impact.** The Project takes place in the District's canals and associated laterals and, therefore, will not impact any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife (CDFW) or the U.S. Fish and Wildlife Service (USFWS). A list of current special status communities was compiled from the CDFW CNDDDB. Once this list was compiled, a preliminary assessment of the project area was performed to characterize the whether or not the special status communities were present. None of the listed communities were within the project area.

Item c): **No Impact.** The Project takes place in the District's canals, laterals, and basins and,

therefore, will not impact any upland habitat or wetlands. However, the assessment of risk for species that live in these areas was considered. Risks to these species are adequately mitigated with **BIO-1**.

Item d): **No Impact**. Water sources for the District may include water from the Kings River watershed, riparian rights from the San Joaquin River, the United States Bureau of Reclamation, or groundwater pumped from wells within the District.

Items e) & f): **No Impact**. The Project does not conflict with, and has no impact to any local policies or ordinances protecting biological resources.

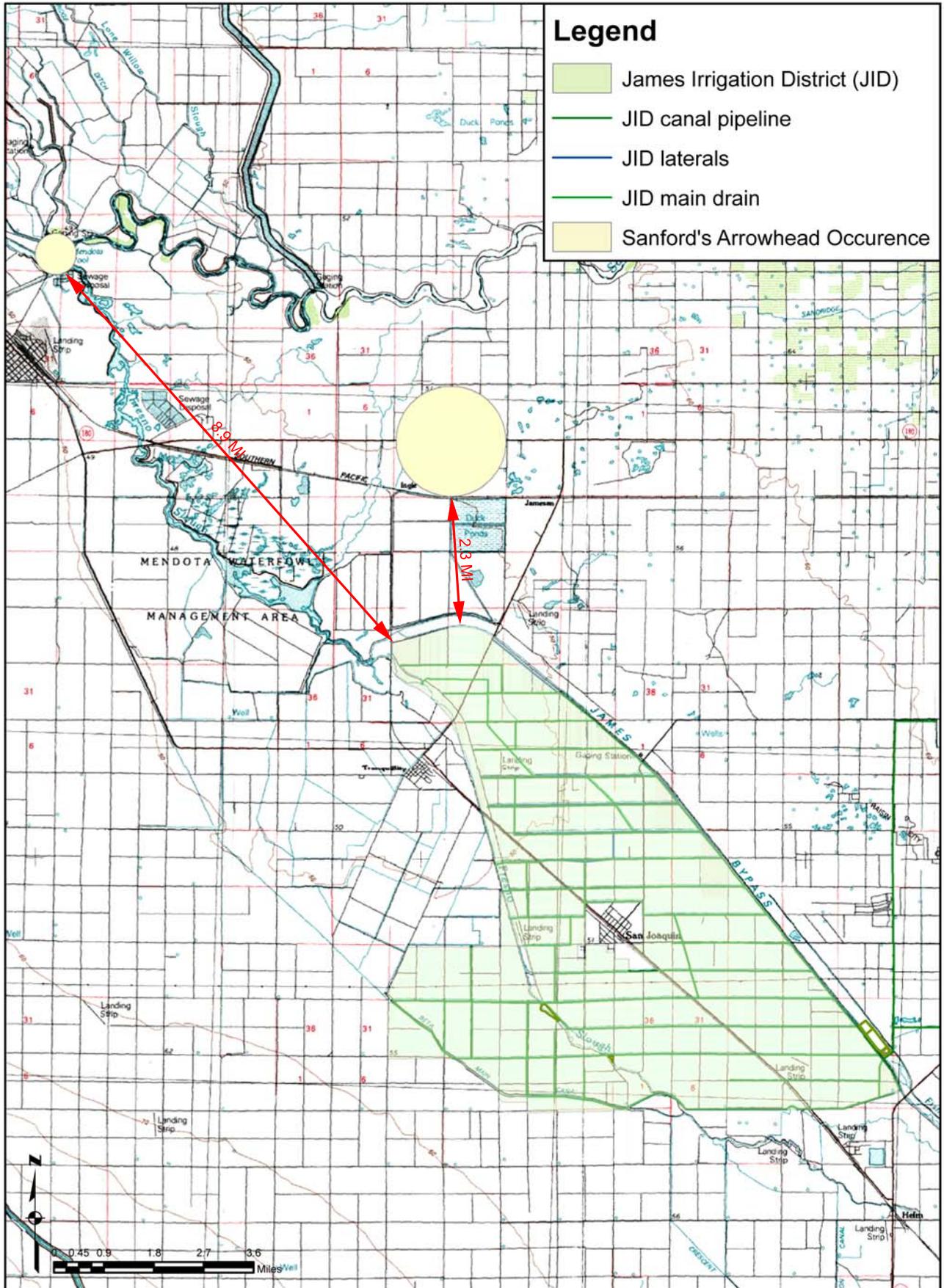


Image Source: USGS 30'x60' Mendota Quad (1982)



BLANKINSHIP & ASSOCIATES, INC.  
 1590 DREW AVENUE  
 SUITE 120  
 DAVIS, CA 95618  
 (530) 7570941

PROJECT:

James Irrigation District  
 IS & MND

FIGURE:

3

DESCRIPTION:

Historical Occurances of  
 Sanford's Arrowhead

DATE	DESCRIPTION	INIT.

DATE: 27 MAR 2014

### 3.5 Cultural Resources

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
--	--------------------------------	--	------------------------------	-----------

Would the Project:

a) Cause a substantial adverse change in the significance of a historical resource as defined in §15064.5?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d) Disturb any human remains, including those interred outside of formal cemeteries?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

### Discussion

Items a) through d): **No Impact.** The Project is confined to the District's canals and associated laterals. No known historical or archaeological resource, unique paleontological resource, unique geologic feature, or human remains in or out of formal cemeteries will be impacted.

### 3.6 Geology and Soils

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
--	--------------------------------	--	------------------------------	-----------

Would the Project:

a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
ii) Strong seismic-related ground shaking?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
iii) Seismic-related ground failure, including liquefaction?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
iv) Landslides?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Result in substantial soil erosion or the loss of topsoil?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
e) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

## Discussion

Items a) through e): **No Impact.** The Project consists of applying aquatic herbicides to the District's canals and associated laterals. The Project does not include any new structures, ground disturbances, or other elements that could expose persons or property to geological hazards. There would be no risk of landslide or erosion of topsoil. The Project would not require a septic or other wastewater system.

### 3.7 Hazards and Hazardous Materials

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
--	--------------------------------	--	------------------------------	-----------

Would the Project:

a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
--	--------------------------	--------------------------	--------------------------	-------------------------------------

## Discussion

Items a) & b): **Less Than Significant Impact.** The Project would involve handling aquatic herbicides which are regulated hazardous materials. Acute exposure to humans can cause eye, skin, and respiratory irritation, and can be harmful if swallowed. Refer to the representative MSDS presented in **Appendix E**. Use of this material would create a potential for spills that could affect worker safety and the environment. The spills could occur potentially at the District facility, at the point of application, or during transport.

The District handles, stores, transports aquatic herbicides, and disposes of containers in accordance with federal, state, and county requirements and manufacturer's recommendations. This approach is supplemented by the following components of the District's aquatic weed management program:

1. District personnel and their contractors that make aquatic herbicide applications are under the direct supervision of a Qualified Applicator Certificate or License holder (QAC/QAL). Expertise and training used by these personnel result in mitigating potentially significant impacts.
2. A written recommendation is prepared by a DPR-licensed Pest Control Advisor (PCA). A PCA undergoes 40 hours of training every 2 years on issues including health and safety and prevention of exposure to sensitive receptors. The written recommendation prepared by the PCA must evaluate proximity of occupied buildings and people, health and environmental hazards and restrictions, and a certification that alternatives and mitigation measures that substantially lessen any significant adverse impact on the environment have been considered and if feasible, adopted. Refer to **Appendix D**.
3. All District personnel and their contractors review and strictly adhere to the aquatic herbicide product label that has clear and specific warnings that alert users to hazards that may exist. An example of a specific product label is included in **Appendix E**.
4. All District personnel and their contractors review and consult the aquatic herbicide Material Safety Data Sheet (MSDS) in **Appendix E**, and the DPR Worker Health and Safety Branch Pesticide Safety Information Series (PSIS). The PSIS and the MSDS have specific information that describes precautions to be taken during the use of the aquatic herbicide.
5. District personnel obtain annual training on the use of acrolein, as described in the Magnacide H Herbicide Application and Safety Manual, if acrolein is anticipated to be used in a given year.
6. District personnel's familiarity with the DPR PSIS series mitigates potentially significant

impacts. For example, the PSIS series describes the personal protective equipment (PPE) needed for the safe handling of aquatic herbicides, including goggles, disposable coveralls, gloves and respirators.

7. The condition of the lateral(s) being treated is field evaluated to ensure that the application is necessary, feasible and can be conducted safely and according to label. This evaluation considers target weed species, level of infestation, water and flow conditions, alternate control methods, and amount of chemical to be applied.
8. Notice is given to the County Agricultural Commissioner (CAC) and the California Department of Fish and Wildlife (CDFW) for acrolein applications.
9. Growers are also given the opportunity to postpone water deliveries in case of sensitivities, such as organic crops. Growers are reminded not to make adjustments to the turnout gates during the hold period prescribed by the label for acrolein.
10. Prior to an application, District personnel seal spill structures at District drainage locations with boards and plastic if control structures are leaking
11. During and after the start of application, District personnel inspect acrolein treated laterals following treatment to ensure the label-prescribed 6 day hold time for acrolein is met before water is released. Water treated with acrolein is only used for irrigation of fields (crop bearing, fallow, or pasture) where the treated water remains on the field, or held for the label-prescribed period before being released or drained to fish bearing waters.
12. Control small leaks (< 1 gallon per minute) that may develop at gates or check structures with sand bags, installation of additional plastic around boards, temporary dikes, pumps, or by lowering the level of treated water below the elevation of the leak. All these actions effectively prevent the release of water treated with aquatic herbicide from leaving a canal or lateral.
13. The location at which the aquatic herbicide is introduced into the canal or lateral is continuously staffed until the application is complete. District staff performing inspections are in continuous cell phone or radio contact with staff at the head of the canal or lateral where the aquatic herbicide is being introduced. In the event that a spill or leak is discovered, addition of aquatic herbicide stops and water delivery to the canal or lateral is reduced or stopped. Not until the leak is fixed does aquatic herbicide application resume.

Item c): **No Impact.** There is one school within one-quarter mile of the Project area. Refer to **Figure 2.** Under normal operation, there is no risk associated with acrolein application. However, in order to be protective of sensitive populations, acrolein injections will not be made at any sites within one-quarter mile of an existing or proposed school. No such restriction exists for the use of copper-containing aquatic herbicides.

Item d): **No Impact.** The District does not contain any hazardous waste sites that are listed on hazardous waste site lists compiled in Government Code Section 65962.5 within its boundaries.

Items e) & f): **No Impact.** .The San Joaquin Airport lies within the District's boundary, however the use of this airport during project activity will not create a safety hazard for District personnel or their contractors.

Item g): **No Impact.** The Project will not impact emergency evacuation routes because public roadways are not be affected by the Project.

Item h): **No Impact.** The Project will not increase fire hazards at the project sites. Truck access and parking near application sites is done in such a manner so as to minimize muffler contact with dry grass.

### 3.8 Hydrology and Water Quality

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
--	--------------------------------	--	------------------------------	-----------

Would the Project:

a) Violate any water quality standards or waste discharge requirements?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
f) Otherwise substantially degrade water quality?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
g) Place housing within 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

h)	Place within a 100-year flood hazard area structures which would impede or redirect flood flows?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
i)	Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
j)	Inundation by seiche, tsunami, or mudflow?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

## Discussion

The District implements an Integrated Pest Management (IPM) program for aquatic weed control. The IPM program involves the scouting of aquatic weed locations and densities, establishment of thresholds above which control is needed, and making applications of aquatic herbicides on an “as-needed” basis to achieve the aquatic weed control necessary to convey water.

Depending on weed presence, aquatic herbicides containing copper and acrolein may be applied as necessary at different locations in the District, depending on need, between the months of March and November.

Aquatic herbicide applications are done over a short duration (typically less than approximately 12 hours per location) and not all canals or laterals are treated at the same time, for the same length of time, or treated every year. Depending on weed presence, some canals or laterals may not get treated at all while others may require multiple treatments the same season. Once water is treated with aquatic herbicides, it is either held for the time required on the product label or delivered to a grower’s field. Acrolein-treated water is delivered to grower’s fields and/or held in the conveyance system until the label-required hold time is met. Copper-based and acrolein-based herbicides will be discussed for checklist item a.) above. All other checklist items will be discussed together at the end of this section.

Prior to aquatic herbicide applications, the following tasks are accomplished:

1. A written recommendation is prepared by a DPR-licensed Pest Control Advisor (PCA). A PCA undergoes 40 hours of training every 2 years on issues including health and safety and prevention of exposure to sensitive receptors. The written recommendation prepared by the PCA must evaluate proximity of occupied buildings and people, health and environmental hazards and restrictions, and a certification that alternatives and mitigation measures that substantially lessen any significant adverse impact on the environment have been considered and if feasible, adopted. Refer to **Appendix D**.
2. All District personnel and their contractors review and strictly adhere to the aquatic herbicide product label that has clear and specific warnings that alert users to hazards that may exist. An example of a specific product label is included in **Appendix E**.
3. All District personnel and their contractors review and consult the aquatic herbicide Material Safety Data Sheet (MSDS) in **Appendix E**, and the DPR Worker Health and Safety Branch Pesticide Safety Information Series (PSIS). The PSIS and the MSDS

have specific information that describes precautions to be taken during the use of the aquatic herbicide. In addition, the District obtains annual training on the use of acrolein as described in the Magnacide-H Herbicide Application and Safety Manual.

4. The condition of the canals, laterals, and basins being treated is field evaluated to ensure that the application is necessary, feasible and can be conducted safely and according to label. This evaluation considers target weed species, level of infestation, water and flow conditions, alternate control methods, and amount of chemical to be applied.
5. Notices are sent to the County Agricultural Commissioner (CAC) and the California Department of Fish and Wildlife (CDFW) for acrolein applications. Growers are also given the opportunity to postpone water deliveries in case of sensitivities, such as pastures with lactating cows or organic crops.
6. Prior to an application, District personnel will seal spill structures with boards and plastic if any leaks are found.
7. During and after the start of application, District personnel inspect acrolein treated canals and laterals to ensure the label-prescribed 6 day hold time for acrolein is met before water is released. Water treated with acrolein is only used for irrigation of fields where the treated water remains on the field, or held for the label-prescribed 6 day hold time before being released.
8. The location at which the aquatic herbicide is introduced into the canal or lateral is continuously staffed until the application is complete. District staff performing canal and lateral inspections are in continuous cell phone or radio contact with staff at the head of the canal or lateral where the aquatic herbicide is being introduced. In the event that a spill or leak is discovered, addition of aquatic herbicide stops and water delivery to the canal or lateral is reduced or stopped. Not until the leak is fixed does aquatic herbicide application resume.

Item a): **Potentially Significant Unless Mitigation Incorporated.** As presented in Section 1.2, the District intends to obtain coverage under the 2004 General Permit that requires compliance with the SIP and the CTR.

### **Acrolein Discussion**

Application of acrolein according to label direction typically results in a concentration of approximately 5,000 µg/L in water, although applications may be made as high as the maximum label application rate of 15,000 µg/L. Water treated with acrolein is only used for irrigation of fields (crop bearing, fallow, or pasture) where the treated water remains on the field, and is not released to natural surfacewater.

Water quality criteria for acrolein are described in the:

- CTR as 320 µg/L for sources of drinking water and 780 µg/L for “other waters”;
- SWRCB 2013 NPDES Aquatic Vegetation and Algae Permit as 21 ug/L for water bodies with beneficial uses of cold or warm freshwater habitat.

The CTR value is based on human health protection for sources of drinking water and fish consumption. The Permit value is based on the CTR and USEPA Water Quality Criteria (SWRCB 2013). These water quality criteria are likely exceeded at and downstream of the point of aquatic herbicide use (i.e., the “treatment area”) when applied at labeled rates. Accordingly, because label application rates exceed the CTR water quality criteria, the District is obtaining a SIP exception.

The Permit specified acrolein WQO for beneficial uses “other than MUN, WARM, or COLD” of 780 ug/L applies to waters treated by the District.

Acrolein applications are made to moving water exposed to sunlight, generally during the summer months. As such, the combination of dilution, evaporation, and degradation due to exposure to water and sunlight result in relatively fast rates of degradation. Numerous references in scientific literature report half-lives ranging from 3-10.2 hours (Turner 2003, WHO 2002). Given a starting concentration of 15,000 µg/L and a conservatively estimated half-life of 10.2 hours, acrolein can reasonably be expected to dissipate according to **Table 2** below:

**Table 2. Anticipated Rate of Acrolein Degradation and Dissipation**

Time (Hours)	Time (Days)	Acrolein Concentration (µg/L)
0	0	15,000
12	0.5	6,636
24	1	2,936
48	2	575
60	2.5	254
72	3	113
78	3.25	75
84	3.5	50
90	3.75	33
96	4	22

As **Table 2** shows, only a short-term acrolein CTR water quality criteria exceedance will occur in District canals. The temporary acrolein CTR exceedance is estimated to return below the 780 ug/L WQO in less than 2 days, and less than 2.5 days to return below the 320 ug/L WQO. It is anticipated that the temporary acrolein RWQCB taste and odor exceedance will return below 110 ug/L in just over 3 days.

In spite of significant evidence that suggests that when used according to label directions by qualified personnel, impacts of the use of acrolein as an aquatic herbicide have no significant impact, the District will implement the following mitigation measures to continue operating without a significant impact and reduce any future potentially significant impacts to less than a significant level: This mitigation measure is:

**HWQ-1.** As required by the SIP and the Permit, the District will prepare and execute an Aquatic Pesticide Application Plan (APAP). The APAP will call for surfacewater

sampling and analysis before, during, and after Project completion to assess the impact, if any, that the Project may have on beneficial uses of water. Additionally, consistent with SIP exception requirements, the District will arrange for a qualified biologist to assess receiving water beneficial uses.

- BIO-1.** Mitigation for potential exposure of Sanford's arrowhead will be to have a qualified biologist, or District staff trained to recognize the species, survey the inside margins of the canals receiving treatment from the application point, continuing downstream until the herbicide is not expected to be present. The distance to be surveyed prior to an acrolein application will be the distance the acrolein-treated water would travel approximately 24 hours.

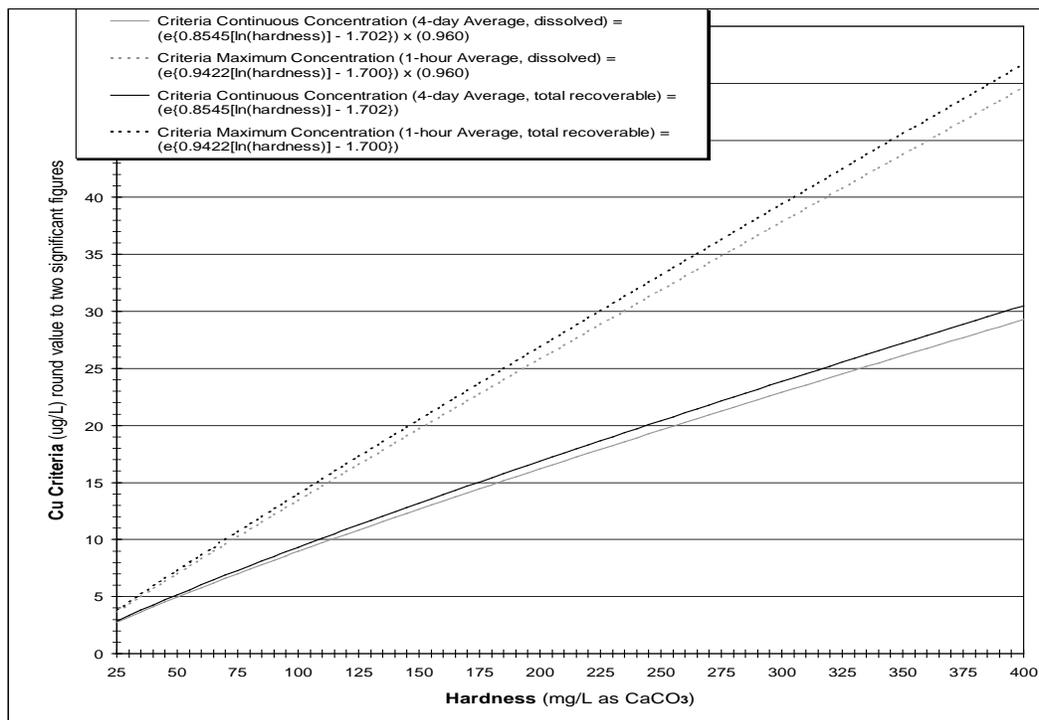
If Sanford's arrowhead is found, the application of acrolein will be postponed until such time as the direct exposure of the plant stems to canal water can be eliminated. One way to eliminate exposure of Sanford's arrowhead to treated water is to lower the water level in the canal below the elevation of the emergent parts of the plant. Once the water will no longer contact the plant, the canal and lateral, or basin may be treated.

With this mitigation, a less than significant impact exists to these species. By regularly monitoring and reporting the presence/absence of Sanford's arrowhead in its canals, laterals, and basins, the District will be able to identify potential problems and take corrective action if necessary.

### **Copper Discussion**

Applications of copper-based aquatic herbicides according to label direction typically require concentrations of copper between 350 and 2,000 µg/L. Water quality criteria for copper as described in the CTR and by the Central Valley RWQCB (RWQCB 2003) are hardness-dependent. Refer to **Figure 4**. District water varies in hardness throughout the season.

Figure 4. Copper Criteria Dependence on Hardness



Based on the relation of copper criteria to hardness, the Permit defined copper concentration criteria for a continuous dissolved concentration (4 day average) would be:

$$\text{Continuous Dissolved Copper Concentration} = e^{(0.8545[\ln(\text{hardness})]-1.702)} * (0.96)$$

For example, if a lateral has a hardness of 100 mg CaCO<sub>3</sub>/L, the continuous dissolved concentration (4 day average) water quality criteria for copper in District canals, laterals, regulation and recharge basins will be approximately 9.0 µg/L.

These water quality criteria maybe exceeded downstream of the point of aquatic herbicide use (i.e., outside of the treatment area or in receiving waters”) when applied at labeled rates. Accordingly, because label application rates may exceed the CTR water quality criteria, the District is obtaining a SIP exception.

As a result of both dilution and uptake, copper-containing aquatic herbicides applied in District canals, laterals, regulation and recharge basins rapidly dissipate and/or become permanently insoluble and as a result are not bioavailable shortly after application (CDFA 2002; Trumbo 1997, 1998; WA DOE 2004). When copper is applied according to label direction, its half-life is estimated at between 3 and 19 hours due to a combination of precipitation, absorption by biota, adsorption by particulate matter, and adsorption or complexation with organic matter. Refer to **Appendix C**.

Given a starting concentration of 2000 µg/L and a conservative half-life of 19 hours, copper can reasonably be expected to dissipate and no longer be bioavailable according to **Table 3** below:

**Table 3. Anticipated Rate of Copper Dissipation**

Time (Hours)	Time (Days)	Estimated Copper Concentration (µg/L)
0	0	2,000
6	0.25	1,607
12	0.5	1,291
24	1	833
48	2	347
72	3	145
96	4	60
120	5	25
144	6	10
168	7	4.4
192	8	1.8
216	9	0.76
240	10	0.32
264	11	0.13
288	12	0.05
312	13	0.02

As **Table 3** shows, only a short-term (less than 7 days) CTR copper water quality criteria exceedance may occur in District canals.

In addition to using a hardness based approach to quantifying copper water quality criteria, the USEPA suggests the use of another model, described below, to analyze and/or predict toxicity of bioavailable copper in the water column. In the 2007 revision of Aquatic Life Ambient Freshwater Quality Criteria-Copper (EPA 2007), the USEPA recommended the Biotic Ligand Model (BLM) as a more accurate approach for assessing toxicity and deriving freshwater quality criteria for copper. The BLM supplements USEPA's previously published recommendation of using the hardness-based estimation and better accounts for the reduction in copper bioavailability that results from competitive binding of copper to other molecules in the water column.

The BLM was developed to predict copper toxicity to aquatic organisms in relation to water quality parameters including pH, hardness, alkalinity, and dissolved organic carbon (DOC). According to the BLM, copper bioavailability is strongly influenced by these parameters. The free cupric ion ( $\text{Cu}^{2+}$ ) is the primary driver of copper bioavailability and toxicity in aquatic ecosystems (EPA 2007).

In order to derive freshwater quality criterion for copper, the BLM uses ten water quality inputs: temperature; pH; dissolved organic carbon (DOC); major cations including calcium (Ca), magnesium (Mg), sodium (Na), potassium (K); major anions including sulfate ( $\text{SO}_4$ ), chloride (Cl); and alkalinity. Copper may be measured for comparison with site-specific criteria, but it is not required as an input to the model to determine copper freshwater quality

criteria. The BLM-based water quality criterion for copper may be more or less stringent than the hardness-based criteria depending on the water quality parameters. However, it is a more accurate than hardness-based criteria because it is based on copper bioavailability to aquatic species.

The BLM may also be used to predict copper toxicity and speciation in varying water conditions. When the model is run in toxicity prediction mode, it predicts the concentration of dissolved copper that produces a particular endpoint (e.g. NOAEL, LOAEL, or LC<sub>50</sub>) for the selected aquatic species. When run in speciation prediction mode, the model can determine the various forms (e.g. CuCO<sub>3</sub>, Cu<sup>2+</sup>, copper bound to DOC) and concentrations of copper in the water when known copper concentration in water is input in the model.

Using the Biotic Ligand Model in copper speciation prediction mode, a total of 27 graphs have been generated to illustrate how variations in water quality parameters including pH, hardness, alkalinity, and dissolved organic carbon (DOC) influence the concentration of bioavailable Cu<sup>2+</sup> (see **Appendix C**). Generally, an increase in one or more of the four water parameters lowers the concentration of the Cu<sup>2+</sup> species, thereby lowering the bioavailability of copper.

When used according to label directions by qualified personnel, impacts of copper-containing aquatic herbicides are expected to have no significant impact. The District will implement the following mitigation measure for applications of copper to continue operating without a significant impact and reduce any future potentially significant impacts to less than a significant level: These mitigation measures for applications of copper are:

**HWQ-1.** As required by the SIP and the SWRCB general permit for the application of aquatic herbicides, the District will prepare and execute an Aquatic Pesticide Application Plan (APAP). The APAP will call for surfacewater sampling and analysis before, during, and after project completion to assess the impact, if any, that the Project may have on beneficial uses of water. Additionally, consistent with SIP exception requirements, the District will arrange for a qualified biologist to assess receiving water beneficial uses.

Item b): **No Impact.** The Project would not involve any construction activities or require the use of groundwater and therefore there is no impact on groundwater recharge or supplies.

Items c), d) & e): **No Impact.** The Project will not involve construction of any structures that would alter drainage patterns or increase storm water runoff. The Project would not increase erosion or siltation on- or off-site. No streambeds would be altered. No increase in drainage capacity of local storm sewers would be required.

Item f): See response to item a).

Items g), h), i) & j): **No Impact.** Since the Project would involve no new construction, no housing or other structures would be placed within a designated 100-year floodplain. The Project would not alter the floodplain or have the potential to redirect flood flows. The Project would not be subject to tsunami or inundation due to mudflows. Nor would the Project expose personnel to a substantial risk due to seiche waves or from flooding as a result of a catastrophic dam failure.

### 3.9 Land Use Planning

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
--	--------------------------------	--	------------------------------	-----------

Would the Project:

a) Physically divide an established community?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

#### Discussion

Item a): **No Impact.** The Project will be implemented within the District's existing canals, laterals, and basins. The Project would not result in any division of an established community.

Item b): **No Impact.** The Project will not create any new land uses or alter any existing uses and would not conflict with any applicable land use plan, policy or agency regulation.

Item c): **No Impact.** Refer to Section 3.4, item f). No known plan conflicts with the Project.

### 3.10 Mineral Resources

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
--	--------------------------------	--	------------------------------	-----------

Would the Project:

a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan other land use plan?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

#### Discussion

Items a) & b): **No Impact.** The Project involves the addition of aquatic herbicides to the District's canals, laterals, regulation and recharge basins and has no impact on the availability of any known mineral resource recovery site.

### 3.11 Noise

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
--	--------------------------------	--	------------------------------	-----------

Would the Project result in:

a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

### Discussion

Items a) through d): **No Impact.** Project activity occurs in rural and agricultural areas that commonly have machinery operating that include tractors, generators, large groundwater and irrigation pumps and heavy trucks. The incidental noise and vibration generated by the

use of pick-up or flatbed trucks is temporary and inconsequential and thus will have no impact.

Items e) & f): **No Impact.** The San Joaquin Airport is located within the District, however project activity will not interfere with the continued operation of adjacent public or private airstrips nor would the project expose people residing or working in the project area to excessive noise levels.

### 3.12 Population and Housing

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
--	--------------------------------	--	------------------------------	-----------

Would the Project:

a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Displace substantial numbers of existing housing units, necessitating the construction of replacement housing elsewhere?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

#### Discussion

Items a) through c): **No Impact.** No new homes, roads or other infrastructure will be required. No displacement of existing homes or people will occur.

### 3.13 Public Services

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Fire protection?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Police protection?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Schools?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Parks?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Other public facilities?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

#### Discussion

Item a): **No Impact.** The Project will not alter or require the construction of new schools, parks, or other public facilities, nor will it increase the need for police and fire services beyond existing conditions.

### 3.14 Recreation

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse effect on the environment?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

#### Discussion

Items a) & b): **No Impact.** The Project takes place in the District's canals, laterals, and basins. District policy strictly prohibits swimming and fishing in canals, laterals, regulation and recharge basins. Treatment of aquatic vegetation improves the ability of the District to deliver water for irrigation purposes and has no impact on recreational activities.

### 3.15 Transportation/Traffic

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
--	--------------------------------	--	------------------------------	-----------

Would the Project:

a) Cause an increase in traffic which is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in either the number of vehicle trips, the volume to capacity ratio on roads, or congestion at intersections)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads or highways?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that result in substantial safety risks?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
e) Result in inadequate emergency access?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
f) Result in inadequate parking capacity?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
g) Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., bus turnouts, bicycle racks)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

#### Discussion

Items a) & b): **No Impact.** The Project involves the use of light to medium duty trucks that will not cause an increase in traffic that is substantial in relation to the existing traffic load and capacity of the county roads in the project area.

Item c): **No Impact.** The Project has no influence on air traffic.

Items d) through g): **No Impact.** The Project does not involve changes in road design or encourage incompatible road or highway uses. Further, the Project does not impact

emergency access or parking. Lastly, the Project does not impact or conflict with adopted policies, plans, or programs supporting alternative transportation.

### 3.16 Utilities and Service Systems

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
--	--------------------------------	--	------------------------------	-----------

Would the Project:

a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
e) Result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
g) Comply with federal, state, and local statutes and regulations related to solid waste?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

#### Discussion

Items a) & b), and e) through g): **No Impact**. The Project does not discharge to a wastewater treatment plant and does not generate any solid waste. All containers used to store and transport aquatic herbicides are returned to the vendor for reuse or disposed of in a lawful manner.

Item c): **No Impact.** The Project will not require the construction of new storm water drainage facilities or expansion of existing facilities.

Item d): **No Impact.** The Project involves the treatment of aquatic vegetation in canals, laterals, and basins used to convey irrigation water and has no known influence on the entitlements or resources utilized by the District.

### 3.17 Mandatory Findings of Significance

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal, or eliminate important examples of the major periods of California history or prehistory?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
c) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Item a): **Potentially Significant Unless Mitigation Incorporated.** The Project involves the use of copper and acrolein-based aquatic herbicides introduced into the District's canals, laterals, and basins at concentrations that temporarily exceed CTR water quality objectives. Significant evidence suggests that when used according to label directions by qualified personnel, CTR exceedance is short-term and impacts of these aquatic herbicides are less than significant.

However, the District will implement mitigation (**BIO-1 and HWQ-1**) to reduce any future potential impacts to less than a significant level.

Although copper and acrolein are hazardous materials, under the standard operating

procedures used District personnel and their contractors, less than a significant impact exists.

Item b): **Less Than Significant Impact.** The cumulative impacts of continued application of copper-based herbicides is not known. Specifically, the extent to which copper accumulates and is bioavailable, if at all, is not clear. Acrolein is known to degrade rapidly and not accumulate. Mitigation has been incorporated into the Project (**BIO-1 and HWQ-1**). This mitigation reduces the impact to a less than a significant.

Item c): **Less Than Significant Impact.** As a result of implementation of District standard procedures as described in the Hazards and Hazardous Materials section, any hazard/hazardous material impacts to the human beings is reduced to a less than a significant level.

## 4.0 LIST OF MITIGATION MEASURES

### 4.1 *Biological Resources*

**BIO-1.** Mitigation for potential exposure of Sanford's arrowhead to acrolein will be to have a qualified biologist, or District staff trained to recognize the Sanford's arrowhead, complete a pre-application survey the inside margins of the canals receiving treatment from the application point, continuing downstream until the herbicide is not expected to be present. The distance to be surveyed prior to an acrolein application will be the distance the acrolein-treated water would travel approximately 24 hours.

If Sanford's arrowhead is found, the application of acrolein will be postponed until such time as the direct exposure of the plant stems to canal water can be eliminated. One way to eliminate exposure of Sanford's arrowhead to treated water is to lower the water level in the canal below the elevation of the emergent parts of the plant. Once the water will no longer contact the plant, the canal and lateral may be treated.

With this mitigation, a less than significant impact exists to these species. By regularly monitoring and reporting the presence/absence of Sanford's arrowhead in its canals, laterals, regulation and recharge basins, the District will be able to identify potential problems and take corrective action if necessary.

### 4.2 *Hydrology & Water Quality*

**HWQ-1.** As required by the SIP and the Permit, the District will revise its Aquatic Pesticide Application Plan (APAP) to reflect the use, monitoring and reporting of copper and acrolein upon being listed on the SIP Exception list of the permit. The APAP will call for surfacewater sampling and analysis before, during, and after Project completion to assess the impact, if any, that the Project may have on beneficial uses of water. Additionally, consistent with SIP exception requirements, the District will arrange for a qualified biologist to assess receiving water beneficial uses.

## 5.0 REFERENCES

- California Toxics Rule (CTR), May 18, 2000. 65 Federal Register 31682-31719 (Adds Section 131.38 to 40 CFR).
- California Department of Food and Agriculture (CDFA). 2002. The California Department of Food and Agriculture Hydrilla Eradication Program water monitoring report, 2002.
- Office of Pesticide Programs. 2000. Pesticide Ecotoxicity Database (Formerly: Environmental Effects Database (EEDB)). Environmental Fate and Effects Division. U.S. EPA, Washington, D.C.
- Regional Water Quality Control Board, Central Valley Region (RWQCB). 2003. A Compilation of Water Quality Goals. Updated September 2011.
- SWRCB, 2000. The Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries in California (the State Implementation Plan, or SIP).
- SWRCB, 2004. Water Quality Order No. 2004-0009-DWQ; Statewide General National Pollutant Discharge Elimination System Permit for the Discharge of Aquatic Pesticides for Aquatic Weed Control in Waters of the United States; General Permit No. CAG990005. Revised June 7, 2006.
- SWRCB, 2013. Water Quality Order No. 2013-0002-DWQ; General Permit No. CAG990005; Statewide General National Pollutant Discharge Elimination System (NPDES) Permit for Residual Aquatic Pesticide Discharges to Waters of the United States from Algae and Aquatic Weed Control Applications. Available: [http://www.waterboards.ca.gov/water\\_issues/programs/npdes/docs/aquatic/weedcontrol/wp2013\\_002dwq.pdf](http://www.waterboards.ca.gov/water_issues/programs/npdes/docs/aquatic/weedcontrol/wp2013_002dwq.pdf).
- Trumbo, J. 1997. Environmental monitoring of Hydrilla eradication activities in Clear Lake, 1996. State of California, The Resources Agency, Department of Fish and Game. Rancho Cordova, California.
- Trumbo, J. 1998. Environmental monitoring of Hydrilla eradication activities in Clear Lake, 1997. State of California, The Resources Agency, Department of Fish and Game. Rancho Cordova, California.
- Turner, L. 2003. Acrolein analysis of risks from the aquatic herbicide use in irrigation supply canals to eleven evolutionary significant units of Pacific salmon and steelhead. U.S. Environmental Protection Agency, Office of Pesticide Programs, Environmental Field Branch. 49 pp.
- U.S. Environmental Protection Agency (USEPA). 1989. Environmental Protection Agency: Endangered species protection program. Federal Register 54(126): 27984-28008.
- USEPA. 1993. Wildlife Exposure Factors Handbook. U.S. Environmental Protection Agency. Report EPA/600/R-93/187.
- USEPA. 1999. Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities. Solid Waste and Emergency Response. EPA/530-D-99-001A.
- USEPA. 2004. Overview of the ecological risk assessment process in the Office of Pesticide Programs, U.S. Environmental Protection Agency. Endangered and Threatened Species Effects Determinations. U.S. Environmental Protection Agency, Office of Prevention, Pesticides and Toxic Substances, Office of Pesticide Programs, Washington, D.C. 92 pp. Available <http://www.epa.gov/espp/consultation/ecorisk-overview.pdf>.
- USEPA. 2007 Aquatic Life Ambient Freshwater Quality Criteria – Copper: 2007 Revision. Office of Water. EPA-822-R-07-001.

USEPA. 2013. ECOTOX User Guide: ECOTOXicology Database System. Version 4.0. Available:  
<http://www.epa.gov/ecotox/>.

WA DOE. 2004. Washington Department of Ecology SEIS for Aquatic Herbicides Vol 6, Section 3, Copper  
Environmental Fate Table 3.5

WHO. 2002. Acrolein, Concise International Chemical Assessment Document 43. World Health  
Organization, The International Programme on Chemical Safety. 49 pp.

## **6.0 LIST OF PREPARERS**

- 1.) John Mallyon, James Irrigation District
- 2.) Ken Mancini, James Irrigation District
- 3.) Michael S. Blankinship, PE, PCA, Blankinship & Associates, Inc.
- 4.) David Bonnar, Staff Scientist, Blankinship & Associates, Inc.
- 5.) Stephen Burkholder, Project Scientist, Blankinship & Associates, Inc.
- 6.) Kenny Tanaka, Staff Engineer, Blankinship & Associates, Inc.
- 7.) Lindsey Curley, Staff Scientist, Blankinship & Associates, Inc.
- 8.) Ryan Beil, Staff Scientist, Blankinship & Associates, Inc.

This page intentionally left blank.

# Appendix A

(Species Descriptions)

## Approach

A Habitat Assessment of the James Irrigation District project site was conducted by Blankinship & Associates, Inc. staff to characterize the habitats present on-site and the likelihood of special status species occurring on the project site.

A list of these special species was compiled using a records search of the California Natural Diversity Database (CNDDDB). Location specific species data is available from both of these sources, and organized geographically into 7.5 minute U.S.G.S. quads. The CNDDDB database was queried using the boundary map for the District, and selecting all 7 quads that intersect with the District's boundaries. In addition, a buffer area made up of the 16 outlying quads adjacent to the original 5 quads was selected for the query, resulting in a total of 23 quads. This approach was used to identify species that might be located in the surrounding areas, but not necessarily reported to CNDDDB as a sighting event within the District boundaries.

Habitat requirements of each of the species were reviewed to determine whether habitat existed within the project area that would meet that species' needs. The breeding or foraging habitat of animals and the habitat requirements of plant species likely to occur in the project area are fully described in below.

## Amphibians

### California Tiger Salamander (*Ambystoma californiense*)

California tiger salamanders are restricted to the Central Valley of California and to lower elevations to the west. Some populations have been extirpated due to urbanization and conversion of native grasslands and wetlands to agriculture (Fisher and Shaffer 1996 in Petranka 1998). They breed in fish-free, seasonally ephemeral ponds. Juveniles and adults are fossorial and are rarely seen other than during the winter breeding season. Breeding migrations occur from November to March (Storer 1925 in Petranka 1998). They commonly use California ground squirrel (*Spermophilus beecheyi*) or valley pocket gopher (*Thomomys bottae*) burrows for summer aestivation. During the summer when herbicide applications will be made, adults will be underground aestivating, and irrigation canals would be not suitable habitat for developing tadpoles, so the risk posed from aquatic herbicides for the control of aquatic weeds in irrigation canals is **unlikely**.

### Western Spadefoot Toad (*Spea (=Scaphiopus) hammondi*)

Western spadefoot toads are almost completely terrestrial, entering water only to breed (see Dimmitt and Ruibal 1980 in Jennings and Hayes 1994). Western spadefoots become surface active following relatively warm (> 10.0-12.8°C) rains in late winter-spring and fall, emerging from burrows in loose soil to a depth of at least 1 m (Stebbins 1972 in Jennings and Hayes 1994, A. McCready, pers. comm. in Jennings and Hayes 1994), but surface activity may occur in any month between October and April if enough rain has fallen (Morey and Guinn 1992 in Jennings and Hayes 1994, S. Morey, pers. comm. in Jennings and Hayes 1994). Since western spadefoot toads are not likely to enter water during the season when aquatic weeds will need to be controlled in irrigation canals, the risk posed from aquatic herbicides for the control of aquatic weeds in irrigation canals is **unlikely**.

## Birds

### Tricolored Blackbird (*Agelaius tricolor*)

Breeding habitat of tricolored blackbirds includes large marshes (Payne 1969 in Beedy and Hamilton 1999). Nesting colonies are generally in emergent aquatic vegetation, but may also be found in trees along streams, weed patches, and grain and alfalfa fields, mustard, safflower, thistle, along an irrigation ditch, or in trees along a river (Orians 1960, 1961). In the Central Valley of California, breeding colonies were described where nests were placed in cattail-bulrush in dry and irrigated pasture; cattail in dry grassland, along a creek, rice and wheat fields, or dry and irrigated pasture; and in blackberry in dry grassland and along a creek (Crane and DeHaven 1977). Tricolored blackbirds forage in cultivated row crops, orchards, vineyards, and heavily grazed rangelands, but these are considered low-quality forage habitats. High quality forage areas included irrigated

pastureland, lightly grazed rangeland, dry seasonal pools, mowed alfalfa fields, feedlots, and dairies (Beedy and Hamilton 1997 in Beedy and Hamilton 1999). In the Central Valley of California, nestling tricolored blackbirds were fed 86% animal matter on a volumetric basis, 11.2% plant matter, and 2.7% grit. The animal matter was primarily insects (79% of total diet) with the majority being beetles (61% of total diet). Plant matter was split evenly between cultivated grains such as oats, wheat and miscellaneous plant matter (Crane and DeHaven 1977). Since tricolored blackbirds are unlikely to feed directly from the treated canals, the risk posed from aquatic herbicides for the control of aquatic weeds in irrigation canals is **insignificant**.

#### **Short-eared owl (*Asio flammeus*)**

Habitat types preferred by short-eared owls include marshes and bogs, prairies and grassy plains, meadows, open woodland, and other areas that are generally open with low-growing vegetation and dry upland for nesting. Short-eared owls prefer to nest on the ground in small depressions with some form of cover (grass or small shrub) and high rodent densities (NatureServe 2013). In winter, they congregate and roost communally, picking shelter areas near hunting grounds. Winter roosts include commercial areas such as abandoned dumps, gravel pits, and storage yards and rural areas such as grass fields and small tree groves (NatureServe 2013). These owls prey mostly on small mammals (voles, mice) but will also pick up bird prey in flight. Habitat is greatly dependent on proximity to food sources (Martin 1990). Short eared owls do not prey on species likely to be exposed to herbicides in irrigation canals, so the risk posed from aquatic herbicides for the control of aquatic weeds in irrigation canals is **insignificant**.

#### **Burrowing Owl (*Athene cunicularia*)**

Burrowing owls inhabit dry, open, shortgrass, treeless plains, and are often associated with burrowing mammals. They can also be found at golf courses, cemeteries, road allowances within cities, airports, vacant lots in residential areas and university campuses, and fairgrounds. The presence of a nest burrow seems to be a critical requirement for western burrowing owls (Thomsen 1971 in Haug *et al.* 1993, Martin 1973 in Haug *et al.* 1993, Zarn 1974 in Haug *et al.* 1993, Wedgwood 1978 in Haug *et al.* 1993, Haug 1985 in Haug *et al.* 1993). They typically forage in shortgrass, mowed, or overgrazed pastures; golf courses and airports (Thomsen 1971 in Haug *et al.* 1993). They are opportunistic feeders, eating primarily arthropods, small mammals, and birds. Amphibians and reptiles constitute a minor component to the diet and possibly only in Florida (Wesemann and Rowe 1987 in Haug *et al.* 1993). The terrestrial nature of their foraging habitats and prey base indicate that the risk posed from aquatic herbicides for the control of aquatic weeds in irrigation canals is **insignificant**.

#### **Swainson's Hawk (*Buteo swainsoni*)**

Swainson's hawks forage in open stands of grass-dominated vegetation, sparse shrublands, and small, open woodlands. They have adapted well to foraging in agricultural areas (e.g., wheat and alfalfa), but cannot forage in most perennial crops or in annual crops that grow much higher than native grasses (Bechard 1982 in England *et al.* 1997, Estep 1989 in England *et al.* 1997, Woodbridge 1991 in England *et al.* 1997). In Central Valley, CA, they forage in row, grain, and hay crop agriculture, particularly during and after harvest, when prey are both numerous and conspicuous. They also are attracted to flood irrigation, primarily in alfalfa fields, when prey take refuge on field margins, and to field burning, which forces prey to evacuate (J.A. Estep per. comm. in England *et al.* 1997). During breeding season, Swainson's hawks mainly feed on vertebrates, including mammals, birds, and reptiles (Schmutz *et al.* 1980 in England *et al.* 1997, Bednarz 1988 in England *et al.* 1997). Invertebrates (especially grasshoppers and dragonflies) are commonly eaten at other times (McAtee 1935 in England *et al.* 1997, Sherrod 1978 in England *et al.* 1997, Jaramillo 1993 in England *et al.* 1997). Swainson's hawks do not prey on species likely to be exposed to herbicides in irrigation canals, so the risk posed from aquatic herbicides for the control of aquatic weeds in irrigation canals is **insignificant**.

#### **Bank Swallow (*Riparia riparia*)**

Bank swallows migrate between discrete breeding habitats along banks and bluffs of rivers, streams, and coastal areas, and winter foraging habitats (Garrison, 1999). They nest in large colonies and are found from sea level to 2100 meters elevation. The bank swallow forages in wetlands, large bodies of water, grasslands, agricultural areas, and open woodlands primarily in the winter (Garrison, 1999). Bank swallows primarily eat insects that are caught in flight although occasionally terrestrial or aquatic insects or insect larvae may be eaten. Most studies show that the bank swallow eats at least a diet of 99% insects (Garrison, 1999). Species may forage for

emergent aquatic insects over water that may bioaccumulate copper. But, given the large amount of potential foraging area, the emergent aquatic insects from treated canals would likely only contribute an insignificant percentage of the total diet. Therefore, no risk due to copper exposure is anticipated and the risk posed from aquatic herbicides for the control of aquatic weeds in irrigation canals is **insignificant**.

## **Fish**

No fish exist in James Irrigation District canals, laterals, regulation or recharge basins. Therefore the risk to fish posed from aquatic herbicides for the control of aquatic weeds in irrigation canals is **insignificant**.

## **Mammals**

### **Pallid Bat (*Antrozous pallidus*)**

Pallid bats inhabit arid deserts and grasslands, often near rocky outcrops and water. They are less abundant in evergreen and mixed conifer woodland. They usually roost in a rock crevice or building, less often in cave, tree hollow, mine, etc. (NatureServe 2004). In Oregon, night roosts were in buildings, under rock overhangs, and under bridges; bats generally were faithful to particular night roosts both within and between years (Lewis 1994 in NatureServe 2004). They prefer narrow crevices in caves as hibernation sites (Caire *et al.* 1989 in NatureServe 2004). The primary diet is arthropods which are captured on the ground, after an aerial search. They also capture some food (large insects) in flight, within a few meters of ground vegetation. Food items include flightless arthropods, Jerusalem crickets, moths, beetles, etc.; may eat small vertebrates (NatureServe 2004). Since their diet consists of mostly terrestrial insects, the risk posed from aquatic herbicides for the control of aquatic weeds in irrigation canals is **insignificant**.

### **Western Red Bat (*Lasiurus blossevillii*)**

The western red bat inhabits grasslands, shrublands, open woodlands, and riparian areas. They typically roost in forests or woodlands, showing a preference for edge habitat (NatureServe 2004, Zeiner *et al.* 1988). Western red bats often roost in tree foliage along edge habitat, with preference given to sites with protection from above and below. They feed on moths, crickets, beetles and flying ants (Zeiner *et al.* 1988). Since their diet consists of mostly terrestrial insects, the risk posed from aquatic herbicides for the control of aquatic weeds in irrigation canals is **insignificant**.

### **Hoary bat (*Lasiurus cinereus*)**

The hoary bat is the most widespread bat in the United States. The bat winters along the coast of California and breeds inland. The bat tends to roost in dense foliage of trees and cavities, such as woodpecker holes (Shump and Shump 1982). They forage in open areas within forest, woodland riparian, and wetland habitats primarily after sundown (Shump and Shump 1982). The primary food source for hoary bats are moths, but they also eat other insects including beetles, flies, grasshoppers, and dragonflies (Shump and Shump 1982). Since their diet consists of mostly terrestrial insects, the risk posed from aquatic herbicides for the control of aquatic weeds in irrigation canals is **insignificant**.

### **Yuma myotis (*Myotis yumanensis*)**

*Myotis yumanensis* is a nocturnal bat found in western North America in habitats ranging from juniper and riparian woodlands to desert regions near open water (Nowak, 1991). *M. yumanensis* is closely associated with water in order to forage and otherwise found roosting in structures such as attics, buildings, mines, and caves. They usually feed over water beginning at dusk and prey consists of small insects such as beetles, moths, and craneflies (Whitaker, 1996). Species may forage for emergent aquatic insects over water that may bioaccumulate copper. But, given the large amount of potential foraging area, the emergent aquatic insects from treated canals would likely only contribute an insignificant percentage of the total diet. Therefore, no risk due to copper exposure is anticipated and the risk posed from aquatic herbicides for the control of aquatic weeds in irrigation canals is **insignificant**.

## Reptiles

### **Giant Garter Snake (*Thamnophis gigas*)**

Giant garter snakes occur in streams and sloughs, usually with mud bottom (Stebbins 1985 in NatureServe 2004). One of the most aquatic of garter snakes; usually in areas of freshwater marsh and low-gradient streams with emergent vegetation, also drainage canals and irrigation ditches (CDFG 1990 in NatureServe 2004) and ponds and small lakes (USFWS 1993 in NatureServe 2004). Usually in areas of permanent water, sometimes in areas of temporary water such as irrigation/drainage canals and (less often) rice fields (Biosystems Analysis, Inc. 1989 in NatureServe 2004, USFWS 1993 in NatureServe 2004). Adult and immature snakes eat small mammals, invertebrates, and fish (NatureServe 2004). While their habitat requirements and feeding habits may overlap with habitats found adjacent to the Project Area, the giant garter snake has not been found within the Project Area. As such, they are not likely to be present when aquatic weeds will need to be controlled in irrigation canals; the risk posed from aquatic herbicides for the control of aquatic weeds in irrigation canals is **unlikely**.

### **Western Pond Turtle (*Emys marmorata*)**

The western pond turtle is found in permanent and intermittent waters of rivers, creeks, small lakes and ponds, marshes, unlined irrigation canals, and reservoirs. Populations can be found in water bodies in urban areas (Sprinks and Shaffer 2005). The turtle often basks on logs, vegetation mats, or rocks, but when disturbed seeks cover underwater (Bury 1972). Western pond turtles are omnivorous eating a variety of aquatic plant material, insects, and aquatic invertebrates (Stebbins 1972, Nussbaum et al. 1983). While their habitat requirements and feeding habits may overlap with habitats found within and adjacent to the Project Area, the western pond turtle has not been found within the Project Area. As such, they are not likely to be present when aquatic weeds will need to be controlled in irrigation canals; the risk posed from aquatic herbicides for the control of aquatic weeds in irrigation canals is **unlikely**.

## Invertebrates

There are no special status invertebrates with habitat present in the project area. Therefore the risk to invertebrates posed from aquatic herbicides for the control of aquatic weeds in irrigation canals is **insignificant**.

## Plants

### **Sanford's Arrowhead (*Sagittaria sanfordii*)**

Sanford's arrowhead is a rhizomatous monocot that is native and endemic to California (CalFlora 2005). It is an aquatic perennial herb that occurs in freshwater wetlands, marshes, swamps, and other assorted shallow freshwater (CNPS 2012). Sanford's arrowhead is a member of the Water Plantain family; it is an obligate wetland plant. Its habitat includes the margins of wetland areas such as streams, rivers, ponds, drainage channels, or irrigation canals. Potential habitat for this species is present in the project area. It is native to California and is endemic (limited) to California alone. It is included in the CNPS Inventory of Rare and Endangered Plants on list [1B.2](#) (rare, threatened, or endangered in CA and elsewhere).

Since Sanford's arrowhead may occur at the margins of District canals, and its stems may be underwater, it could come into contact with acrolein- or copper-treated water. After an application of a copper-containing herbicide, there will not be sufficient contact time, or copper concentration to adversely affect the plant's stems. Following an application of acrolein, the treatment rate is such that the plant's stems may be adversely affected. As such, the impact to Sanford's arrowhead may be potentially significant without mitigation incorporated. Implementation of Mitigation Measure Bio-1 would reduce the impact of Project activities associated with the application of acrolein to **less than significant**.

## References

- American Ornithologists' Union. 1998. Check-list of North American birds. 7<sup>th</sup> edition. American Ornithologists' Union, Washington, DC.
- Bechard M.J. 1982. Effect of vegetative cover on foraging site selection by Swainson's hawk. *Condor* 84: 153-159.
- Bednarz, J.C. 1988. A comparative, study of the breeding ecology of Harris' and Swainson's hawks in southeastern New Mexico. *Condor* 90: 311-323.
- Beedy, E.C. and W.J. Hamilton, III. 1997. Tricolored blackbird status update and management guidelines. September (Jones and Stokes Associates, Inc. 97-099.) Sacramento, CA. Prepared for U.S. Fish and Wildlife Service, Portland, Oregon, and California Department of Fish and Game, Sacramento, CA.
- Beedy, E.C. and W.J. Hamilton, Jr. 1999. Tricolored blackbird (*Agelaius tricolor*). In *The Birds of North America*, No. 423 (Poole, A.; Gill, F., Eds.). The Birds of North America, Inc., Philadelphia, PA. 24 pp.
- Biosystems Analysis, Inc. 1989. Endangered Species Alert Program Manual: Species Accounts and Procedures. Southern California Edison Environmental Affairs Division.
- Bury, R. B. 1972. Habits and home range of the Pacific pond turtle, CLEMMYS MARMORATA, in a stream community. Ph.D. dissertation, Univ. California, Berkeley.
- Caire, W., J.D. Tyler, B.P. Glass, and M.A. Mares. 1989. *Mammals of Oklahoma*. University of Oklahoma Press, Norman, Oklahoma. 567 pp.
- CalFlora: Information on California plants for education, research and conservation. [web application]. 2005. Albany, California: The CalFlora Database [a non-profit organization]. Available: <http://www.calflora.org/>. (Accessed: January 9, 2006)
- California Department of Fish and Game (CDFG). 1990. 1989 annual report on the status of California's state listed threatened and endangered plants and animals. 188 pp.
- California Native Plant Society (CNPS). 2012. Inventory of Rare and Endangered Plants (online edition, v8-01a). California Native Plant Society. Sacramento, CA. Accessed on Monday, July 16, 2012.
- California Natural Diversity Database (CNDDDB). Wildlife & Habitat Data Analysis Branch, Department of Fish & Game. (Commercial Version: March 31, 2012).
- Cramp, S., D.J. Brooks, E. Dunn, R. Gillmor, J. Hall-Craggs *et al.* 1988. *The birds of the western Palearctic*. Volume 5: tyrant flycatchers to thrushes. Oxford University Press, Oxford, UK.
- Crase, F.T. and R.W. DeHaven. 1977. Food of nestling tricolored blackbirds. *Condor* 79(2): 265-269.
- Dimmitt, M. A., and R. Ruibal. 1980. Environmental correlates of emergence in spadefoot toads (*Scaphiopus*). *Journal of Herpetology* 14(1):21-29.
- England, A.S., M.J. Bechard, and C.S. Houston. 1997. Swainson's hawk (*Buteo swainsoni*). In *The Birds of North America*, No. 265 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D.C. 28 pp.
- Estep, J.A. 1989. Biology, movements, and habitat relationships of the Swainson's hawk in the Central Valley of California, 1986-87. California Department of Fish and Game, Nongame Bird and Mammal Section Report.
- Garrison, B.A. 1999. Bank swallow (*Riparia riparia*). In *The Birds of North America*, No. 414 (Poole, A.; Gill, F., Eds.). Philadelphia: The Birds of North America, Inc. 28 pp.
- Gross, A.O. 1942. Bank swallow. Pp. 400-424 in *Life histories of North American flycatchers, larks, swallows, and their allies* (A.C. Bent, ed.). U.S. National Museum Bulletin 179.
- Haug, E.A. 1985. Observations on the breeding ecology of burrowing owls in Saskatchewan. M.Sc. thesis, University of Saskatchewan, Saskatoon.

- Haug, E.A., B.A. Millsap, and M.S. Martell. 1993. Burrowing owl (*Speotyto cunicularia*). In *The Birds of North America*, No. 61 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia and The American Ornithologists' Union, Washington, DC. 20 pp.
- Jaramillo, A.P. 1993. Wintering Swainson's hawks in Argentina: food and age segregation. *Condor* 95: 475-479.
- Jennings, M.R. and M.P. Hayes. 1994. Amphibian and reptile species of special concern in California. The California Department Of Fish And Game, Inland Fisheries Division. 260 pp.
- Lewis, S.E. 1994. Night roosting ecology of pallid bats (*Antrozous pallidus*) in Oregon. *American Midland Naturalist* 132:219-226.
- Martin, D.J. 1973. Selected aspects of burrowing owl ecology and behaviour in central New Mexico. *Condor* 75: 446-456.
- Martin, G. 1990. *Birds by Night*. T& AD Poyser, London.
- McAtee, W.L. 1935. Food habits of common hawks. U.S. Department of Agriculture Circular 370.
- Mead, C.J. 1979. Colony fidelity and interchange in the sand martin. *Bird Study* 26: 99-106.
- Morey, S.R. and D. A. Guinn. 1992. Activity patterns, food habits, and changing abundance in a community of vernal pool amphibians. pp. 149-158 In: D. F. Williams, S. Byrne, and T. A. Rado (editors), *Endangered and sensitive species of the San Joaquin Valley, California: Their biology, management, and conservation*. The California Energy Commission, Sacramento, California, and the Western Section of The Wildlife Society.
- NatureServe. 2013. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: January 19, 2014).
- Nowak, R. 1991. *Walker's Mammals of the World: Fifth Edition*. Baltimore and London: The Johns Hopkins University Press.
- Nussbaum, R. A., E. D. Brodie, Jr., and R. M. Storm. 1983. *Amphibians and reptiles of the Pacific Northwest*. Univ. Press of Idaho. 332pp.
- Orians, G.H. 1960. Autumnal breeding in the tricolored blackbird. *Auk* 77(4): 379-398.
- Orians, G.H. 1961. The ecology of blackbird (*Agelaius*) social systems. *Ecological Monographs* 31(3): 285-312.
- Payne, R. 1969. Breeding seasons and reproductive physiology of tricolored blackbirds and redwinged blackbirds. *University of California Publications of Zoology* 90: 1-137.
- PlacerData. Phase 1 Habitat Conservation Plan/Natural Community Conservation Plan Species Accounts. Updated June 2003. Available: <http://placerrdata.org/home.htm>. (Accessed April 26, 2004).
- Schmutz, J.K., S.M. Schmutz, and D.A. Boag. 1980. Coexistence of three species of hawks (*Buteo* spp.) in the prairie parkland ecotone. *Canadian Journal of Zoology* 58: 1075-1089.
- Sherrod, S.K. 1978. Diets of North American falconiformes. *Journal of Raptor Research* 12: 49-121.
- Spinks, P. Q., and H. B. Shaffer. 2005. Range-wide molecular analysis of the western pond turtle (*Emys marmorata*): cryptic variation, isolation by distance, and their conservation implications. *Molecular Ecology* 14:2047-2064.
- Stebbins, R.C. 1972. *Amphibians and reptiles of California*. California Natural History Guides (31). University of California Press, Berkeley, Los Angeles, and London.
- Stebbins, R. C. 1972. *California amphibians and reptiles*. Univ. California Press, Berkeley. 152pp.
- Stebbins, R.C. 1985. *A field guide to western reptiles and amphibians*. Second edition. Houghton Mifflin Company, Boston, Massachusetts. 336 pp.

- Stoner, D. 1936. Studies on the bank swallow, *Riparia riparia riparia* (Linnaeus) in the Oneida Lake Region. Roosevelt Wild Life Annals 4: 126-233.
- Storer, T. I. 1925. A synopsis of the amphibia of California. University of California Publications in Zoology 27:1-342.
- Thomsen, L. 1971. Behavior and ecology of burrowing owls on the Oakland municipal airport. Condor 73: 177-192.
- Turner, A.K. 1980. The use of time and energy by aerial-feeding birds. Ph.D. dissertation, University of Stirling, Scotland.
- Turner, A.K. and C. Rose. 1989. Swallows and martins and identification guide and handbook. Houghton Mifflin Co., Boston, MA.
- U.S. Fish and Wildlife Service (USFWS). 1993. Determination of threatened status for the giant garter snake. Federal Register 58(201):54053-66.
- U.S. Fish and Wildlife Service (USFWS). 1999. Conservation Guidelines for the Valley Elderberry Longhorn Beetle. U.S. Fish and Wildlife Service; Sacramento, California. 13 pp.
- Wesemann, T. and M. Rowe. 1987. Factors influencing the distribution and abundance of burrowing owls in Cape Coral, Florida. Pp. 129-137 in Integrating man and nature in the metropolitan environment (L.W. Adams and D.L. Leedy, eds.). National Institute of Urban Wildlife, Columbia, MD.
- Whitaker, J. 1996. *National Audubon Society Field Guide to North American Mammals*. New York: Alfred A. Knopf, Inc.
- Woodbridge, B. 1991. Habitat selection by nesting Swainson's hawks: A hierarchical approach. M.S. Thesis, Oregon State University, Corvallis, OR.
- Zarn, M. 1974. Burrowing owl, Report No. 11. Habitat management series for unique or endangered species. Bureau of Land Management, Denver, CO.
- Zeiner, D.C., W.F.Laudenslayer, Jr., K.E. Mayer, and M. White, eds. 1988-1990. California's Wildlife. Vol. I-III. California Department of Fish and Game, Sacramento, California. Life History Account for Western Red Bat. Available: <http://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=2339> (Accessed: July 16, 2012)

# Appendix B

(Herbicide and Ecological Toxicity Data)

## ACROLEIN

Persistence:	Hydrolysis – $t_{1/2}$ = 3.5 days at pH 5; 1.5 days at pH 7; 4 hours at pH 10 (Tomlin 2002) $t_{1/2}$ = 3.8 days at pH 5; 1.5 days at pH 7; 19 hours at pH 9 (Turner and Erickson 2003) Photodegradation in air – stable (WHO 1991) Photodegradation on soil – $t_{1/2}$ = Aerobic sediment metabolism – $t_{1/2}$ = 7.6 hr (WHO 2002) Anaerobic sediment metabolism – $t_{1/2}$ = 10 days (WHO 2002) Terrestrial Field Dissipation – $t_{1/2}$ in air < 3 hrs (Eisler 1994) Reactivity-based $t_{1/2}$ in soil = 30 and 100 hours (WHO 2002) Aquatic Field Dissipation – $t_{1/2}$ = 3 to 7 hours in irrigation canals at pH 7.1 to 7.5 and 16 to 24°C (WHO 1991) $t_{1/2}$ = 7.3 – 10.2 hrs in irrigation canals (WHO 2002) Reactivity in surface water $t_{1/2}$ = 30 – 100 hours (WHO 2002) $t_{1/2}$ = 50 hours at pH 6.6 and 38 hours at pH 8.6 (Eisler 1994)
--------------	--

### Physical Properties

Water Solubility:	208 g/kg at 20°C (Tomlin 2002) 206 g/L at 20°C (WHO 1991) 206-208 g/L (Eisler 1994) 206-270 g/L (WHO 2002)
Volatility:	29 kPa at 20°C and 59 kPa at 38°C (Tomlin 2002) 29.3 kPa at 20°C (WHO 1991) 215-220 mm Hg at 20°C (Eisler 1994) 29.3-36.5 kPa at 20°C (WHO 2002)
Octanol/Water Partitioning Coefficient ( $K_{ow}$ )	$\log P$ = 1.08 (Tomlin 2002) $\log P$ = 0.9 (WHO 1991) $\log P$ = 0.01 (Eisler 1994) $\log P$ = -1.1-1.02 (WHO 2002) ( $K_{ow}$ > 100 indicates EPA may require Fish Bioaccumulation Test)

### Bioaccumulation

WHO 1991

Because of its high water solubility and low  $K_{ow}$ , it would not be expected to bioaccumulate.

Eisler 1994

After 28 days exposure to 13 ppb acrolein, the whole-fish bioconcentration factor in bluegill sunfish (*Lepomis macrochirus*) was 344.

WHO 2002

In the study cited by Eisler, some of the radioactivity measure in the fish tissues may have been in the form of metabolites and not acrolein. An updated BCF is 0.6 along with a  $\log K_{ow}$  of -0.01.

## U.S. EPA 2003

An estimated bioconcentration factor of 3 suggests the potential for bioconcentration in aquatic organisms is low.

**Sublethal Effects**

## WHO 1991

Laboratory rats exposed to acrolein via inhalation at concentrations of 10 to 5000 mg/m<sup>3</sup> for 1 minute showed an increase in blood pressure. The heart rate was increased at concentrations from 50 to 500 mg/m<sup>3</sup>. In an acute oral toxicity test with rats, 11.2 mg/kg decreased reflexes, resulted in body sag, caused poor body tone, caused lethargy and stupor, caused tremors, and led to respiratory distress. Acrolein depresses pulmonary host defenses.

## Eisler 1994

Most terrestrial crop plants can tolerate acrolein in irrigation water at concentrations up to 25 ppm, and some can tolerate 70-80 ppm.

## Folmar 1976

Rainbow trout (*Oncorhynchus mykiss*) fry showed strong avoidance to acrolein at a concentration of 0.1 ppm but not 0.001 or 0.01 ppm in the laboratory.

## Folmar 1978

Mayfly nymphs (*Ephemerella walkeri*) showed no avoidance to acrolein at concentrations of 0.001 to 0.1 ppm in the laboratory.

**Metabolites**

## Turner and Erickson 2003

No toxicity data were available for the major hydration product of acrolein, 3-hydroxypropanal.

**COPPER**

## Persistence:

Hydrolysis – Not Available  
 Photodegradation in water – Not Available  
 Photodegradation on soil – Not Available  
 Aerobic soil metabolism – Not Available  
 Anaerobic aquatic metabolism – Not Available  
 Terrestrial Field Dissipation – Not Available

**Physical Properties**

## Water Solubility:

Copper Sulfate: 230.5 g/kg (25°C) (Tomlin 2002)

## Volatility:

Not Volatile (Tomlin 2002)

## Octanol/Water Partitioning

Not Available

Coefficient (K<sub>ow</sub>)

(K<sub>ow</sub> > 100 indicates EPA may require Fish Bioaccumulation Test)

## Bioaccumulation

Edwards *et al.* 1998

The uptake of copper in common nettle (*Urtica dioica*) and earthworms (*Eisenia fetida*) from a contaminated dredge spoil was measured. In the aerial portions of the common nettle, the biological absorption coefficient (concentration in plant tissue ÷ concentration in soil) was 0.072 to 0.265. In root tissue, the biological absorption coefficient was 0.075 to 0.303. To determine the uptake of copper in earthworms, contaminated soil was brought into the laboratory and earthworms introduced for 28 days. Soil copper levels were 16 times higher in the contaminated soil than in control soil, but the concentrations in the earthworms only differed by 2.6 times. The earthworms did absorb copper from the contaminated soils, but not to an extent reflecting the level of contamination.

Gintenreiter *et al.* 1993

Copper concentrations in the tissues of the gypsy moth (*Lymantria dispar*) increased from earlier to later developmental stages, but the trend was not smooth. Fourth instars showed a decrease when compared to 3<sup>rd</sup> instars, and adults had lower concentrations than pupae. Concentration factors were 2 to 5. Copper concentrations were passed from one generation to the next.

Gomot and Pihan 1997

Bioconcentration of copper was evaluated in two subspecies of land snails, *Helix aspersa aspersa* and *Helix aspersa maxima*. These snails showed a tendency to accumulate copper in excess of the amount available from its diet. The subspecies exhibited different bioconcentration factors for different tissues. For the foot, *H. a. aspersa* had factors ranging from 2.3 to 13.2, whereas *H. a. maxima* had factors ranging from 1.7 to 10.2. For the viscera, *H. a. aspersa* had factors ranging from 2.1 to 9.1, whereas *H. a. maxima* had factors ranging from 1.9 to 9.0. Differences in the bioconcentration factor appear to be more related to the other components of the diet, not the copper concentration in the diet.

Gomot de Vaufleury and Pihan 2000

Copper concentrations were measured in terrestrial snails (*Helix aspersa*). Differences were demonstrated among laboratory and field values. However, no soil or vegetation samples for the laboratory and field sites were analyzed for copper, so it is not possible to determine whether copper was accumulated at rates above background or whether they reflect some fraction of background levels.

Han *et al.* 1996

Shellfish accumulated copper in natural and aquaculture ponds in Taiwan. The sediments in the aquaculture ponds were finer grain and contained 4X concentrations of copper. Five mollusks were collected, but only purple clams (*Hiatula diphos*) and hard clams (*Meretrix lusoria*) were collected from both environments. The relative accumulation in each environment did not show a consistent pattern for both species indicating that the concentration in the shellfish was not controlled only by total copper concentrations in the sediments.

Haritonidis and Malea 1999

Copper concentrations in green algae (*Ulva rigida*) ( $2.2 \pm 0.2$  µg/g dry weight) collected from Thermaikos Gulf, Greece were less than seawater concentrations ( $1.5 \pm 0.08$  µg/L) and sediment ( $2.7 \pm 0.5$  µg/g dry weight). This suggests that copper will not bioconcentrate in algae.

Harrahy and Clements 1997

Bioaccumulation factors were calculated for the benthic invertebrate, *Chironomus tentans*, to be 16.63 and 12.99 during two uptake tests. Depuration was rapid. Copper concentrations were similar to

background within four days. The authors caution that the bioaccumulation factors presented may be related to bioavailability that is driven by sediment characteristics.

Hendriks *et al.* 1998

Bioaccumulation ratios were determined for zebra mussels (*Dreissena polymorpha*) from the Rhine-Meuse Delta in the Netherlands. For copper, the ratio between mussels and suspended solids was 0.31 indicating tissue concentrations did not exceed environmental concentrations and that copper had not bioaccumulated

Janssen and Hogervorst 1993

Concentration factors were calculated for nine arthropod species inhabiting the forest litter layer in a clean reference site and a polluted site in The Netherlands: pseudoscorpion (*Neobisium muscorum*), harvestman (*Paroligolophus agrestis*), carabids (*Notiophilus biguttatus* and *Calathus melanocephalus*), mites (*Pergamasus crassipes*, *P. robustus*, and *Platynothrus peltifer*), dipluran (*Campodea staphylinus*), and collembolan (*Orchesella cincta*). Copper concentration factors for the eight species ranged from 0.85 – 4.08 in the reference site versus 0.40 – 1.62 in the polluted site. Copper was concentrated more when copper leaf litter concentrations were lower.

Khan *et al.* 1989

Bioconcentration factors in grass shrimp (*Palaemonetes pugio*) were determined for two populations, one from an industrialized site and another from a relatively pristine site. Levels of copper measured in shrimp from the industrialized site were greater than from the pristine site, but the industrialized site showed a concentration factor of 0.07, whereas the pristine site showed a concentration factor of 1.1 when compared to sediment concentrations.

Marinussen *et al.* 1997a

Earthworms (*Dendrobaena veneta*) were exposed to soils containing various levels of copper. Earthworm tissue concentrations increased proportionally to the soil copper concentrations up to 150 ppm. Above 150 ppm in the soils, tissue concentrations leveled off at about 60 ppm.

Marinussen *et al.* 1997b

Soil, containing  $815 \pm 117$  ppm Cu, was collected from a contaminated site in The Netherlands. Earthworms (*Dendrobaena veneta*) were introduced to the soil in the laboratory. Earthworms appeared to reach equilibrium with the soil exhibiting tissue concentrations of *c.* 60 ppm through 56 days of exposure. At 112 days exposure, the tissue concentrations increased to *c.* 120 ppm. The authors did not have an explanation for this anomaly. After being transferred to uncontaminated soil, the earthworms eliminated the copper according to a two-compartment model with the half-life times being,  $t_{1/2-1} = 0.36$  d and  $t_{1/2-2} = 37$  d.

Morgan and Morgan 1990

Earthworms (*Lumbricus rubellus*) were collected from an uncontaminated site and four metalliferous mine sites. Copper concentrations in soil and in tissues were measured. The worms were held under clean conditions to allow eliminate soil from their alimentary canal. The concentrations of copper in earthworm tissues reflected the concentrations in the soil. The authors conclude that there was no evidence that copper was sequestered in earthworms.

Morgan and Morgan 1999

Copper concentrations in earthworm (*Aporrectodea caliginosa* and *Lumbricus rubellus*) tissue were lower than in their ingesta. This suggests that copper does not bioaccumulate in earthworms.

Neuhauser *et al.* 1995

Overall, copper did not bioconcentrate in earthworm in contaminated soil, but showed a slight tendency to bioconcentrate when soil copper concentrations were low.

Pyatt *et al.* 1997

Appreciable concentrations (0.3 – 4.6%) of copper were measured in all tissues of the freshwater snail (*Lymnaea stagnalis*), whereas no measurable quantities of copper were found in food or water. The authors conclude that bioaccumulation occurred.

Svendsen and Weeks 1997a,b

There is an inverse relationship between the bioconcentration factors and soil concentrations under laboratory conditions for the earthworm *Eisenia andrei* and under field conditions for the earthworm *Lumbricus rubellus*. Bioconcentration factors ranged from 4.0 using control soil and 0.30 using soil amended with 339 ppm Cu under laboratory conditions. Bioconcentration factors in the field ranged from 4.1 under control conditions to 0.4 when the soil plots contained 231 ppm Cu.

### **Fish Dietary Toxicity**

Berntssen *et al.* 1999

Laboratory tests were conducted to determine the effects of dietary copper on Atlantic salmon (*Salmo salar*). Dietary concentrations were 0, 35, and 700 mg Cu/kg diet for an experiment lasting 28 days. Addition of the copper supplemented diet did not cause an increase in the water concentrations of copper. Dietary exposure significantly increased intestinal cell proliferation and apoptosis (degeneration of cells into membrane-bound particles that are then phagocytized by other cells). The copper exposed groups did not grow during the trial.

Lundebye *et al.* 1999

Laboratory tests were conducted to determine the effects of dietary copper on Atlantic salmon (*Salmo salar*). Dietary concentrations were 0, 35, and 700 mg Cu/kg diet for an experiment lasting 28 days, and 5, 35, 500, 700, 900, and 1750 mg Cu/kg diet in an experiment lasting 12 weeks. Mean weights of fish used in the tests were 72 and 0.9 g in the first and second experiments, respectively. No mortality was observed in the first experiment, and only 2% died in the second experiment. Food consumption was not altered in either experiment at any dietary concentration. Cells of the intestinal lining were damaged in fish at both dietary concentrations in the first experiment. Growth of fish in the second experiment was reduced at dietary concentrations  $\geq 900$  mg/kg after 10 weeks and at dietary concentrations  $\geq 700$  mg/kg after 12 weeks.

Miller *et al.* 1993

When rainbow trout (*Oncorhynchus mykiss*) were exposed in the laboratory simultaneously to dietary Cu concentrations of up to 684  $\mu\text{g/g}$  dry weight and water concentrations of up to 127  $\mu\text{g/L}$ , no overt signs of toxicity were noted. Fish were fed to satiation three times daily. Dietary exposure was the principal source of tissue Cu, but as water concentrations were increased, uptake from water increased. However, exposure to waterborne Cu was more effective at inducing tolerance to subsequent exposure to toxic concentrations of Cu.

Handy 1993

Rainbow trout (*Oncorhynchus mykiss*) were fed commercial trout chow with and without 10 mg Cu/kg dry weight for 28 days. The water concentrations of Cu remained below 1 ppb. Fish were hand-fed to satiation daily. No outward signs of toxicity were noted and a single mortality occurred in the Cu-treated fish on day 6 of treatment. Despite some regurgitation of diet pellets, no body weight

loss was noted. Dietary copper increased tissue concentrations at day 28 to 2.52, 72.66, and 0.636  $\mu\text{g}$  Cu/g weight in the gills, liver and muscle. Concentration in the kidneys were not elevated.

Murai *et al.* 1981

Channel catfish were provided diets containing supplemental copper at concentrations of 0, 2, 4, 8, 16, and 32 mg/kg for 16 weeks. At the end of 4 weeks, average weight gain had been reduced in the group receiving 32 mg/kg in the diet. After 16 weeks, average weight gain was reduced in the group receiving 16 mg/kg also. Weight gain/diet consumed was reduced for catfish receiving  $\geq 8$  mg/kg dietary Cu after 16 weeks. Packed cell volume in the blood and hemoglobin were not adversely affected, but the number of erythrocytes was reduced in the group receiving 16 mg/kg.

Mount *et al.* 1994

Rainbow trout (*Oncorhynchus mykiss*) were fed brine shrimp (*Artemia* sp.) enriched with Cu, Cd, Pb, and Zn alone or as a mixture along with As for 60 days. The water contained 12  $\mu\text{g/L}$  Cu, 1.1  $\mu\text{g/L}$  Cd, 3.2  $\mu\text{g/L}$  Pb, and 50  $\mu\text{g/L}$  Zn. Cu concentrations in the shrimp were 20, 40, and 80  $\mu\text{g/g}$  fresh weight when trout were exposed to Cu alone. Survival of trout was decreased in the medium and high Cu treatments with 69 and 72% survival, respectively. Weight and length of trout were not impacted by feeding on brine shrimp containing Cu. Cu concentrations in whole fish were elevated as compared to controls either in clean water or metal-containing water, but the Cu concentrations did not differ among dietary treatment levels. No detrimental impacts were observed in the exposures to multiple metals via the diet. In that exposure scenario, concentrations in the diet were 0.5, 1, 1.5 and 2X the low concentrations from the first scenario.

Farag *et al.* 1994

Rainbow trout were fed invertebrates collected from the Clark Fork River, Montana and from an uncontaminated reference site for 21 days. Juvenile fish received invertebrates containing 1.54 As, 0.10 Cd, 18.57 Cu, 0.86 Pb, 32.09 Zn (all  $\mu\text{g/g}$  wet weight). Adult fish received invertebrates containing 3.20 As, 0.24 Cd, 26.13 Cu, 1.77 Pb, 68.99 Zn (all  $\mu\text{g/g}$  wet weight). Water was either standard laboratory water or contained metal concentrations based on the U.S. EPA's water-quality criteria with concentrations of 2.2  $\mu\text{g Cd/L}$ , 24  $\mu\text{g Cu/L}$ , 6.4  $\mu\text{g Pb/l}$  and 100  $\mu\text{g Zn/L}$ . Mortality of juveniles was significantly greater in tanks with metal-treated water regardless of whether the dietary invertebrates contained metals. Mortality was slightly increased in juveniles in laboratory water that received invertebrates with metals. No differences in growth were observed in any treatment. No mortality was observed in adult trials. Exposure to metals either in the water or via diet caused scale loss in adults. Juveniles were too small to evaluate scale loss. Physiological condition of fish fed invertebrates containing metals was compromised.

Woodward *et al.* 1995

Rainbow trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*) were held in standard laboratory water or contained metal concentrations based on 50% the U.S. EPA's water-quality criteria with concentrations of 1.1  $\mu\text{g/L}$  Cd, 12  $\mu\text{g/L}$  Cu, 3.2  $\mu\text{g/L}$  Pb, and 50  $\mu\text{g/L}$  Zn from hatching to 88 days of age. Three diets were provided that comprised of benthic invertebrates collected from three locations on the Clark Fork River, Montana. Fish received pelleted invertebrates containing 6.5 As, no Cd, 87 Cu, 6.9 Pb, and 616 Zn (all mg/g dry weight); 19 As, no Cd, 178 Cu, 15 Pb, and 650 Zn (all mg/g dry weight); or 19 As, 0.26 Cd, 174 Cu, 15 Pb, and 648 Zn (all mg/g dry weight). Survival was not affected for either species by any combination of water or diet. Growth of brown trout was reduced in the groups receiving the diets with higher metals concentration and by exposure to metal-containing water from day 26 onward in the test. In rainbow trout, no effects were seen on growth at day 18, but by day 53, growth was reduced in fish exposed to higher metal concentrations in diet or water. However, the rainbow trout exposed to diets with higher metals concentrations had similar

growth patterns regardless of whether they were also exposed to metals-containing water. Also, the growth of the rainbow trout exposed to treated water and the diet with low metal concentrations recovered by day 88 and were no longer significantly different from fish in untreated water.

#### Draves and Fox 1998

In a reach of the Montreal River in northern Ontario contaminated from gold mine tailings, water concentrations were significantly higher for Cu, Cd, and Pb, but not for Zn. Juvenile yellow perch (*Perca flavescens*), a benthic feeding species, had significantly less food in their stomachs in the contaminated reach than perch in an uncontaminated reach. However, body weights of juvenile perch did not differ between the contaminated and uncontaminated reaches. Within the contaminated reach, Cu body burdens were significantly negatively correlated with body weight. Concentrations of Cu in Chironomidae, Hemiptera, Cladocera, Odonata, and Amphipoda were compared between reaches. Concentrations in Chironomidae, Hemiptera, Cladocera, and Amphipoda were greater in the contaminated reach, but Cu concentrations were greater in Odonata in the uncontaminated reach.

### **Sublethal Effects**

#### Folmar 1976

Rainbow trout (*Oncorhynchus mykiss*) fry showed strong avoidance to copper ( $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ ) at concentrations of 0.0001 to 0.01 ppm in the laboratory.

#### Folmar 1978

Mayfly nymphs (*Ephemerella walkeri*) showed strong avoidance to copper ( $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ ) at a concentration of 0.1 ppm but not 0.001 or 0.01 ppm in the laboratory.

### Acrolein Ecological Aquatic Toxicity Studies

Chemical	Species Name	Common Name	Study Duration (days)	Effect Type	Response Measurement	Response Value	Response Unit	Reference
Acrolein	<i>Anabaena flos-aquae</i>	bluegreen algae	5	Growth	EC50	36	ug/L	USEPA, 2014
Acrolein	<i>Anabaena flos-aquae</i>	bluegreen algae	5	Population	NOEL	12	ug/L	USEPA, 2014
Acrolein	<i>Selenastrum capricornutum</i>	Green algae	5	Growth	EC50	50	ug/L	USEPA, 2014
Acrolein	<i>Selenastrum capricornutum</i>	Green algae	5	Growth	NOEL	30	ug/L	USEPA, 2014
Acrolein	<i>Xenopus laevis</i>	African Clawed Frog	4	Mortality	LC50	7	ug/L	Eisler, 1994
Acrolein	<i>Rhinella arenarum</i>	toad	4	Mortality	NOEC	5	ug/L	USEPA, 2013
Acrolein	<i>Rhinella arenarum</i>	toad	4	Mortality	LOEC	10	ug/L	USEPA, 2013
Acrolein	<i>Rhinella arenarum</i>	toad	4	Mortality	LC50	23	ug/L	USEPA, 2013
Acrolein	<i>Crassostrea virginica</i>	Eastern oyster	4	Behavior	EC50	106	ug/L	USEPA, 2014
Acrolein	<i>Crassostrea virginica</i>	Eastern oyster	4	Behavior	NOEL	30	ug/L	USEPA, 2014
Acrolein	<i>Americamysis bahia</i>	Opossum Shrimp	4	Mortality	LC50	500	ug/L	USEPA, 2013
Acrolein	<i>Americamysis bahia</i>	Opossum Shrimp	4	Mortality	NOEC	36	ug/L	USEPA, 2013

Chemical	Species Name	Common Name	Study Duration (days)	Effect Type	Response Measurement	Response Value	Response Unit	Reference
Acrolein	<i>Hyalella curvispina</i>	scud	4	Mortality	LOEC	100	ug/L	USEPA, 2013
Acrolein	<i>Hyalella curvispina</i>	scud	4	Mortality	LC50	240	ug/L	USEPA, 2013
Acrolein	<i>Hyalella curvispina</i>	scud	4	Mortality	NOEC	50	ug/L	USEPA, 2013
Acrolein	<i>Daphnia magna</i>	water flea	2	Behavior	NOEC	14.2	ug/L	USEPA, 2014
Acrolein	<i>Lemna gibba</i>	Duckweed	14	Growth	EC50	72	ug/L	USEPA, 2014
Acrolein	<i>Lemna gibba</i>	Duckweed	14	Population	NOEL	25	ug/L	USEPA, 2014
Acrolein	<i>Stuckenia pectinata</i>	Sago Pondweed	1	Growth	LOEL	5200	ug/L	USEPA, 2013
Acrolein	<i>Anas platyrhynchos</i>	Mallard Duck	21	Mortality	LD50	28	mg/kg b.w.	USEPA, 2014
Acrolein	<i>Anas platyrhynchos</i>	Mallard Duck	14	Mortality	LD50	9.11	mg/kg b.w.	USEPA, 2014
Acrolein	<i>Colinus virginianus</i>	Northern Bobwhite Quail	21	Mortality	LD50	19	mg/kg b.w.	USEPA, 2014
Acrolein	<i>Lepomis macrochirus</i>	Bluegill sunfish	4	Mortality	LC50	22.4	ug/L	USEPA, 2014
Acrolein	<i>Amia calva</i>	Bowfin	1	Mortality	LC50	62	ug/L	USEPA, 2014
Acrolein	<i>Pimephales promelas</i>	Fathead Minnow	4	Mortality	LC50	14	ug/L	Eisler, 1994

Chemical	Species Name	Common Name	Study Duration (days)	Effect Type	Response Measurement	Response Value	Response Unit	Reference
Acrolein	<i>Pimephales promelas</i>	Fathead Minnow	2	Mortality	LC50	15	ug/L	USEPA, 2013
Acrolein	<i>Micropterus salmoides</i>	Largemouth bass	4	Mortality	LC50	160	ug/L	Eisler, 1994
Acrolein	<i>Fundulus similis</i>	Longnose killifish	2	Mortality	LC50	240	ug/L	USEPA, 2014
Acrolein	<i>Gambusia affinis</i>	Mosquitofish	2	Mortality	LC50	61	ug/L	USEPA, 2014
Acrolein	<i>Oncorhynchus mykiss</i>	Rainbow Trout	4	Mortality	LC50	38	ug/L	USEPA, 2013
Acrolein	<i>Oncorhynchus mykiss</i>	Rainbow Trout	4	Mortality	NOEC	10	ug/L	USEPA, 2013
Acrolein	<i>Oncorhynchus mykiss</i>	Rainbow Trout	4	Mortality	LOEC	25	ug/L	USEPA, 2013
Acrolein	<i>Cyprinodon variegatus</i>	Sheepshead minnow	4	Mortality	LC50	430	ug/L	USEPA, 2014
Acrolein	<i>Simulium sp.</i>	Blackfly larvae	1	Mortality	LC50	600	ug/L	USEPA, 2013
Acrolein	<i>Simulium sp.</i>	Blackfly larvae	1	Mortality	NOEC	150	ug/L	USEPA, 2013
Acrolein	<i>Chironomus sp.</i>	Midge	1	Mortality	LC50	2830	ug/L	USEPA, 2013
Acrolein	<i>Chironomus sp.</i>	Midge	1	Mortality	NOEC	1000	ug/L	USEPA, 2013

**Notes:**

EC50 - Effective concentration for 50% of the population

LC50 - Lethal concentration for 50% of the population

LD50 - Lethal dose for 50% of the population

LOEC - Lowest Observable Effect Concentration

LOEL - Lowest Observable Effect Level

NOEC - No Observable Effect Concentration

NOEL - No Observable Effect Level

Behavior - Overt activity measurement of an organism including but not limited to avoidance, aggression, and feeding behavior.

Growth - Measurements that include changes in body weight, morphology, and development.

Mortality - Measurements where the cause of death can be attributed to the chemical.

Population - Measurements related to changes in a group of organisms of the same species occupying the same area at a given time.

## Copper Ecological Aquatic Toxicity Studies

Chemical	Species Name	Common Name	Study Duration (days)	Effect Type	Response Measurement	>,<	Response Value	Response Unit	Reference
Copper ethanolamine complex	<i>Egeria densa</i>	Brazilian waterweed	1	Biochemical	LOEL	None	1000	ug/L	USEPA, 2013
Copper ethanolamine complex	<i>Egeria densa</i>	Brazilian waterweed	1	Biochemical	NOEL	None	1000	ug/L	USEPA, 2013
Copper ethanolamine complex	<i>Lepomis macrochirus</i>	Bluegill sunfish	4	Mortality	NOEL	None	2000	ug/L	USEPA, 2014
Copper ethanolamine complex	<i>Lepomis macrochirus</i>	Bluegill sunfish	4	Mortality	LC50	None	42000	ug/L	USEPA, 2014
Copper ethanolamine complex	<i>Oncorhynchus mykiss</i>	Rainbow Trout	4	Mortality	LC50	None	1500	ug/L	USEPA, 2014
Copper ethylenediamine complex	<i>Landoltia punctata</i>	Duckweed	2	Biochemical	NOEL	None	100	ug/L	USEPA, 2013
Copper ethylenediamine complex	<i>Landoltia punctata</i>	Duckweed	2	Biochemical	NOEL	None	100	ug/L	USEPA, 2013
Copper triethanolamine complex	<i>Landoltia punctata</i>	Duckweed	2	Biochemical	NOEL	None	100	ug/L	USEPA, 2013
Copper triethanolamine complex	<i>Landoltia punctata</i>	Duckweed	2	Biochemical	NOEL	None	100	ug/L	USEPA, 2013
Copper triethanolamine complex	<i>Anas platyrhynchos</i>	Mallard Duck	9	Mortality	NOEL	>	5000	mg/kg	USEPA, 2014
Copper triethanolamine complex	<i>Anas platyrhynchos</i>	Mallard Duck	9	Mortality	LC50	>	5000	mg/kg	USEPA, 2014
Copper triethanolamine complex	<i>Colinus virginianus</i>	Northern Bobwhite Quail	8	Mortality	LC50	>	5000	mg/kg	USEPA, 2014
Copper triethanolamine complex	<i>Lepomis macrochirus</i>	Bluegill sunfish	4	Mortality	LC50	None	17600	ug/L	USEPA, 2014
Copper triethanolamine complex	<i>Lepomis macrochirus</i>	Bluegill sunfish	4	Mortality	NOEL	None	18500	ug/L	USEPA, 2014

Chemical	Species Name	Common Name	Study Duration (days)	Effect Type	Response Measurement	>,<	Response Value	Response Unit	Reference
Copper triethanolamine complex	<i>Lepomis macrochirus</i>	Bluegill sunfish	4	Mortality	LC50	None	51000	ug/L	USEPA, 2014
Copper triethanolamine complex	<i>Lepomis macrochirus</i>	Bluegill sunfish	4	Mortality	LC50	None	57000	ug/L	USEPA, 2014
Copper triethanolamine complex	<i>Lepomis cyanellus</i>	Green sunfish	4	Mortality	LC50	None	1300	ug/L	USEPA, 2014
Copper triethanolamine complex	<i>Oncorhynchus mykiss</i>	Rainbow Trout	4	Mortality	LC50	None	840	ug/L	USEPA, 2014
Copper triethanolamine complex	<i>Oncorhynchus mykiss</i>	Rainbow Trout	4	Mortality	NOEL	None	100	ug/L	USEPA, 2014
Copper triethanolamine complex	<i>Oncorhynchus mykiss</i>	Rainbow Trout	2	Mortality	LC50	None	790	ug/L	USEPA, 2014
Copper triethanolamine complex	<i>Oncorhynchus mykiss</i>	Rainbow Trout	4	Mortality	LC50	None	26	ug/L	USEPA, 2014
Copper sulfate pentahydrate	<i>Anabaena flos-aquae</i>	bluegreen algae	5	Population	NOEL	None	20	ug/L	USEPA, 2014
Copper sulfate pentahydrate	<i>Selenastrum capricornutum</i>	Green algae	5	Population	NOEL	None	2	ug/L	USEPA, 2014
Copper sulfate pentahydrate	<i>Lemna minor</i>	Duckweed	5	Growth	NOEL	None	100	ug/L	USEPA, 2014
Copper sulfate pentahydrate	<i>Lemna minor</i>	Duckweed	5	Growth	EC50	None	2300	ug/L	USEPA, 2014
Copper sulfate pentahydrate	<i>Colinus virginianus</i>	Northern Bobwhite Quail	14	Mortality	LC50	None	340	mg/kg b.w.	USEPA, 2014
Copper sulfate pentahydrate	<i>Colinus virginianus</i>	Northern Bobwhite Quail	14	Mortality	LC50	None	357.9	mg/kg b.w.	USEPA, 2014
Copper sulfate pentahydrate	<i>Colinus virginianus</i>	Northern Bobwhite Quail	14	Mortality	NOEL	None	120	mg/kg b.w.	USEPA, 2014
Copper sulfate pentahydrate	<i>Lepomis macrochirus</i>	Bluegill sunfish	4	Mortality	LC50	None	2870	ug/L	USEPA, 2014
Copper sulfate pentahydrate	<i>Lepomis macrochirus</i>	Bluegill sunfish	4	Mortality	LC50	None	1300	ug/L	USEPA, 2014

Chemical	Species Name	Common Name	Study Duration (days)	Effect Type	Response Measurement	>,<	Response Value	Response Unit	Reference
Copper sulfate pentahydrate	<i>Lepomis macrochirus</i>	Bluegill sunfish	4	Mortality	NOEL	None	650	ug/L	USEPA, 2014
Copper sulfate pentahydrate	<i>Lepomis macrochirus</i>	Bluegill sunfish	4	Mortality	NOEL	None	1000	ug/L	USEPA, 2014
Copper sulfate pentahydrate	<i>Oncorhynchus mykiss</i>	Rainbow Trout	4	Mortality	NOEL	None	1960	ug/L	USEPA, 2014
Copper sulfate pentahydrate	<i>Oncorhynchus mykiss</i>	Rainbow Trout	4	Mortality	LC50	None	3580	ug/L	USEPA, 2014
Copper sulfate pentahydrate	<i>Oncorhynchus mykiss</i>	Rainbow Trout	4	Mortality	NOEL	None	56	ug/L	USEPA, 2014
Copper sulfate pentahydrate	<i>Oncorhynchus mykiss</i>	Rainbow Trout	4	Mortality	LC50	None	130	ug/L	USEPA, 2014
Copper (II) sulfate	<i>Microcystis aeruginosa</i>	bluegreen algae	1	Biochemical	NOEC	None	250	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Euglenophyceae</i>	Euglenoid Class	27	Population	NOEL	None	65.3	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Chlorella sp.</i>	Green Algae	3	Population	NOEC	None	2.3	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Chlorella sp.</i>	Green Algae	3	Population	LOEC	None	7.9	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Pseudokirchneriella subcapitata</i>	Green Algae	3	Population	NOEC	None	4.2	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Chlorella sp.</i>	Green Algae	2	Population	LOEL	None	0.4	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Xenopus laevis</i>	African Clawed Frog	4	Mortality	LC50	None	1370	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Xenopus laevis</i>	African Clawed Frog	4	Growth	NOEC	None	100	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Bufo boreas</i>	Boreal Toad	4	Mortality	LC50	None	120	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Epidalea calamita</i>	Natterjack toad	4	Mortality	LC50	None	80	ug/L	USEPA, 2013

Chemical	Species Name	Common Name	Study Duration (days)	Effect Type	Response Measurement	>,<	Response Value	Response Unit	Reference
Copper (II) sulfate	<i>Epidalea calamita</i>	Natterjack toad	4	Growth	NOEC	None	100	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Epidalea calamita</i>	Natterjack toad	4	Growth	LOEC	None	50	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Gammarus balcanicus</i>	Amphipod	4	Biochemical	NOEL	None	10000	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Tetrahymena sp.</i>	Ciliate Protozoan	1	Mortality	LC50	None	3300	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Mesocyclops pehpeiensis</i>	Copepod	2	Mortality	LC50	None	75	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Mesocyclops pehpeiensis</i>	Copepod	9	Growth	EC50	None	25	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Barytelphusa cunicularis</i>	Crab	4	Mortality	LC50	None	215000	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Cherax destructor</i>	Crayfish	4	Mortality	LC50	None	379	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Cherax destructor</i>	Crayfish	4	Mortality	LC50	None	379	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Astacus leptodactylus</i>	Crayfish	14	Biochemical	LOEL	None	10	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Orconectes immunis</i>	Crayfish	5	Physiology	LOEL	None	160	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Astacus leptodactylus</i>	Crayfish	14	Biochemical	NOEL	None	10	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Cherax destructor</i>	Crayfish	3	Mortality	LC50	None	509	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Orconectes immunis</i>	Crayfish	5	Mortality	LC50	None	20000	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Spiralothelphusa hydrodroma</i>	Freshwater Field Crab	15	Biochemical	LOEC	None	25460	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Macrobrachium dayanum</i>	Freshwater Prawn	2	Cellular	NOEC	None	418	ug/L	USEPA, 2013

Chemical	Species Name	Common Name	Study Duration (days)	Effect Type	Response Measurement	>,<	Response Value	Response Unit	Reference
Copper (II) sulfate	<i>Macrobrachium dayanum</i>	Freshwater Prawn	4	Mortality	LC50	None	418	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Macrobrachium dayanum</i>	Freshwater Prawn	1	Cellular	LOEC	None	418	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Macrobrachium rosenbergii</i>	Giant River Prawn	7	Biochemical	NOEC	None	10	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Macrobrachium rosenbergii</i>	Giant River Prawn	7	Biochemical	LOEC	None	50	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Macrobrachium rosenbergii</i>	Giant River Prawn	4	Mortality	LC50	None	452	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Hydra viridissima</i>	Hydra	4	Mortality	LC50	None	28	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Chasmagnathus granulata</i>	Neohelice Crab	14	Growth	NOEL	None	100	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Hyalella sp.</i>	Scud	4	Mortality	LC50	None	170	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Typha latifolia</i>	Cattail	8	Biochemical	NOEC	None	500	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Typha latifolia</i>	Cattail	4	Biochemical	NOEC	None	500	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Typha latifolia</i>	Cattail	8	Biochemical	LOEC	None	500	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Typha latifolia</i>	Cattail	4	Biochemical	LOEC	None	1000	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Typha latifolia</i>	Cattail	2	Biochemical	LOEC	None	5000	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Ceratophyllum demersum</i>	Coontail	1	Physiology	LOEC	>	2500	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Ceratophyllum demersum</i>	Coontail	1	Physiology	LOEC	>	100	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Lemna gibba</i>	Duckweed	14	Growth	NOEC	None	100	ug/L	USEPA, 2013

Chemical	Species Name	Common Name	Study Duration (days)	Effect Type	Response Measurement	>,<	Response Value	Response Unit	Reference
Copper (II) sulfate	<i>Lemna gibba</i>	Duckweed	14	Growth	LOEC	None	250	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Lemna minor</i>	Duckweed	10	Growth	EC50	None	470	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Lemna minor</i>	Duckweed	4	Biochemical	LOEC	None	5000	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Lemna minor</i>	Duckweed	4	Biochemical	NOEC	None	500	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Lemna minor</i>	Duckweed	4	Biochemical	LOEC	None	500	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Lemna minor</i>	Duckweed	4	Biochemical	NOEC	None	50	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Lemna minor</i>	Duckweed	4	Biochemical	NOEC	None	50	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Cabomba aquatica</i>	Fanwort	4	Physiology	LOEC	None	12	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Elodea canadensis</i>	Pondweed	4	Physiology	LOEC	None	12	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Eichhornia crassipes</i>	Water Hyacinth	14	Biochemical	NOEC	None	500	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Eichhornia crassipes</i>	Water Hyacinth	14	Biochemical	LOEC	None	1000	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Gallus domesticus</i>	Domestic Chicken	12	Growth	NOEC	None	2	mg/kg	USEPA, 2013
Copper (II) sulfate	<i>Gallus domesticus</i>	Domestic Chicken	15	Biochemical	LOEL	None	20	mg/kg	USEPA, 2013
Copper (II) sulfate	<i>Lepomis macrochirus</i>	Bluegill sunfish	4	Mortality	LC50	None	2640	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Ictalurus punctatus</i>	Channel catfish	4	Mortality	LC50	None	710	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Pimephales promelas</i>	Fathead Minnow	2	Mortality	LC50	None	7.2	ug/L	USEPA, 2013

Chemical	Species Name	Common Name	Study Duration (days)	Effect Type	Response Measurement	>,<	Response Value	Response Unit	Reference
Copper (II) sulfate	<i>Pimephales promelas</i>	Fathead Minnow	2	Mortality	LC50	None	5.9	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Pimephales promelas</i>	Fathead Minnow	4	Mortality	LC50	None	96.6	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Gambusia affinis</i>	Mosquitofish	4	Mortality	LC50	None	250	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Oncorhynchus mykiss</i>	Rainbow Trout	4	Mortality	LC50	None	94	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Oncorhynchus mykiss</i>	Rainbow Trout	7	Biochemical	NOEC	None	41.06	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Oncorhynchus mykiss</i>	Rainbow Trout	4	Mortality	LC50	None	80	ug/L	USEPA, 2013
Copper (II) sulfate	<i>Pelodiscus sinensis</i>	Chinese Softshell Turtle	112	Growth	NOEC	None	10.9	mg/kg	USEPA, 2013
Copper (II) sulfate	<i>Pelodiscus sinensis</i>	Chinese Softshell Turtle	112	Growth	LOEC	None	20.4	mg/kg	USEPA, 2013
Copper (II) sulfate	<i>Pelodiscus sinensis</i>	Chinese Softshell Turtle	112	Biochemical	NOEC	None	41.8	mg/kg	USEPA, 2013
Copper (II) sulfate	<i>Pelodiscus sinensis</i>	Chinese Softshell Turtle	112	Biochemical	LOEC	None	78.6	mg/kg	USEPA, 2013

**Notes:**

EC50 - Effective concentration for 50% of the population

LC50 - Lethal concentration for 50% of the population

LD50 - Lethal dose for 50% of the population

LOEC - Lowest Observable Effect Concentration

LOEL - Lowest Observable Effect Level

NOEC - No Observable Effect Concentration

NOEL - No Observable Effect Level

Biochemical - Measurement of biotransformation or metabolism of chemical compounds, modes of toxic action, and biochemical responses in plants and animals. Examples of biochemical effects include changes in enzyme or hormonal activity.

Behavior - Overt activity measurement of an organism including but not limited to avoidance, aggression, and feeding behavior.

Cellular - Measurements regarding changes in structure and chemical composition of cells and tissues of plants or animals as related to their functions.

Growth - Measurements that include changes in body weight, morphology, and development.

Mortality - Measurements where the cause of death can be attributed to the chemical.

Physiology - Measurement regarding basic activity within tissues and cells of plants or animals. Effects include physiological responses such as injury, immunity, and intoxication.

Population - Measurements related to changes in a group of organisms of the same species occupying the same area at a given time.

## REFERENCES

- Berntssen, H.G., K. Hylland, S.E. Wendelaar Bonga, and A. Maage. 1999. Toxic levels of dietary copper in Atlantic salmon (*Salmo salar* L.) parr. *Aquatic Toxicology* 46(2): 87-99.
- Draves, J.F. and M.G. Fox. 1998. Effects of a mine tailings spill on feeding and metal concentrations in yellow perch (*Perca flavescens*). *Environmental Toxicology and Chemistry* 17(8): 1626-1632.
- Edwards, S.C., C.L. MacLeod, and J.N. Lester. 1998. The bioavailability of copper and mercury to the common nettle (*Urtica dioica*) and the earthworm *Eisenia fetida* from contaminated dredge spoil. *Water, Air, and Soil Pollution* 102: 75-90.
- Eisler, R. Acrolein hazards to fish, wildlife and invertebrates: a synoptic review. U.S. Department of Interior, National Biological Survey Biological Report 23. 29 pp.
- Farag, A.M., C. J. Boese, D.F., Woodward, H.L. Bergman. 1994. Physiology changes and tissue metal accumulation in rainbow trout exposed to foodborne and waterborne metals. *Environmental Toxicology and Chemistry* 13(2): 2021-2029.
- Folmar, L.C. 1976. Overt avoidance reaction of rainbow trout fry to nine herbicides. *Bulletin of Environmental Contamination and Toxicology* 15(5): 509-514.
- Folmar, L.C. 1978. Avoidance chamber response of mayfly nymphs exposed to eight herbicides. *Bulletin of Environmental Contamination and Toxicology* 19(3): 312-318.
- Gintenreiter, S., J. Ortel, and H.J. Nopp. 1993. Bioaccumulation of cadmium, lead, copper, and zinc in successive developmental stages of *Lymantria dispar* L. (Lymantriidae, Lepid)—a life cycle study. *Archives of Environmental Contamination and Toxicology* 25: 55-61.
- Gomot, A. and F. Pihan. 1997. Comparison of the bioaccumulation capacities of copper and zinc in two snail subspecies (*Helix*). *Ecotoxicology and Environmental Safety* 38(2): 85-94.
- Gomot de Vaufleury, A. and F. Pihan. 2000. Growing snails used as sentinels to evaluate terrestrial environment contamination by trace elements. *Chemosphere* 40(3): 275-284.
- Han, B.-C., W.-L. Jeng, T.-C. Hung, and M.-Y. Wen. 1996. Relationship between copper speciation in sediments and bioaccumulation by marine bivalves of Taiwan. *Environmental Pollution* 91(1): 35-39.
- Handy, R.D. 1993. The effect of acute exposure to dietary Cd and Cu on organ toxicant concentration in rainbow trout, *Oncorhynchus mykiss*. *Aquatic Toxicology* 27(1-2): 1-14.
- Haritonidis, S. and P. Malea. 1999. Bioaccumulation of metals by the green alga *Ulva rigida* from Thermaikos Gulf, Greece. *Environmental Pollution* 104(3): 365-372.
- Harrahy, E.A. and W.H. Clements. 1997. Toxicity and bioaccumulation of a mixture of heavy metals in *Chironomus tentans* (Diptera: Chironomidae) in synthetic sediment. *Environmental Toxicology and Chemistry* 16(2): 317-327.

- Hendriks, A.J., H. Pieters, and J. de Boer. 1998. Accumulation of metals, polycyclic (halogenated) aromatic hydrocarbons, and biocides in zebra mussels and eel from the Rhine and Meuse Rivers. *Environmental Toxicology and Chemistry* 17(10): 1885-1898.
- Janssen, M.P.M. and R.F. Hogervorst. 1993. Metal accumulation in soil arthropods in relation to micro-nutrients. *Environmental Pollution* 79: 181-189.
- Khan, A.T., J.S. Weis, and L. D'Andrea. 1989. Bioaccumulation of four heavy metals in two populations of grass shrimp, *Palaemonetes pugio*. *Bulletin of Environmental Contamination and Toxicology* 42: 339-343
- Lundebye, A.-K., M.H.G. Berntssen, S.E. Wendelaar Bonga, and A. Maage. 1999. Biochemical and physiological responses in Atlantic salmon (*Salmo salar*) following dietary exposure to copper and cadmium. *Marine Pollution Bulletin* 39(1-12): 137-144.
- Marinussen, M.P.J.C, S.E.A.T.M. van der Zee, and F.A.M. de Haan. 1997a. Cu accumulation in the earthworm *Dendrobaena veneta* in a heavy metal (Cu, Pb, Zn) contaminated site compared to Cu accumulation in laboratory experiments. *Environmental Pollution* 96(2): 227-233.
- Marinussen, M.P.J.C., S.E.A.T.M. van der Zee, F.A.M. de Haan, L.M. Bouwman, and M.M. Hefting. 1997b. Heavy metal (copper, lead, and zinc) accumulation and excretion by the earthworm, *Dendrobaena veneta*. *Journal of Environmental Quality* 26(1): 278-284.
- Miller, P.A., R.P. Lanno, M.E. McMaster, and D.G. Dixon. 1993. Relative contributions of dietary and waterborne copper to tissue copper burdens and waterborne-copper tolerance in rainbow trout (*Oncorhynchus mykiss*). *Canadian Journal of Fisheries and Aquatic Sciences* 50(8): 1683-1689.
- Morgan, J.E., and A.J. Morgan. 1990. The distribution of cadmium, copper, lead, zinc, and calcium in the tissues of the earthworm *Lumbricus rubellus* sampled from one uncontaminated and four polluted sites. *Oecologia* 84(4): 559-566.
- Morgan, J.E. and A.J. Morgan. 1999. The accumulation of metals (Cd, Cu, Pb, Zn, and Ca) by two ecologically contrasting earthworm species (*Lumbricus rubellus* and *Aporrectodea caliginosa*): implications for ecotoxicological testing. *Applied Soil Ecology* 13: 9-20.
- Mount, D.R., A.K. Barth, T.D. Garrison, K.A. Barten, and J.R. Hockett. 1994. Dietary and waterborne exposure of rainbow trout (*Oncorhynchus mykiss*) to copper, cadmium, lead and zinc using a live diet. *Environmental Toxicology and Chemistry* 13(12): 2031-2041.
- Murai, T., J.W. Andrews, and R.G. Smith, Jr. 1981. Effects of dietary copper on channel catfish. *Aquaculture* 22(4): 353-357.
- Neuhauser, E.F., Z.V. Cukic, M.R. Malecki, R.C. Loehr, P.R. Durkin. 1995. Bioconcentration and biokinetics of heavy metals in the earthworm. *Environmental Pollution* 89(3): 293-301.
- Office of Pesticide Programs. 2014. Pesticide Ecotoxicity Database (Formerly: Environmental Effects Database (EEDB)). Environmental Fate and Effects Division, U.S.EPA, Washington, D.C. Available <http://www.ipmcenters.org/Ecotox/>

- Pyatt, F.B. A.J. Pyatt, and V.W. Pentreath. 1997. Distribution of metals and accumulation of lead by different tissues in the freshwater snail *Lymnaea stagnalis* (L.). *Environmental Toxicology and Chemistry* 16(6): 1393-1395.
- Svendsen, C. and J.M. Weeks. 1997a. Relevance and applicability of a simple earthworm biomarker of copper exposure: I. Links to ecological effects in a laboratory study with *Eisenia andrei*. *Ecotoxicology and Environmental Safety* 36(1): 72-79.
- Svendsen, C. and J.M. Weeks. 1997b. Relevance and applicability of a simple earthworm biomarker of copper exposure: II. Validation and applicability under field conditions in a mesocosm experiment with *Lumbricus rubellus*. *Ecotoxicology and Environmental Safety* 36(1): 80-88.
- Tomlin, C.D.S. 2002. *The e-Pesticide Manual, (Twelfth Edition) Version 2.2*. British Crop Protection Council. Farnham, Surrey.
- Turner, L. and W. Erickson. 2003. Acrolein analysis of risks from the aquatic herbicide use in irrigation supply canals to eleven evolutionary significant units of Pacific salmon and steelhead. U.S. Environmental Protection Agency, Office of Pesticide Programs, Environmental Field Branch. 49 pp.
- U.S. EPA. 1989. Environmental Protection Agency: Endangered species protection program. *Federal Register* 54(126): 27984-28008.
- U.S. EPA. 1993. *Wildlife Exposure Factors Handbook*. U.S. Environmental Protection Agency. Report EPA/600/R-93/187.
- U.S. EPA. 1999. *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities*. Solid Waste and Emergency Response. EPA/530-D-99-001A.
- U.S. EPA. 2003. *Toxicological review of acrolein: in support of summary information on the integrated risk information system (IRIS)*. U.S. Environmental Protection Agency. Report EPA/635/R-03/003.
- U.S. EPA. 2013. *Pesticide Ecotoxicity Database*. U.S. Environmental Protection Agency, Office of Pesticide Programs, Environmental Fate and Effects Division. Available at [http://cfpub.epa.gov/ecotox/quick\\_query.htm](http://cfpub.epa.gov/ecotox/quick_query.htm).
- U.S. EPA. 2013. *ECOTOX User Guide: ECOTOXicology Database System. Version 4.0*. Available: <http://www.epa.gov/ecotox/>.
- WHO. 1991. *Acrolein, Environmental Health Criteria 127*. World Health Organization, International Programme on Chemical Safety. Available at <http://www.inchem.org/documents/ehc/ehc/ehc227.htm>.
- WHO. 2002. *Acrolein, Concise International Chemical Assessment Document 43*. World Health Organization, The International Programme on Chemical Safety. 49 pp.
- Woodward, D.F., A.M. Farag, H.L. Bergman, A.J. DeLonay, E.E. Little, C.E. Smith, F.T. Barrows. 1995. *Metals-contaminated benthic invertebrates in the Clark Fork River, Montana: effects on*

age-0 brown trout and rainbow trout. *Canadian Journal of Fisheries and Aquatic Sciences* 52(9): 1994-2004.

# Appendix C

(Copper Speciation Graphs from the Biotic Ligand Model)

## Biotic Ligand Model Copper Speciation Graphs for Varying Water Parameters

In addition to using a hardness-based approach to quantifying copper water quality criteria, the USEPA suggests the use of a model, described below, to analyze and/or predict concentration of bioavailable copper in the water column. The bioavailability of copper directly influences its toxicity.

In the 2007 revision of Aquatic Life Ambient Freshwater Quality Criteria-Copper (EPA 2007), the USEPA recommended the Biotic Ligand Model (BLM) as a more accurate approach for assessing bioavailability and toxicity and deriving freshwater quality criteria for copper. The BLM supplements USEPA's previously published recommendation of using the hardness-based estimation and better accounts for the reduction in copper bioavailability that results from competitive binding of copper to other molecules in the water column.

The BLM was developed to predict copper bioavailability and toxicity to aquatic organisms in relation to water quality parameters including pH, hardness, alkalinity, and dissolved organic carbon (DOC). According to the BLM, copper bioavailability is strongly influenced by these parameters. The free cupric ion ( $\text{Cu}^{2+}$ ) is the primary driver of copper bioavailability and toxicity in aquatic ecosystems (EPA 2007).

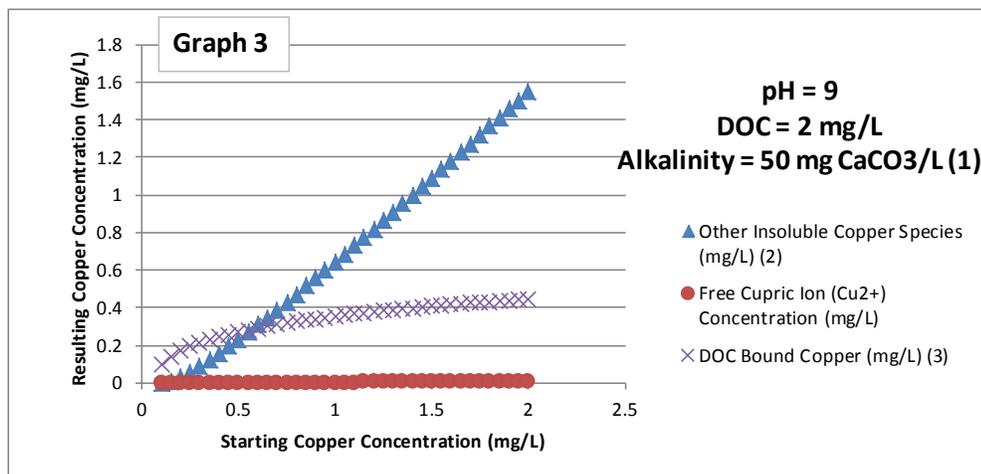
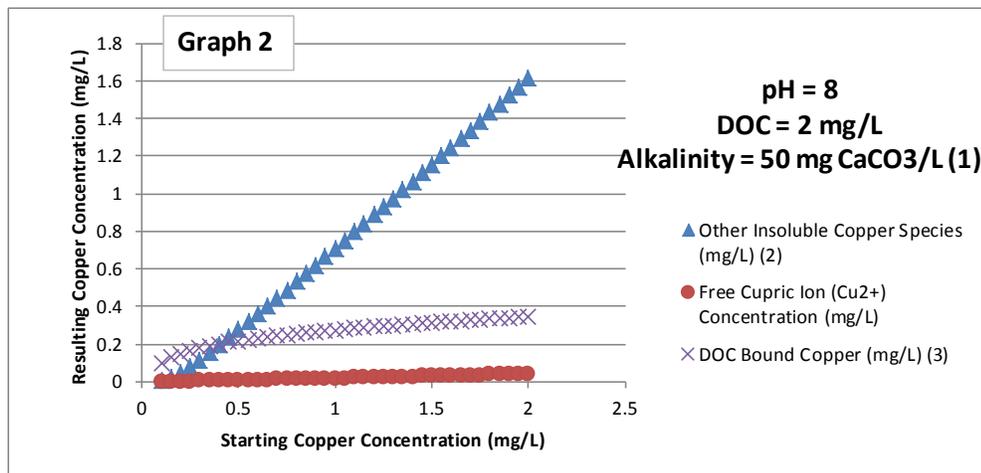
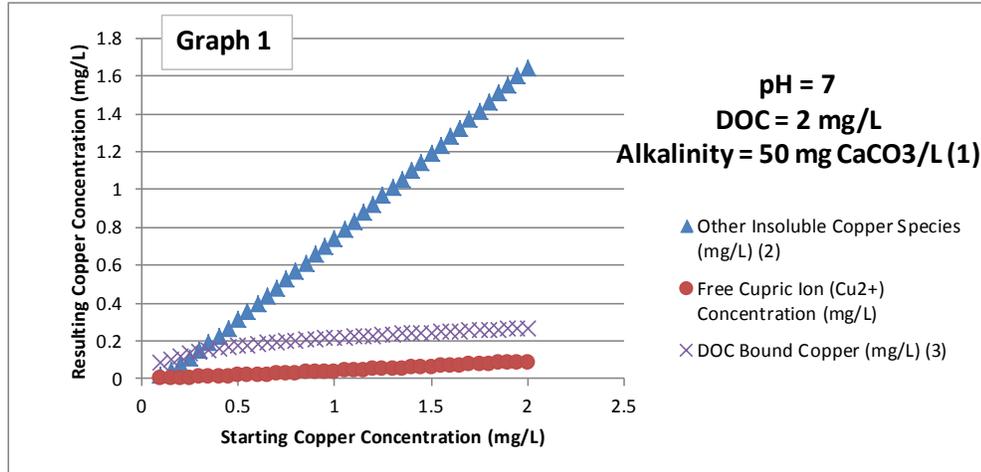
In order to derive freshwater quality criterion for copper, the BLM uses ten water quality inputs: temperature; pH; dissolved organic carbon (DOC); major cations including calcium (Ca), magnesium (Mg), sodium (Na), potassium (K); major anions including sulfate ( $\text{SO}_4$ ), chloride (Cl); and alkalinity. Copper may be measured for comparison with site-specific criteria, but it is not required as an input to the model to determine copper freshwater quality criteria. The BLM-based water quality criterion for copper may be more or less stringent than the hardness-based criteria depending on the water quality parameters. However, it is a more accurate than hardness-based criteria because it is based on copper bioavailability to aquatic species.

The BLM may also be used to predict copper toxicity and speciation in varying water conditions. When the model is run in toxicity prediction mode, it predicts the concentration of dissolved copper that produces a particular endpoint (e.g. NOAEL, LOAEL, or  $\text{LC}_{50}$ ) for the selected aquatic species. When run in speciation prediction mode, the model can determine the various forms (e.g.  $\text{CuCO}_3$ ,  $\text{Cu}^{2+}$ , copper bound to DOC) and concentrations of copper in the water when known copper concentration in water is input in the model.

Using the Biotic Ligand Model in copper speciation prediction mode, a total of 27 graphs have been generated to illustrate how variations in water quality parameters including pH, hardness, alkalinity, and dissolved organic carbon (DOC) influence the concentration of bioavailable  $\text{Cu}^{2+}$ . See the tables and graphs below. Generally, an increase in one or more of the four water parameters lowers the concentration of the  $\text{Cu}^{2+}$  species, thereby lowering the bioavailability of copper.

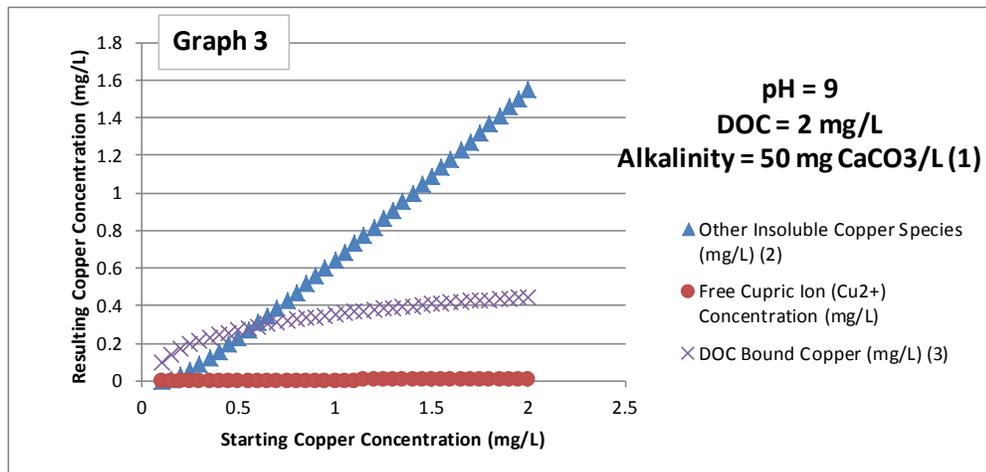
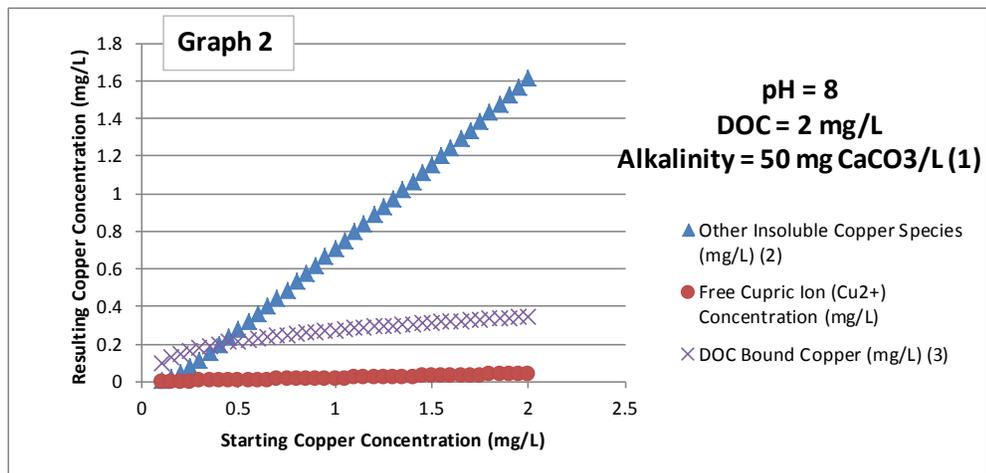
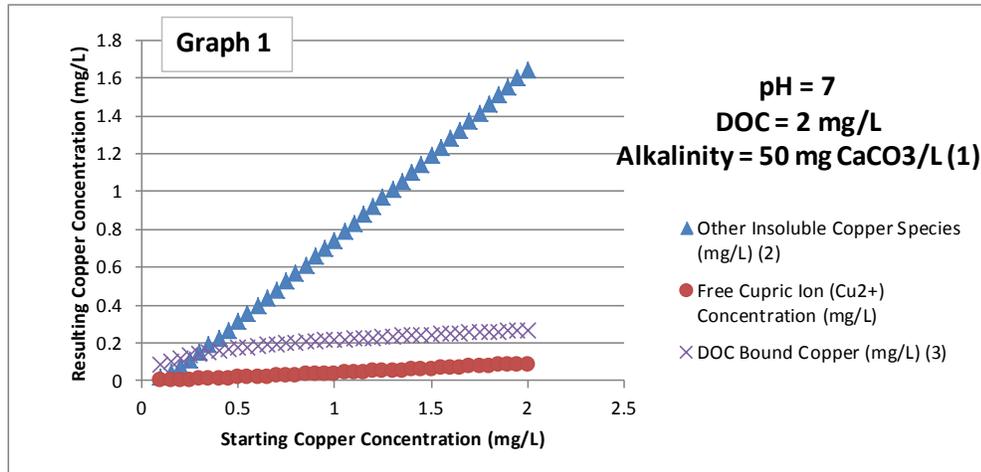
APPENDICES

<b>Graph #</b>	<b>Dissolved Organic Carbon (mg/L)</b>	<b>pH (unitless)</b>	<b>Alkalinity &amp; Hardness (mg CaCO3/L)</b>
1	2	7	50
2	2	8	50
3	2	9	50
4	2	7	100
5	2	8	100
6	2	9	100
7	2	7	200
8	2	8	200
9	2	9	200
10	4	7	50
11	4	8	50
12	4	9	50
13	4	7	100
14	4	8	100
15	4	9	100
16	4	7	200
17	4	8	200
18	4	9	200
19	6	7	50
20	6	8	50
21	6	9	50
22	6	7	100
23	6	8	100
24	6	9	100
25	6	7	200
26	6	8	200
27	6	9	200

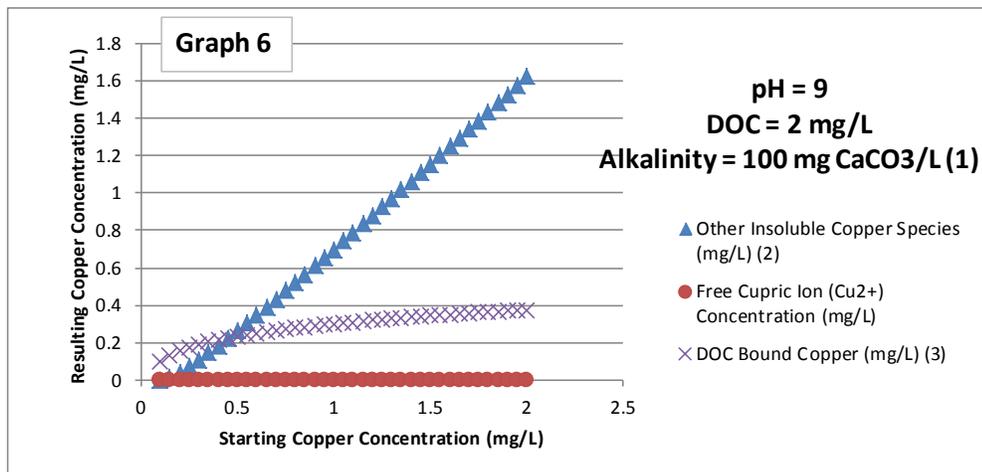
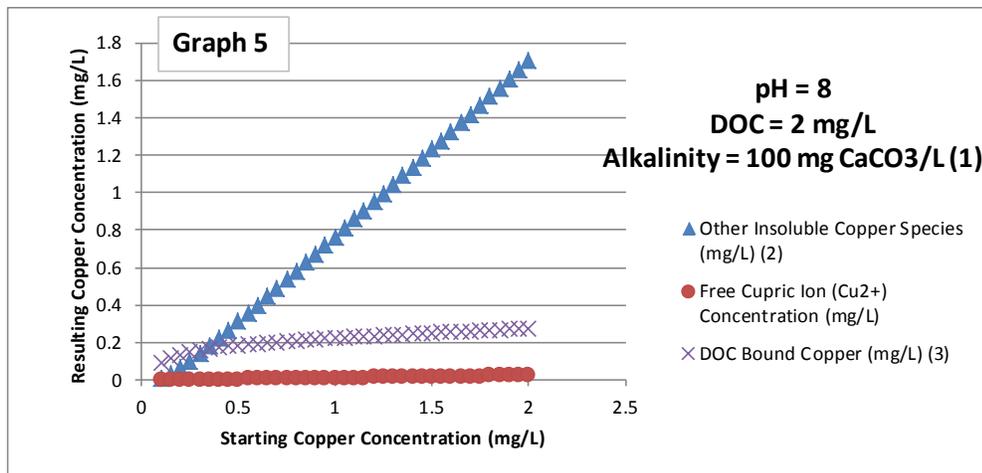
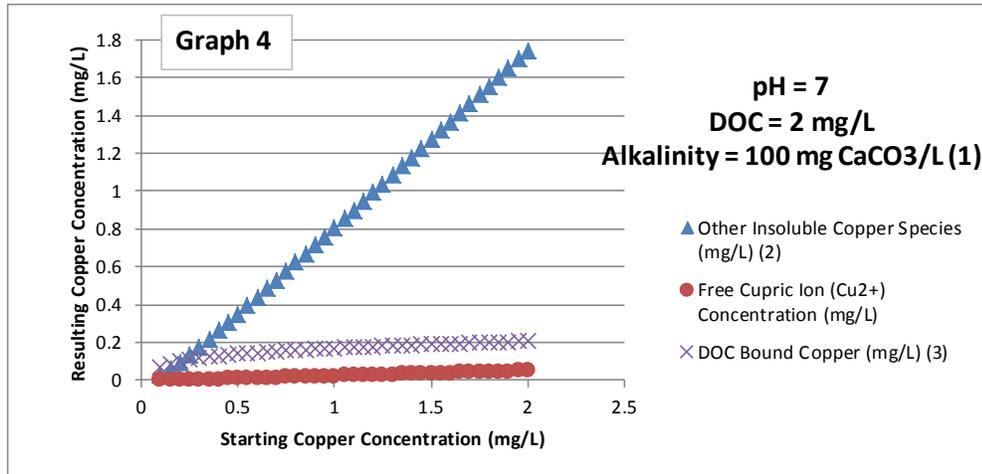


**Notes:**

- (1) Hardness and Alkalinity are both expressed as CaCO<sub>3</sub> and are assumed equal.
- (2) "Other Insoluble Copper Species" is the copper not accounted for by "Free Cupric Ion" and "DOC Bound Copper" species. It exists as various copper-ligands and/or copper salts, including but not limited to: CuCO<sub>3</sub>, CuHCO<sub>3</sub><sup>+</sup>, and Cu(OH)<sub>2</sub>.
- (3) DOC is the dissolved organic carbon content capable of complexing with copper cations, rendering them non-bioavailable. The humic acid content of the DOC was assumed to be 10%.

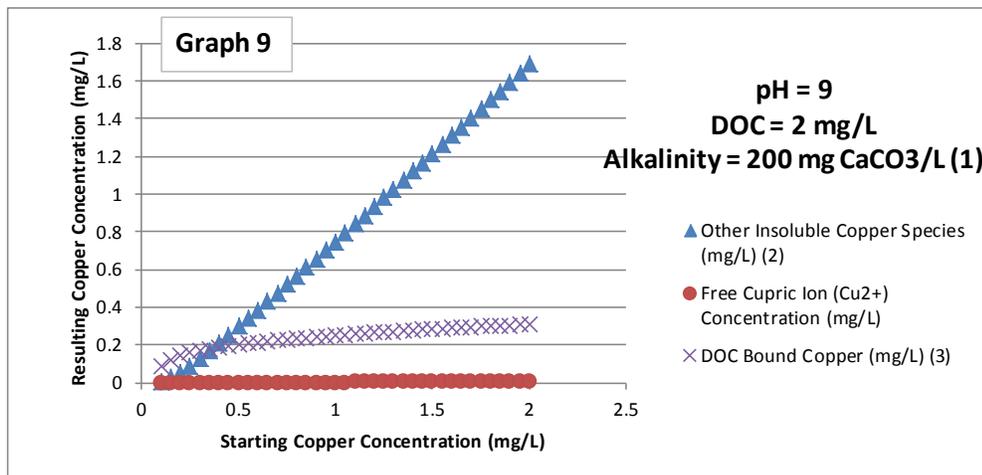
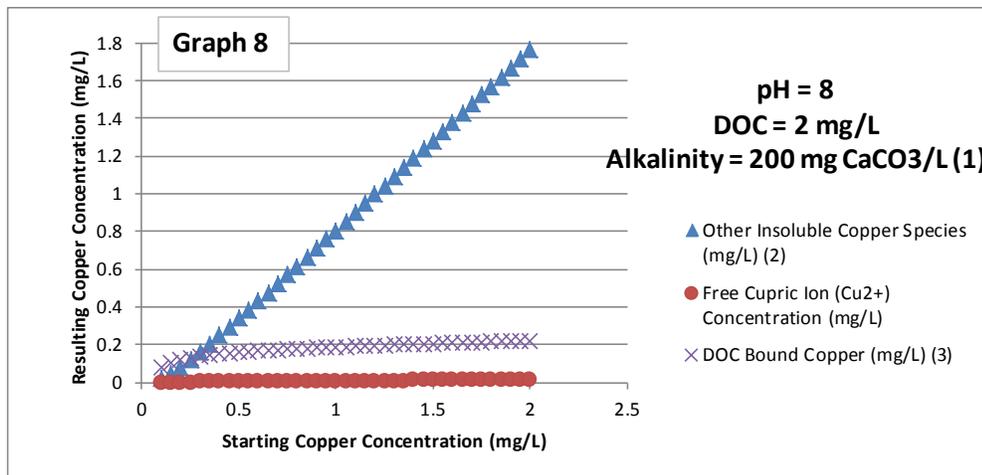
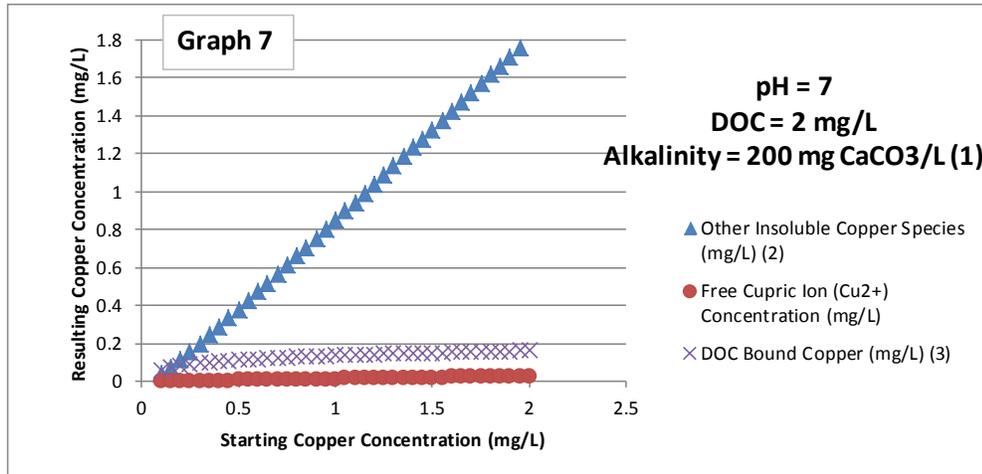
**Notes:**

- (1) Hardness and Alkalinity are both expressed as CaCO<sub>3</sub> and are assumed equal.
- (2) "Other Insoluble Copper Species" is the copper not accounted for by "Free Cupric Ion" and "DOC Bound Copper" species. It exists as various copper-ligands and/or copper salts, including but not limited to: CuCO<sub>3</sub>, CuHCO<sub>3</sub><sup>+</sup>, and Cu(OH)<sub>2</sub>.
- (3) DOC is the dissolved organic carbon content capable of complexing with copper cations, rendering them non-bioavailable. The humic acid content of the DOC was assumed to be 10%.



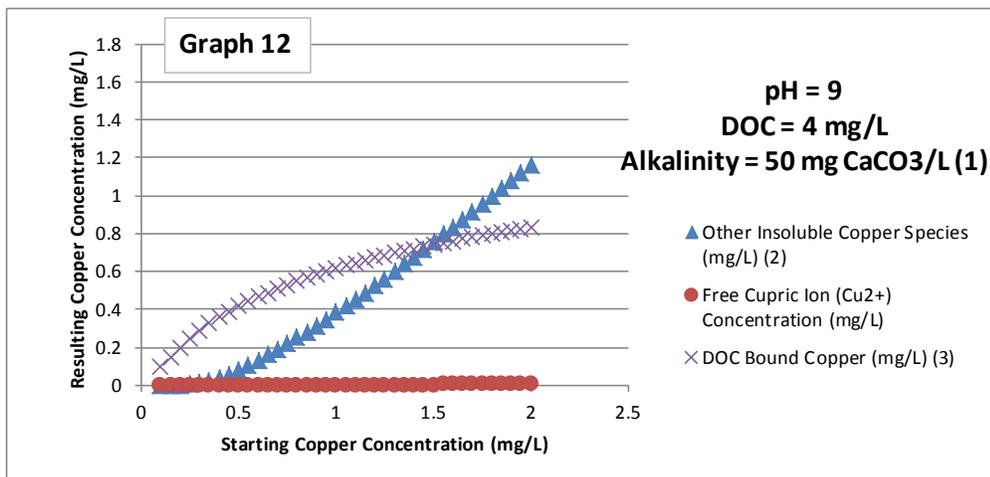
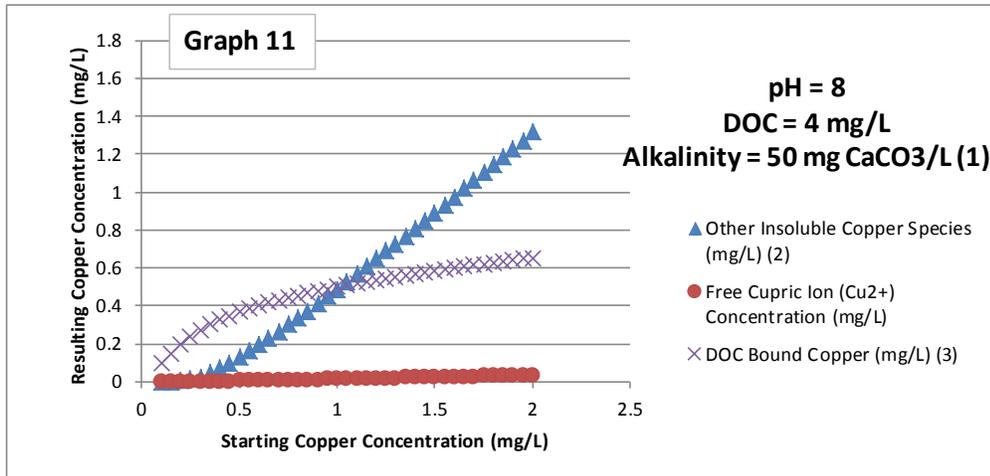
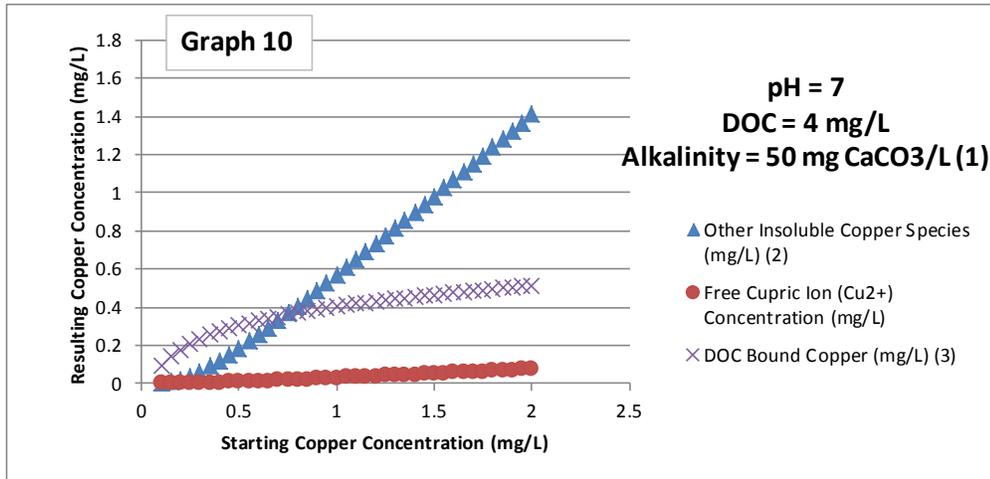
**Notes:**

- (1) Hardness and Alkalinity are both expressed as CaCO<sub>3</sub> and are assumed equal.
- (2) "Other Insoluble Copper Species" is the copper not accounted for by "Free Cupric Ion" and "DOC Bound Copper" species. It exists as various copper-ligands and/or copper salts, including but not limited to: CuCO<sub>3</sub>, CuHCO<sub>3</sub><sup>+</sup>, and Cu(OH)<sub>2</sub>.
- (3) DOC is the dissolved organic carbon content capable of complexing with copper cations, rendering them non-bioavailable. The humic acid content of the DOC was assumed to be 10%.



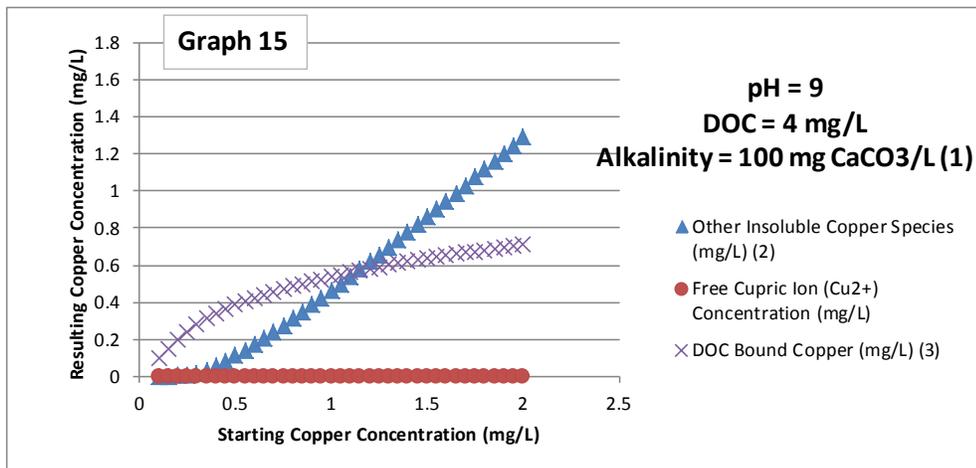
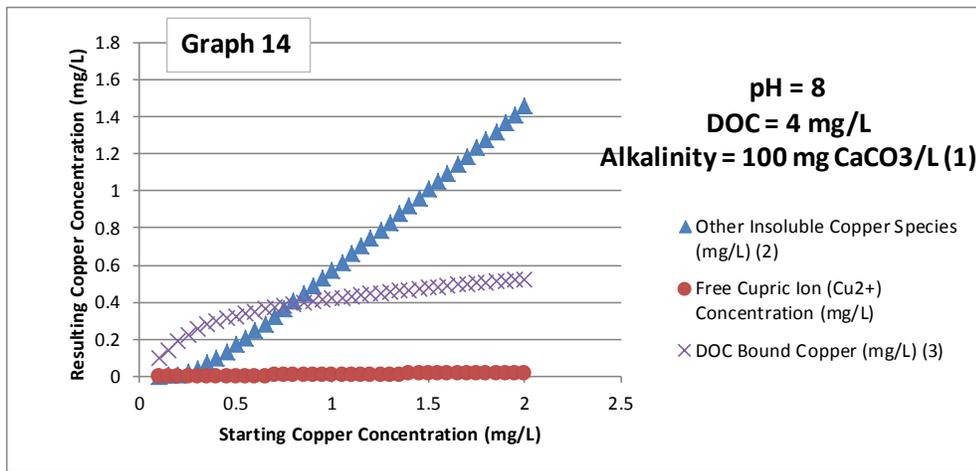
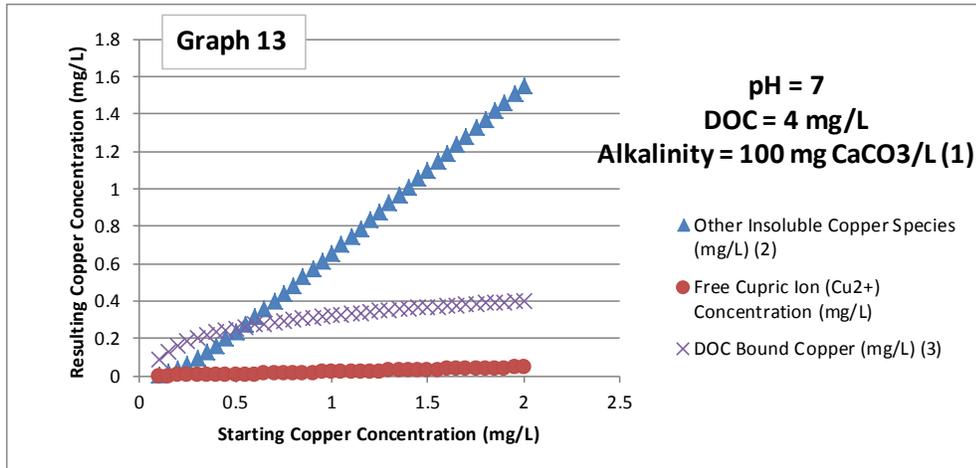
**Notes:**

- (1) Hardness and Alkalinity are both expressed as CaCO<sub>3</sub> and are assumed equal.
- (2) "Other Insoluble Copper Species" is the copper not accounted for by "Free Cupric Ion" and "DOC Bound Copper" species. It exists as various copper-ligands and/or copper salts, including but not limited to: CuCO<sub>3</sub>, CuHCO<sub>3</sub><sup>+</sup>, and Cu(OH)<sub>2</sub>.
- (3) DOC is the dissolved organic carbon content capable of complexing with copper cations, rendering them non-bioavailable. The humic acid content of the DOC was assumed to be 10%.



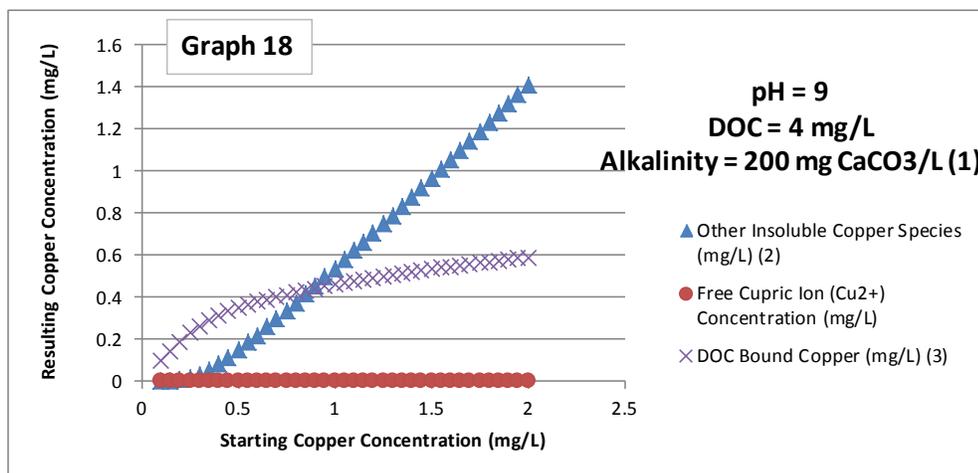
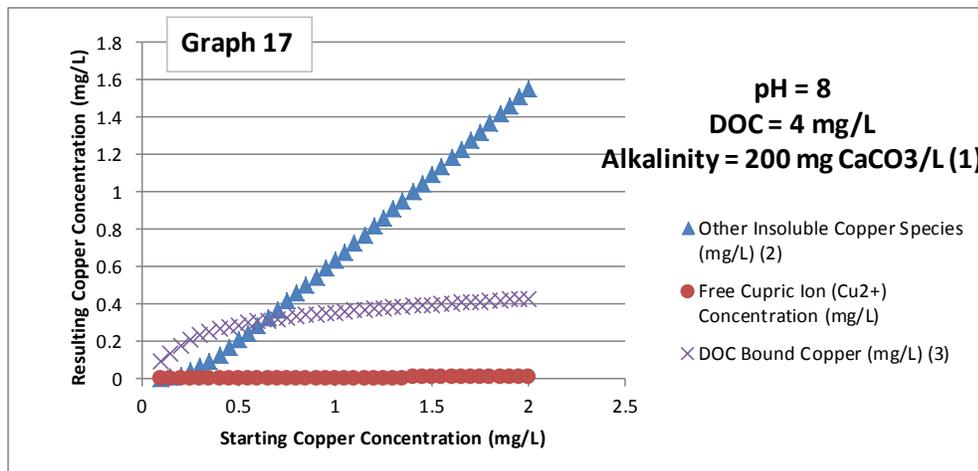
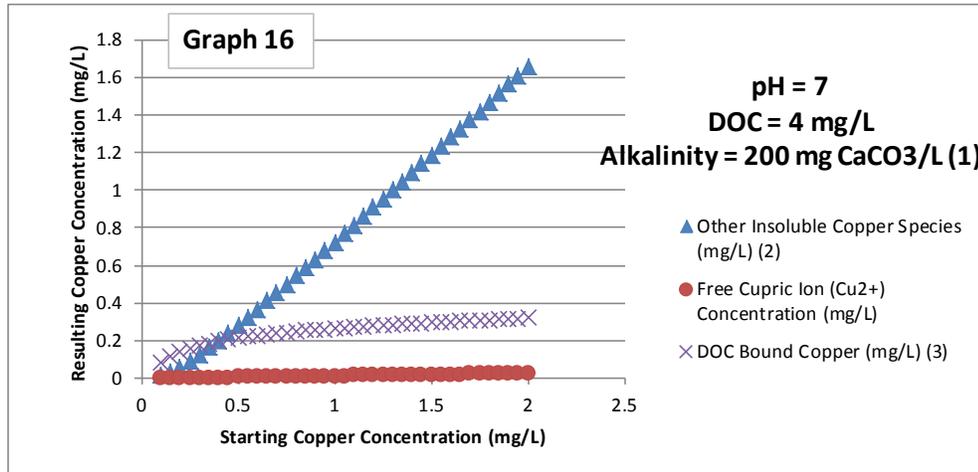
**Notes:**

- (1) Hardness and Alkalinity are both expressed as CaCO<sub>3</sub> and are assumed equal.
- (2) "Other Insoluble Copper Species" is the copper not accounted for by "Free Cupric Ion" and "DOC Bound Copper" species. It exists as various copper-ligands and/or copper salts, including but not limited to: CuCO<sub>3</sub>, CuHCO<sub>3</sub><sup>+</sup>, and Cu(OH)<sub>2</sub>.
- (3) DOC is the dissolved organic carbon content capable of complexing with copper cations, rendering them non-bioavailable. Dissolved organic carbon was modeled with 10% humic acid content.



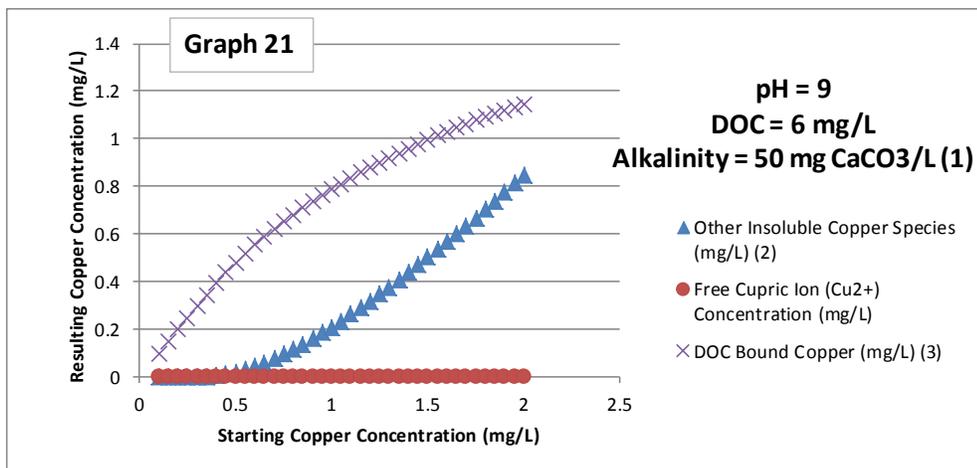
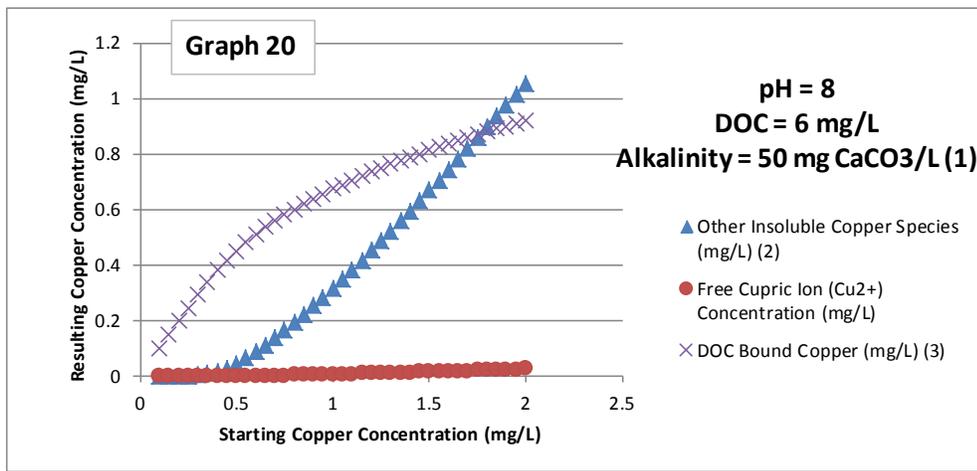
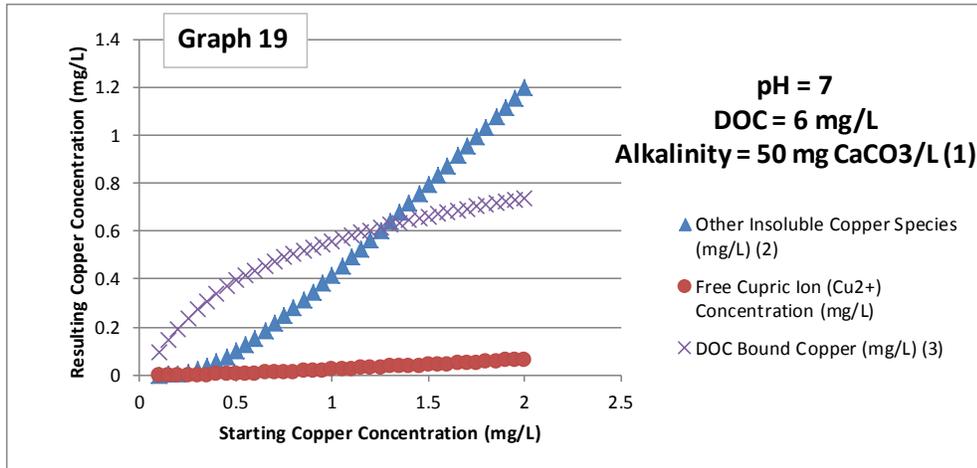
**Notes:**

- (1) Hardness and Alkalinity are both expressed as CaCO<sub>3</sub> and are assumed equal.
- (2) "Other Insoluble Copper Species" is the copper not accounted for by "Free Cupric Ion" and "DOC Bound Copper" species. It exists as various copper-ligands and/or copper salts, including but not limited to: CuCO<sub>3</sub>, CuHCO<sub>3</sub><sup>+</sup>, and Cu(OH)<sub>2</sub>.
- (3) DOC is the dissolved organic carbon content capable of complexing with copper cations, rendering them non-bioavailable. Dissolved organic carbon was modeled with 10% humic acid content.



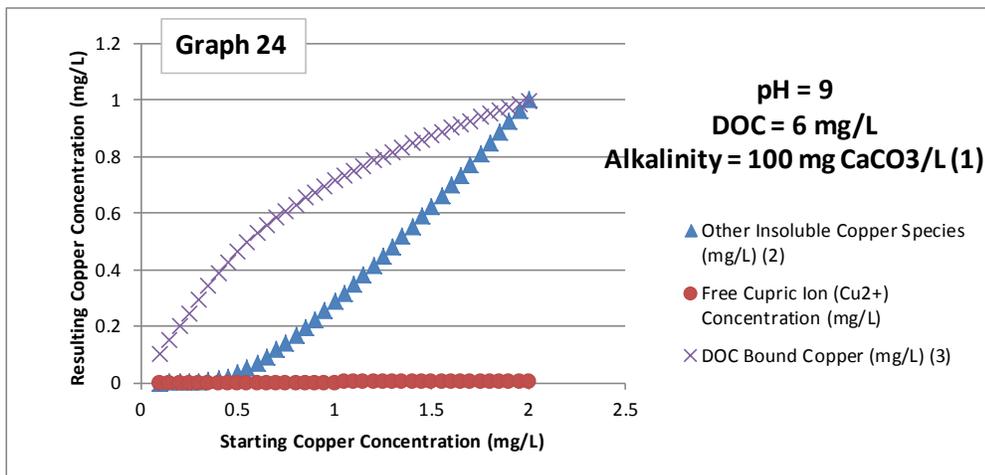
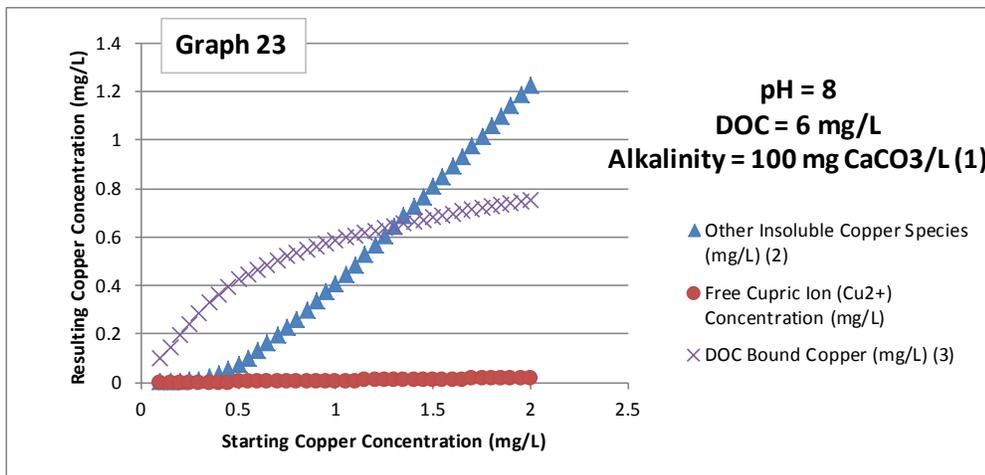
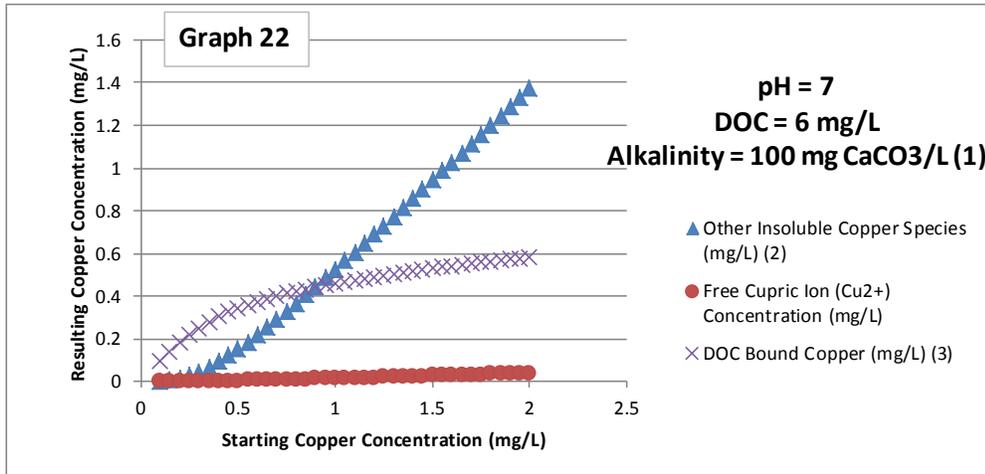
**Notes:**

- (1) Hardness and Alkalinity are both expressed as CaCO<sub>3</sub> and are assumed equal.
- (2) "Other Insoluble Copper Species" is the copper not accounted for by "Free Cupric Ion" and "DOC Bound Copper" species. It exists as various copper-ligands and/or copper salts, including but not limited to: CuCO<sub>3</sub>, CuHCO<sub>3</sub><sup>+</sup>, and Cu(OH)<sub>2</sub>.
- (3) DOC is the dissolved organic carbon content capable of complexing with copper cations, rendering them non-bioavailable. Dissolved organic carbon was modeled with 10% humic acid content.



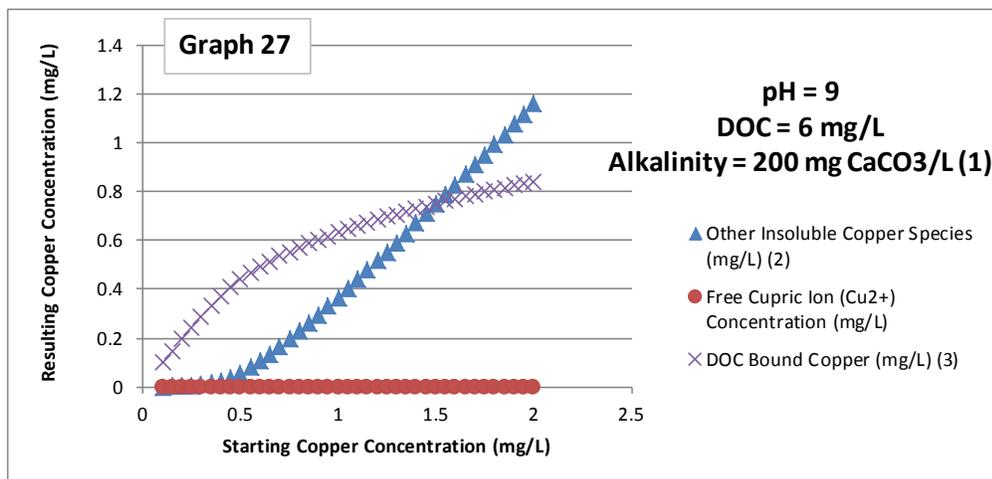
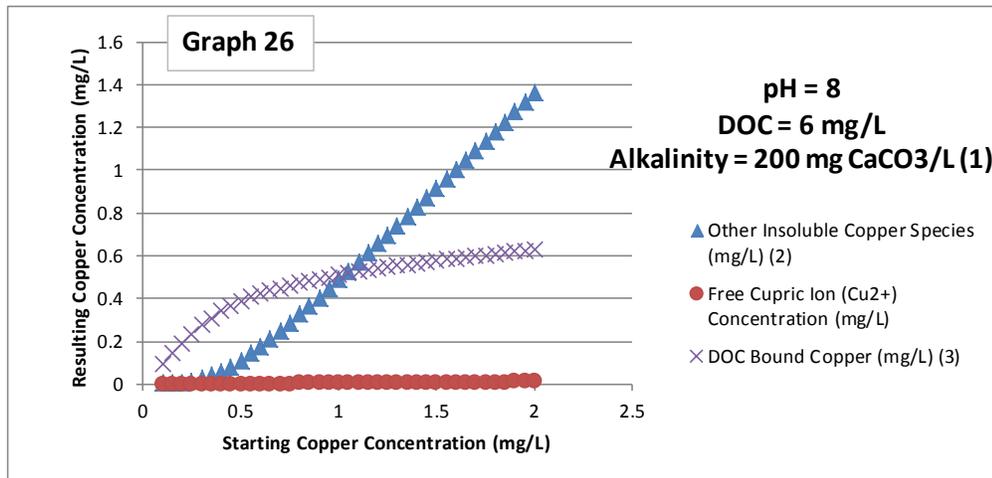
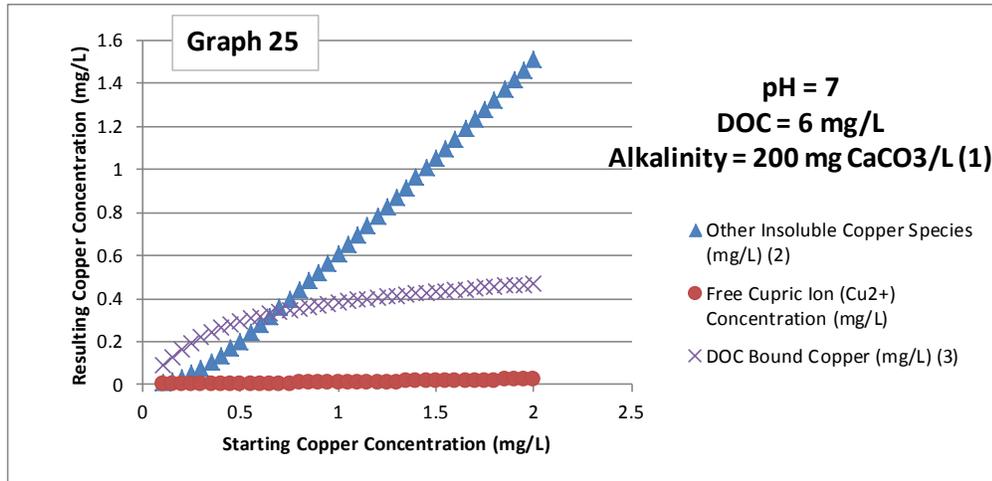
**Notes:**

- (1) Hardness and Alkalinity are both expressed as CaCO<sub>3</sub> and are assumed equal.
- (2) "Other Insoluble Copper Species" is the copper not accounted for by "Free Cupric Ion" and "DOC Bound Copper" species. It exists as various copper-ligands and/or copper salts, including but not limited to: CuCO<sub>3</sub>, CuHCO<sub>3</sub><sup>+</sup>, and Cu(OH)<sub>2</sub>.
- (3) DOC is the dissolved organic carbon content capable of complexing with copper cations, rendering them non-bioavailable. Dissolved organic carbon was modeled with 10% humic acid content.



**Notes:**

- (1) Hardness and Alkalinity are both expressed as CaCO<sub>3</sub> and are assumed equal.
- (2) "Other Insoluble Copper Species" is the copper not accounted for by "Free Cupric Ion" and "DOC Bound Copper" species. It exists as various copper-ligands and/or copper salts, including but not limited to: CuCO<sub>3</sub>, CuHCO<sub>3</sub><sup>+</sup>, and Cu(OH)<sub>2</sub>.
- (3) DOC is the dissolved organic carbon content capable of complexing with copper cations, rendering them non-bioavailable. Dissolved organic carbon was modeled with 10% humic acid content.



**Notes:**

- (1) Hardness and Alkalinity are both expressed as CaCO<sub>3</sub> and are assumed equal.
- (2) "Other Insoluble Copper Species" is the copper not accounted for by "Free Cupric Ion" and "DOC Bound Copper" species. It exists as various copper-ligands and/or copper salts, including but not limited to: CuCO<sub>3</sub>, CuHCO<sub>3</sub><sup>+</sup>, and Cu(OH)<sub>2</sub>.
- (3) DOC is the dissolved organic carbon content capable of complexing with copper cations, rendering them non-bioavailable. Dissolved organic carbon was modeled with 10% humic acid content.

# Appendix D

(DPR PCA Recommendation Form)

### Pest Control Recommendation

1. Operator of the Property.		2.Recommendation Expiration Date	
Address		City	County
3. Location to be Treated			
4. Commodity to be Treated			5. Acres or Units to be Treated
6. Method of Application: <input type="checkbox"/> Air <input type="checkbox"/> Ground <input type="checkbox"/> Fumigation <input type="checkbox"/> Other _____		7. Pest(s) to be Controlled	
8. Name of Pesticide(s)	Rate per Acre or Unit	Dilution Rate	Volume per Acre or Unit
9. Hazards and/or Restrictions: <input type="checkbox"/> 1. Highly toxic to bees. <input type="checkbox"/> 2. Toxic to birds, fish and wildlife. <input type="checkbox"/> 3. Do not apply when irrigation or run-off is likely to occur. <input type="checkbox"/> 4. Do not apply near desirable plants. <input type="checkbox"/> 5. Do not allow to drift onto humans, animals, or desirable plants. <input type="checkbox"/> 6. Keep out of lakes, streams, and ponds. <input type="checkbox"/> 7. Birds feeding on treated area may be killed. <input type="checkbox"/> 8. Do not apply when foliage is wet (dew, rain, etc.). <input type="checkbox"/> 9. May cause allergic reaction to some people. <input type="checkbox"/> 10. This product is corrosive and reacts with certain materials (see label). <input type="checkbox"/> 11. Closed system required. <input type="checkbox"/> 12. Restricted use pesticide (California and/or EPA). <input type="checkbox"/> 13. Hazardous area involved (see map and warnings) <input type="checkbox"/> 14. Other (see attachment)		10. Schedule, Time or Conditions	
		11. Surrounding Crop Hazards	
		12. Proximity of Occupied Dwellings, People, Pets, or Livestock	
		13. Non-Pesticide Pest Control, Warnings and Other Remarks	
		14. Criteria Used for Determining Need for Pest Control Treatment: <input type="checkbox"/> Sweep Net Counts <input type="checkbox"/> Leaf or Fruit Counts <input type="checkbox"/> Preventative <input type="checkbox"/> Field Observation <input type="checkbox"/> Pheromone or Other Trap <input type="checkbox"/> Soil Sampling <input type="checkbox"/> Other	
15. Crop and Site Restrictions: <input type="checkbox"/> 1. Worker reentry interval ____ days. <input type="checkbox"/> 2. Do not use within ____ days of harvest/slaughter. <input type="checkbox"/> 3. Posting required? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> 4. Do not irrigate for at least ____ days after application. <input type="checkbox"/> 6. Do not feed treated foliage or straw to livestock. <input type="checkbox"/> 7. Plantback restrictions (see label) <input type="checkbox"/> 8. Other ( see attachment )		N	
16. I certify that I have considered alternatives and mitigation measures that would substantially lessen any significant impact on the environment, and have adopted those feasible.		W	
Adviser Signature	Date	E	
Adviser License Number			
Employer			
Employer's Address			
		S	

# Appendix E

(Example Product Labels and MSDS Sheets)

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 algacides 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 in 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 CaCO<sub>3</sub>.

**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 <sup>b</sup>	Band	Bdct <sup>b</sup>	Band	Bdct <sup>b</sup>	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>

<sup>a</sup>Recommendations 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. <sup>b</sup>Bdct = 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

# Material Safety Data Sheet

**Material Name: Copper Sulfate Pentahydrate**

**ID: C1-121A**

**\*\*\* Section 1 - Chemical Product and Company Identification \*\*\***

**Chemical Name:** Copper Sulfate Pentahydrate

**Product Use:** For Commercial Use

**Synonyms:** Copper Sulfate Crystals, Blue Copper, Blue Stone, Blue Vitriol, Copper (II) sulfate, Cupric Sulfate, Copper Sulfate Fine 200, Fine 100, Fine 30, 20, Small, Medium, Large, FCC IV, and Very High Purity

**Supplier Information**

Chem One Ltd. (Importer of record)  
8017 Pinemont Drive, Suite 100  
Houston, Texas 77040-6519

Phone: (713) 896-9966  
Fax: (713) 896-7540  
Emergency # (800) 424-9300 or (703) 527-3887

**General Comments**

NOTE: Emergency telephone numbers are to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure, or accident involving chemicals. All non-emergency questions should be directed to customer service.

**\*\*\* Section 2 - Composition / Information on Ingredients \*\*\***

CAS #	Component	Percent
7758-99-8	Copper (II) Sulfate Pentahydrate	> 99

**Component Related Regulatory Information**

This product may be regulated, have exposure limits or other information identified as the following: Copper (7440-50-8) and inorganic compounds, as Cu, Copper (7440-50-8) dusts and mists, as Cu and Copper fume, Cu.

**Component Information/Information on Non-Hazardous Components**

This product is considered hazardous under 29 CFR 1910.1200 (Hazard Communication).

**\*\*\* Section 3 - Hazards Identification \*\*\***

**Emergency Overview**

Copper Sulfate Pentahydrate is a blue crystalline or powdered, odorless solid. Potentially fatal if swallowed. May cause irritation to the eyes, respiratory system and skin. Fire may produce irritating, corrosive and/or toxic fumes. Firefighters should use full protective equipment and clothing.

**Hazard Statements**

HARMFUL OR FATAL IF SWALLOWED. Can cause irritation of eyes, skin, respiratory tract and, in extreme cases, burns. Avoid contact with eyes and skin. Avoid breathing dusts. Wash thoroughly after handling. Keep container closed. Use with adequate ventilation. Keep from contact with clothing and other combustible materials.

**Potential Health Effects: Eyes**

Exposure to particulates or solution of this product may cause redness and pain. Prolonged contact may cause conjunctivitis, ulceration and corneal abnormalities.

**Potential Health Effects: Skin**

This product can cause irritation of the skin with pain, itching and redness. Severe overexposure can cause skin burns. Prolonged exposure may cause dermatitis and eczema.

**Potential Health Effects: Ingestion**

Harmful or fatal if swallowed. May cause gastrointestinal irritation with symptoms such as nausea, vomiting, and diarrhea. Ingestion may cause degeneration of liver, kidney, or renal failure. Persons who survive ingestion may develop granulomatous lesions of the kidney. Ingestion of large amounts may lead to convulsions, coma or death.

**Potential Health Effects: Inhalation**

May irritate the nose, throat and respiratory tract. Symptoms can include sore throat, coughing and shortness of breath. In severe cases, ulceration and perforation of the nasal septum can occur. If this material is heated, inhalation of fumes may lead to development of metal fume fever. This is a flu-like illness with symptoms of metallic taste, fever and chills, aches, chest tightness and cough. Repeated inhalation exposure can cause shrinking of the lining of the inner nose.

**HMIS Ratings: Health Hazard: 2\* Fire Hazard: 0 Physical Hazard: 1 Personal Protective Equipment: E = chemical goggles, impervious gloves, dust respirator.**

Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe \* = Chronic hazard

## Material Safety Data Sheet

**Material Name: Copper Sulfate Pentahydrate**

**ID: C1-121A**

### \*\*\* Section 4 - First Aid Measures \*\*\*

**First Aid: Eyes**

In case of contact with eyes, rinse immediately with plenty of water for at least 20 minutes. Seek immediate medical attention.

**First Aid: Skin**

Remove all contaminated clothing. For skin contact, wash thoroughly with soap and water for at least 20 minutes. Seek immediate medical attention if irritation develops or persists.

**First Aid: Ingestion**

DO NOT INDUCE VOMITING. Have victim rinse mouth thoroughly with water, if conscious. Never give anything by mouth to a victim who is unconscious or having convulsions. Contact a physician or poison control center immediately.

**First Aid: Inhalation**

Remove source of contamination or move victim to fresh air. Apply artificial respiration if victim is not breathing. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Administer oxygen if breathing is difficult. Get immediate medical attention.

**First Aid: Notes to Physician**

Provide general supportive measures and treat symptomatically. Basic Treatment: Establish a patent airway. Suction if necessary. Watch for signs of respiratory insufficiency and assist ventilations if necessary. Administer oxygen by non-rebreather mask at 10 to 15 L/minutes. Monitor for shock and treat if necessary. For eye contamination, flush eyes immediately with water. Irrigate each eye continuously with normal saline during transport. Do not use emetics. For ingestion, rinse mouth and administer 5 mL/kg up to 200 mL of water for dilution if the patient can swallow, has a strong gag reflex, and does not drool. Administer activated charcoal. Advanced Treatment: Consider orotracheal or nasotracheal intubation for airway control in the patient who is unconscious. Start an IV with lactated Ringer's SRP: "To keep open", minimal flow rate. Watch for signs of fluid overload. For hypotension with signs of hypovolemia, administer fluid cautiously. Consider vasopressors if hypotensive with a normal fluid volume. Watch for signs of fluid overload. Use proparacaine, hydrochloride to assist eye irrigation.

### \*\*\* Section 5 - Fire Fighting Measures \*\*\*

**Flash Point:** Not flammable

**Method Used:** Not applicable

**Upper Flammable Limit (UEL):** Not applicable

**Lower Flammable Limit (LEL):** Not applicable

**Auto Ignition:** Not applicable

**Flammability Classification:** Not applicable

**Rate of Burning:** Not applicable

**General Fire Hazards**

Copper Sulfate Pentahydrate is not combustible, but may decompose in the heat of a fire to produce corrosive and/ or toxic fumes.

**Hazardous Combustion Products**

Sulfur oxides and copper fumes.

**Extinguishing Media**

Use methods for surrounding fire.

**Fire Fighting Equipment/Instructions**

Firefighters should wear full protective clothing including self-contained breathing apparatus. Runoff from fire control or dilution water may be corrosive and/or toxic and cause pollution.

**NFPA Ratings: Health: 2 Fire: 0 Reactivity: 1 Other:**

Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe

### \*\*\* Section 6 - Accidental Release Measures \*\*\*

**Containment Procedures**

Stop the flow of material, if this can be done without risk. Contain the discharged material. If sweeping of a contaminated area is necessary use a dust suppressant agent, which does not react with product (see Section 10 for incompatibility information).

**Clean-Up Procedures**

Wear appropriate protective equipment and clothing during clean-up. Shovel the material into waste container. Thoroughly wash the area after a spill or leak clean-up. Prevent spill rinsate from contamination of storm drains, sewers, soil or groundwater.

**Evacuation Procedures**

Evacuate the area promptly and keep upwind of the spilled material. Isolate the spill area to prevent people from entering. Keep materials which can burn away from spilled material. In case of large spills, follow all facility emergency response procedures.

## Material Safety Data Sheet

Material Name: **Copper Sulfate Pentahydrate**

ID: **C1-121A**

### Special Procedures

Remove soiled clothing and launder before reuse. Avoid all skin contact with the spilled material. Have emergency equipment readily available.

### \* \* \* Section 7 - Handling and Storage \* \* \*

### Handling Procedures

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling, when used as a pesticide. Do not breathe dust. Avoid all contact with skin and eyes. Use this product only with adequate ventilation. Wash thoroughly after handling.

### Storage Procedures

Keep in original container in locked storage area. Keep container tightly closed when not in use. Store containers in a cool, dry location, away from direct sunlight, sources of intense heat, or where freezing is possible. Material should be stored in secondary containers or in a diked area, as appropriate. Store containers away from incompatible chemicals (see Section 10, Stability and Reactivity). Storage areas should be made of fire-resistant materials. Post warning and "NO SMOKING" signs in storage and use areas, as appropriate. Use corrosion-resistant structural materials, lighting, and ventilation systems in the storage area. Floors should be sealed to prevent absorption of this material. Have appropriate extinguishing equipment in the storage area (i.e., sprinkler system, portable fire extinguishers). Empty containers may contain residual particulates; therefore, empty containers should be handled with care. Do not cut, grind, weld, or drill near this container. Never store food, feed, or drinking water in containers that held this product. Keep this material away from food, drink and animal feed. Inspect all incoming containers before storage, to ensure containers are properly labeled and not damaged. Do not store this material in open or unlabeled containers. Limit quantity of material stored. Store in suitable containers that are corrosion-resistant.

### \* \* \* Section 8 - Exposure Controls / Personal Protection \* \* \*

### Exposure Guidelines

#### A: General Product Information

Follow the applicable exposure limits.

#### B: Component Exposure Limits

The exposure limits given are for Copper & inorganic Compounds, as Cu (7440-50-8), Copper fume as Cu or Copper dusts and mists, as Cu.

ACGIH: 1 mg/m<sup>3</sup> TWA (dusts & mists)  
0.2 mg/m<sup>3</sup> TWA (fume)

OSHA: 1 mg/m<sup>3</sup> TWA (dusts & mists)  
0.1 mg/m<sup>3</sup> TWA (fume)

NIOSH: 1 mg/m<sup>3</sup> TWA (dusts & mists)  
0.1 mg/m<sup>3</sup> TWA (fume)

DFG MAKs 1 mg/m<sup>3</sup> TWA Peak, 30 minutes, average value (copper and inorganic copper compounds)  
0.1 mg/m<sup>3</sup> TWA Peak, 30 minutes, average value (fume)

### Engineering Controls

Use mechanical ventilation such as dilution and local exhaust. Use a corrosion-resistant ventilation system and exhaust directly to the outside. Supply ample air replacement. Provide dust collectors with explosion vents.

### PERSONAL PROTECTIVE EQUIPMENT

*The following information on appropriate Personal Protective Equipment is provided to assist employers in complying with OSHA regulations found in 29 CFR Subpart I (beginning at 1910.132). Please reference applicable regulations and standards for relevant details.*

#### Personal Protective Equipment: Eyes/Face

Wear safety glasses with side shields (or goggles) and a face shield, if this material is made into solution. If necessary, refer to U.S. OSHA 29 CFR 1910.133.

#### Personal Protective Equipment: Skin

Wear chemically-impervious gloves, made of any waterproof material, boots and coveralls to avoid skin contact. If necessary, refer to U.S. OSHA 29 CFR 1910.138.

## Material Safety Data Sheet

Material Name: Copper Sulfate Pentahydrate

ID: C1-121A

### \*\*\* Section 8 - Exposure Controls / Personal Protection (Continued)\*\*\*

#### Personal Protective Equipment: Respiratory

If respiratory protection is needed, use only protection authorized in the U.S. Federal OSHA Standard (29 CFR 1910.134), applicable U.S. State regulations. Oxygen levels below 19.5% are considered IDLH by OSHA. In such atmospheres, use of a full-facepiece pressure/demand SCBA or a full facepiece, supplied air respirator with auxiliary self-contained air supply is required under OSHA's Respiratory Protection Standard (1910.134-1998). If airborne concentrations are above the applicable exposure limits, use NIOSH-approved respiratory protection. If airborne concentrations are above the applicable exposure limits, use NIOSH-approved respiratory protection. The following NIOSH Guidelines for Copper dust and mists (as Cu) are presented for further information.

Up to 5 mg/m<sup>3</sup>: Dust and mist respirator.

Up to 10 mg/m<sup>3</sup>: Any dust and mist respirator except single-use and quarter mask respirators or any SAR.

Up to 25 mg/m<sup>3</sup>: SAR operated in a continuous-flow mode or powered air-purifying respirator with a dust and mist filter(s).

Up to 50 mg/m<sup>3</sup>: Air purifying, full-facepiece respirator with high-efficiency particulate filter(s), any powered air-purifying respirator with tight-fitting facepiece and high-efficiency particulate filter(s) or full-facepiece SCBA, or full-facepiece SAR.

Up to 100 mg/m<sup>3</sup>: Positive pressure, full-facepiece SAR.

Emergency or Planned Entry into Unknown Concentrations or IDLH Conditions: Positive pressure, full-facepiece SCBA, or positive pressure, full-facepiece SAR with an auxiliary positive pressure SCBA.

Escape: Full-facepiece respirator with high-efficiency particulate filter(s), or escape-type SCBA.

NOTE: The IDLH concentration for Copper dusts and mists (as Cu) is 100 mg/m<sup>3</sup>.

#### Personal Protective Equipment: General

Have an eyewash fountain and safety shower available in the work area

### \*\*\* Section 9 - Physical & Chemical Properties \*\*\*

#### Physical Properties: Additional Information

The data provided in this section are to be used for product safety handling purposes. Please refer to Product Data Sheets, Certificates of Conformity or Certificates of Analysis for chemical and physical data for determinations of quality and for formulation purposes.

<b>Appearance:</b> Blue crystals or powder	<b>Odor:</b> Odorless
<b>Physical State:</b> Solid	<b>pH:</b> 3.7-4.2 (10% soln.)
<b>Vapor Pressure:</b> 20 torr at 22.5 deg C	<b>Vapor Density:</b> 8.6
<b>Boiling Point:</b> 560 deg C (1040 deg F) [decomposes]	<b>Freezing/Melting Point:</b> 150 deg C (302 deg F)
<b>Solubility (H2O):</b> 31.6 g/100 cc (@ 0 deg C)	<b>Specific Gravity:</b> 2.28 @ 15.6 deg C (H2O = 1)
<b>Softening Point:</b> Not available	<b>Particle Size:</b> Various
<b>Molecular Weight:</b> 249.68	<b>Bulk Density:</b> Not available
	<b>Chemical Formula:</b> CuSO4*5H2O

### \*\*\* Section 10 - Chemical Stability & Reactivity Information \*\*\*

#### Chemical Stability

Copper Sulfate Pentahydrate is hygroscopic, but stable when kept dry, under normal temperature and pressures.

#### Chemical Stability: Conditions to Avoid

Avoid high temperatures, exposure to air and incompatible materials.

#### Incompatibility

Copper Sulfate causes hydroxylamine to ignite and the hydrated salt is vigorously reduced. Solutions of sodium hypobromite are decomposed by powerful catalytic action of cupric ions, even as impurities. Copper salts, including Copper Sulfate may react to form explosive acetylides when in contact with acetylene or nitromethane. Contact with reducing agents, can cause a vigorous reaction, especially in solution. This product can corrode steel and iron. Copper Sulfate Pentahydrate is incompatible with magnesium, strong bases, alkalines, phosphates, acetylene, hydrazine, and zirconium. Copper Sulfate Pentahydrate can be corrosive to aluminum.

#### Hazardous Decomposition

Sulfur oxides and Copper oxides.

#### Hazardous Polymerization

Will not occur.

## Material Safety Data Sheet

Material Name: Copper Sulfate Pentahydrate

ID: C1-121A

### \*\*\* Section 11 - Toxicological Information \*\*\*

#### Acute and Chronic Toxicity

##### A: General Product Information

Acute toxicity is largely due to the caustic (alkaline) properties of this material. Harmful or fatal if swallowed. Product is an eye and skin irritant, and may cause burns. Product is a respiratory tract irritant, and inhalation may cause nose irritation, sore throat, coughing, and chest tightness and possibly, ulceration and perforation of the nasal septum.

Chronic: Long term skin overexposure to this product may lead to dermatitis and eczema. Prolonged or repeated eye contact may cause conjunctivitis and possibly corneal abnormalities. Chronic overexposure to this product may cause liver and kidney damage, anemia and other blood cell abnormalities.

##### B: Component Analysis - LD<sub>50</sub>/LC<sub>50</sub>

###### Copper Sulfate Pentahydrate (7758-99-8)

Oral-rat LD<sub>50</sub>: = 300 mg/kg; Intraperitoneal-Rat LD<sub>50</sub>: 18,700 mg/kg; Intraperitoneal-rat LD<sub>50</sub>: 20 mg/kg; Subcutaneous-rat LD<sub>50</sub>: 43 mg/kg; Intravenous-rat LD<sub>50</sub>: 48900 µg/kg; Unreported-rat LD<sub>50</sub>: 520 mg/kg; Oral-mouse LD<sub>50</sub>: 369 mg/kg; Intraperitoneal-Mouse LD<sub>50</sub>: 33 mg/kg; Intraperitoneal-mouse LD<sub>50</sub>: 7182 µg/kg; Intravenous-mouse LD<sub>50</sub>: 23300 µg/kg

##### B: Component Analysis - TDLo/LDLo

###### Copper Sulfate Pentahydrate (7758-99-8)

Oral-man LDLo: 857 mg/kg; Oral-Human LDLo: 50 mg/kg; Behavioral: somnolence (general depressed activity); Kidney, Urethra, Bladder: changes in tubules (including acute renal failure, acute tubular necrosis); Blood: hemorrhage; Oral-Human TDLo: 11 mg/kg; Gastrointestinal: gastritis; Gastrointestinal: hypermotility, diarrhea, nausea or vomiting; Oral-Human TDLo: 272 mg/kg; liver, kidney, Blood effects; Oral-Human LDLo: 1088 mg/kg; Oral-child : 150 mg/kg; Kidney, Urethra, Bladder: changes in tubules (including acute renal failure, acute tubular ; necrosis); Blood: other hemolysis with or without anemia; unknown-Man LDLo: 221 mg/kg; Oral-Woman TDLo: 2400 mg/kg/day; Gastrointestinal tract effects; DNA Inhibition-Human: lymphocyte 76 mmol/L; Oral-woman LDLo: 100 mg/kg; Vascular: Blood pressure lowering not characterized in autonomic section; Liver: hepatitis (hepatocellular necrosis), diffuse; Kidney, Urethra, Bladder: changes in tubules (including acute renal failure, acute tubular necrosis); Oral-Human LDLo: 143 mg/kg; Pulmonary system effects, Gastrointestinal tract effects ;Oral-rat TDLo: 915 mg/kg/1 year-intermittent: Cardiac: changes in coronary arteries; Blood: changes in serum composition (e.g. TP, bilirubin, cholesterol); Oral-rat TDLo: 157 mg/kg/6 weeks-intermittent: Endocrine: changes in adrenal weight; Nutritional and Gross Metabolic: weight loss or decreased weight gain; Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: dehydrogenases; Oral-rat TDLo: 7530 mg/kg/30 days-intermittent: Blood: changes in serum composition (e.g. TP, bilirubin, cholesterol); Blood: changes in erythrocyte (RBC) count; Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels:- multiple enzyme effect; Oral-rat TDLo: 2 gm/kg/20 days-intermittent: Liver: other changes; Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: phosphatases, Enzyme inhibition, induction, or change in blood or tissue levels; Intraperitoneal-rat TDLo: 791 mg/kg/18 weeks-intermittent: Nutritional and Gross Metabolic: weight loss or decreased weight gain; Intraperitoneal-rat TDLo: 7500 µg/kg; female 3 day(s) after conception: Reproductive: Fertility: other measures of fertility; Subcutaneous-rat TDLo: 12768 µg/kg; male 1 day(s) pre-mating: Reproductive: Paternal Effects: testes, epididymis, sperm duct; Intratesticular-rat TDLo: 3192 µg/kg; male 1 day(s) pre-mating: Reproductive: Paternal Effects: spermatogenesis (incl. genetic material, sperm morphology, motility, and count), testes, epididymis, sperm duct; Oral-mouse TDLo: 3 gm/kg/8 weeks-continuous: Blood: changes in spleen; Immunological Including Allergic: decrease in cellular immune response, decrease in humoral immune response; Oral-mouse TDLo: 2 gm/kg/3 weeks-continuous: Blood: changes in spleen; Immunological Including Allergic: decrease in cellular immune response, decrease in humoral immune response; Subcutaneous-mouse LDLo: 500 µg/kg; Subcutaneous-mouse TDLo: 12768 µg/kg; male 30 day(s) pre-mating: Reproductive: Paternal Effects: testes, epididymis, sperm duct; Intravenous-mouse TDLo: 3200 µg/kg; female 8 day(s) after conception: Reproductive: Effects on Embryo or Fetus: fetotoxicity (except death, e.g., stunted fetus), Specific Developmental Abnormalities: Central Nervous System, cardiovascular (circulatory) system; Intravenous-mouse TDLo: 3200 µg/kg; female 7 day(s) after conception: Reproductive: Fertility: post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants); Oral-Dog, adult LDLo: 60 mg/kg; Intravenous-guinea pig TDLo: 2 mg/kg; Subcutaneous-Guinea Pig, adult LDLo: 62 mg/kg; Oral-Pigeon LDLo: 1000 mg/kg; Oral-Domestic animals (Goat, Sheep) LDLo: 5 mg/kg; Oral-Bird-wild species LDLo: 300 mg/kg; Intravenous-frog LDLo: 25 mg/kg; Parenteral-chicken TDLo: 10 mg/kg; Tumorigenic: equivocal tumorigenic agent by RTECS criteria; Endocrine: tumors; Oral-pig TDLo: 140 mg/kg; female 1-15 week(s) after conception, lactating female 4 week(s) post-birth: Reproductive: Effects on Newborn: biochemical and metabolic; Intravenous-hamster TDLo: 2130 µg/kg; female 8 day(s) after conception: Reproductive: Fertility: post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants), Specific Developmental Abnormalities: Central Nervous System, body wall

## Material Safety Data Sheet

Material Name: Copper Sulfate Pentahydrate

ID: C1-121A

### \*\*\* Section 11 - Toxicological Information (Continued) \*\*\*

#### Carcinogenicity

##### A: General Product Information

Copper Sulfate Pentahydrate (7758-99-8)

Cytogenetic Analysis-Rat/ast 300 mg/kg

##### B: Component Carcinogenicity

Copper dusts and mists, as Cu (7440-50-8)

EPA: EPA-D (Not Classifiable as to Human Carcinogenicity - inadequate human and animal evidence of carcinogenicity or no data available)

#### Epidemiology

No information available.

#### Neurotoxicity

Has not been identified.

#### Mutagenicity

Human and animal mutation data are available for Copper Sulfate Pentahydrate; these data were obtained during clinical studies on specific human and animal tissues exposed to high doses of this compound.

#### Teratogenicity

There are no reports of teratogenicity in humans. Animal studies indicate that a deficiency or excess of copper in the body can cause significant harm to developing embryos. The net absorption of copper is limited and toxic levels are unlikely from industrial exposure.

#### Other Toxicological Information

Individuals with Wilson's disease are unable to metabolize copper. Thus, persons with pre-existing Wilson's disease may be more susceptible to the effects of overexposure to this product.

### \*\*\* Section 12 - Ecological Information \*\*\*

#### Ecotoxicity

##### A: General Product Information

Harmful to aquatic life in very low concentrations. Copper Sulfate Pentahydrate is toxic to fish and marine organisms when applied to streams, rivers, ponds or lakes.

##### B: Ecotoxicity

Copper Sulfate Pentahydrate (7758-99-8)

LC<sub>50</sub> (*Lepomis machochirus* bluegill) wt 1.5 g = 884 mg/L at 18°C, static bioassay (95% confidence limit 707-1,100 mg/L) (technical material, 100% (about 25% elemental copper); LC<sub>50</sub> (*Leopmis cyanellus*, Green Sunfish) = 1.1 g, 3,510 µg/L at °C; LC<sub>50</sub> (*Pimephales promelas*, Fat-head minnow) = 1.2 g, 838 µg/L at 18°C; LC<sub>50</sub> (*Crassius auratus*, Goldfish) = 0.9 g, 1380 µg/L at 18°C; LC<sub>50</sub> (*Crassius auratus*, Goldfish) = 0.1-2.5 mg/L; LC<sub>50</sub> (*EEL*) = 0.1-2.5 mg/L; LC<sub>50</sub> (*Salmo gairdneri*, Rainbow trout) = 1.6 g, 135 µg/L at 18°C; LC<sub>50</sub> (*Salmo gairdneri*, Rainbow trout) 48 hours = 0.14 ppm; LC<sub>50</sub> (*Daphnia magna*) no time specified = 0.182 mg/L; LC<sub>50</sub> (*Salmo gairdneri*, Rainbow trout) no time specified = 0.17 mg/L; LC<sub>50</sub> (*Lepomis machochirus*, Blue gill) no time specified = 1.5 g, 884 µg/L at 18°C; LC<sub>50</sub> (Stripped Bass) 96 hours = 1 ppm or lower; LC<sub>50</sub> (Prawn) 48 hours = 0.14; LC<sub>50</sub> (Shrimp) 96 hours = 17.0 ppm copper; LC<sub>50</sub> (Blue Crab) 96 hours = 28 ppm copper; LC<sub>50</sub> (Oyster) 96 hours = 5.8 ppm copper; LC<sub>50</sub> (*Viviparus bengalensis* snail) 96 hours = 0.060 ppm copper (at 32.5°C; 0.066 ppm copper static bioassay); LC<sub>50</sub> (*Viviparus bengalensis* snail) 96 hours = 0.09 ppm copper (at 27.3°C; 0.066 ppm copper static bioassay); LC<sub>50</sub> (*Viviparus bengalensis* snail) 96 hours = 0.39 ppm copper (at 20.3°C; 0.066 ppm copper static bioassay)

#### Environmental Fate

If released to soil, copper sulfate may leach to groundwater, be partly oxidized or bind to humic materials, clay or hydrous oxides of iron and manganese. In water, it will bind to carbonates as well as humic materials, clay and hydrous oxides of iron and manganese. Copper is accumulated by plants and animals, but it does not appear to biomagnify from plants to animals. In air, copper aerosols have a residence time of 2 to 10 days in an unpolluted atmosphere and 0.1 to greater than 4 days in polluted, urban areas.

### \*\*\* Section 13 - Disposal Considerations \*\*\*

#### US EPA Waste Number & Descriptions

##### A: General Product Information

This product is a registered pesticide.

##### B: Component Waste Numbers

No EPA Waste Numbers are applicable for this product's components.

## Material Safety Data Sheet

**Material Name: Copper Sulfate Pentahydrate**

**ID: C1-121A**

### \*\*\* Section 13 - Disposal Considerations (Continued) \*\*\*

#### Disposal Instructions

All wastes must be handled in accordance with local, state and federal regulations. This material can be converted to a less hazardous material by weak reducing agents followed by neutralization. Do not reuse empty containers. Do not rinse unless required for recycling. If partly filled, call local solid waste agency or (1-800-CLEANUP or equivalent organization) for disposal instructions. Never pour unused product down drains or on the ground.

#### Pesticide Disposal

Pesticide wastes are acutely hazardous. Improper disposal of excess pesticides, spray mixtures, or rinsate is a violation of U.S. Federal and Canadian Law. If these wastes cannot be disposed of by use, according to product label instruction, contact your U.S. State, or Canadian Province Pesticide or Environmental Control Agency, or the hazardous waste representative at the nearest U.S. EPA Regional Office for guidance.

### \*\*\* Section 14 - Transportation Information \*\*\*

NOTE: The shipping classification information in this section (Section 14) is meant as a guide to the overall classification of the product. However, transportation classifications may be subject to change with changes in package size. Consult shipper requirements under I.M.O., I.C.A.O. (I.A.T.A.) and 49 CFR to assure regulatory compliance.

#### US DOT Information

**Shipping Name:** Environmentally Hazardous Substance, solid, n.o.s. (cupric sulfate)

**Hazard Class:** 9 (Miscellaneous Hazardous Materials)

**UN/NA #:** UN 3077

**Packing Group:** III

**Required Label(s):** Class 9 (Miscellaneous Hazardous Materials)

**RQ Quantity:** 10 lbs (4.54 kg)[Cupric Sulfate]

#### Additional Shipping Information

Cupric Sulfate is a Severe Marine Pollutant (49 CFR 172.322) and requires the marine pollutant mark for vessel transportation. Because Copper Sulfate is listed as a Severe Marine Pollutant as found in Appendix B to 172.101 and when shipped by vessel, each inner package which exceeds 500 g (17.6 ounces) will need a marine pollutant marking. UN-certified package, marked with the Proper Shipping Name, UN Number will be required when shipped by vessel, when each inner package exceeds 500 g (17.6 ounces).

**Limited Quantity Shipments:** Inner packagings less than 500 g (17.6 ounces) will not need to be in a UN-approved box and will not need a Marine Pollutant marking. Such shipments need not be marked with the Proper Shipping Name of the contents, but shall be marked with the UN Number (3077) of the contents, preceded by the letters "UN", placed within a diamond. The width of the line forming the diamond shall be at least 2 mm; the number shall be at least 6 mm high. The total weight of each outer packaging cannot exceed 30 kg (66 pounds). For a shipment by air the class 9 label will be required.

#### Domestic Transportation Exception

49 CFR 172.504(f)(9) Domestic transportation, a Class 9 placard is not required. A bulk packaging containing a Class 9 material must be marked with the appropriate identification number displayed on a Class 9 placard, an orange panel or a white-square-on-point display configuration as required by subpart D of this part. 49 CFR 172(d)(3) allows the use of the class 9 placard to replace the marine pollutant marking for domestic shipments.

# Material Safety Data Sheet

**Material Name: Copper Sulfate Pentahydrate**

**ID: C1-121A**

**\*\*\* Section 14 - Transportation Information (Continued) \*\*\***

**International Air Transport Association (IATA)**

For Shipments by Air transport: We classify this product as hazardous (Class 9) when shipped by air because 49 CFR 173.140 (a). "For the purposes of this subchapter, miscellaneous hazardous material (Class 9) means a material which presents a hazard during transportation, but which does not meet the definition of any other hazard class. This class includes: (a) Any material which has an anesthetic, noxious, or other similar property which could cause extreme annoyance or discomfort to a flight crew member so as to prevent the correct performance of assigned duties."

**Proper Shipping Name:** Environmentally hazardous substance, solid, n.o.s. (cupric sulfate)

**Hazard Class:** 9

**UN:** UN 3077

**Packing Group:** III

**Passenger & Cargo Aircraft Packing Instruction:** 911

**Passenger & Cargo Aircraft Maximum Net Quantity:** No Limit

**Limited Quantity Packing Instruction (Passenger & Cargo Aircraft):** Y911

**Limited Quantity Maximum Net Quantity (Passenger & Cargo Aircraft):** 30 kg

**Special Provisions:** A97

**ERG Code:** 9L

**International Maritime Organization (I.M.O.) Classification**

For shipments via marine vessel transport, the following classification information applies.

**Proper Shipping Name:** Environmentally hazardous substance, solid, n.o.s. (Cupric sulfate)

**Hazard Class:** class 9

**UN #:** UN3077

**Packing Group:** III

**Special Provisions:** 274, 909, 944

**Limited Quantities:** 500g.

**Packing Instructions:** P002, LP02

**Packing Provisions:** PP12

**IBC Provisions:** IBC07

**IBC Provisions:** B3

**EmS:** Fire F-A Spill S-B

**Stowage and Segregation:** Category A

This material is considered a severe marine pollutant by the IMO and shipments of the material must carry the marine pollutant mark label. Refer to IMO Amendment 31-02 Chapter 2.10.

**\*\*\* Section 15 - Regulatory Information \*\*\***

**US Federal Regulations**

**A: General Product Information**

Copper Sulfate Pentahydrate (CAS # 7758-99-8) is listed as a Priority and Toxic Pollutant under the Clean Water Act.

**B: Component Analysis**

This material contains one or more of the following chemicals required to be identified under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65) and/or CERCLA (40 CFR 302.4):

**Copper Compounds (7440-50-8)**

SARA 313: final RQ = 5000 pounds (2270 kg) Note: No reporting of releases of this substance is required if the diameter of the pieces of the solid metal released is equal to or greater than 0.004 inches.

**Cupric Sulfate (7758-98-7)**

CERCLA: final RQ = 10 pounds (4.54 kg)

**C: Sara 311/312 Tier II Hazard Ratings:**

Component	CAS #	Fire Hazard	Reactivity Hazard	Pressure Hazard	Immediate Health Hazard	Chronic Health Hazard
Copper Sulfate Pentahydrate	7758-99-8	No	No	No	Yes	Yes

## Material Safety Data Sheet

**Material Name: Copper Sulfate Pentahydrate**

**ID: C1-121A**

**\*\*\* Section 15 - Regulatory Information (Continued)\*\*\***

**US Federal Regulations (continued)**

**State Regulations**

**A: General Product Information**

**California Proposition 65**

Copper Sulfate Pentahydrate is not on the California Proposition 65 chemical lists.

**B: Component Analysis - State**

The following components appear on one or more of the following state hazardous substance lists:

Component	CAS #	CA	FL	MA	MN	NJ	PA
Copper	7440-50-8	Yes	No	Yes	No	Yes	Yes
Copper, fume, dust and mists		No	Yes	No	Yes	No	Yes
Copper Sulfate Pentahydrate	7758-99-8	No	No	No	No	Yes	Yes

**Other Regulations**

**A: General Product Information**

When used as a pesticide, the requirements of the U.S. Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), or requirements under the Canadian Pest Control Act, are applicable.

**B: Component Analysis - Inventory**

Component	CAS #	TSCA	DSL	EINECS
Copper Sulfate Pentahydrate	7758-99-8	Exempted	No	Yes

Although this compound is not on the TSCA Inventory, it is exempted as a hydrate of a listed compound, Copper Sulfate (CAS # 7758-98-7), per 40 CFR 710.4 (d)(3) and 40 CFR 720.30 (h)(3). Under this section of TSCA, any chemical substance which is a hydrate of a listed compound is exempted.

**C: Component Analysis - WHMIS IDL**

The following components are identified under the Canadian Hazardous Products Act Ingredient Disclosure List:

Component	CAS #	Minimum Concentration
Copper Sulfate Pentahydrate	7758-99-8	1 percent

**ANSI Labeling (Z129.1):**

**DANGER! MAY BE FATAL IF SWALLOWED. CAUSES SKIN AND EYE IRRITATION. HARMFUL IF INHALED.** Keep from contact with clothing. Do not taste or swallow. Do not get on skin or in eyes. Avoid breathing dusts or particulates. Keep container closed. Use only with adequate ventilation. Wash thoroughly after handling. Wear gloves, goggles, faceshields, suitable body protection, and NIOSH-approved respiratory protection, as appropriate. **FIRST-AID:** In Case of Contamination of Skin or Clothing: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. In Case of Contamination of 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. 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. If Ingested: 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. Call a poison control center or doctor for treatment advice. 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. **IN CASE OF FIRE:** Use water fog, dry chemical, CO<sub>2</sub>, or "alcohol" foam. **IN CASE OF SPILL:** Absorb spill with inert material. Place residue in suitable container. Consult Material Safety Data Sheet for additional information.

**Labeling Information for Pesticide Use of Product:**

**DANGER! HAZARD TO HUMANS AND DOMESTIC ANIMALS.**

**DANGER: CORROSIVE:** Causes eye damage and irritation to the skin and mucous membrane. 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 water-proof material, shoes, plus socks and protective eyewear. Discard clothing and other absorbent materials that have been drenched or heavily contaminated with this solutions of this product. Do not reuse such contaminated items. Follow manufacturer's instructions for cleaning and maintaining PPE. If no such instructions for reusable items exist, wash using detergent and hot water. Keep and wash PPE separately for other laundry.

## Material Safety Data Sheet

Material Name: Copper Sulfate Pentahydrate

ID: C1-121A

### \*\*\* Section 15 - Regulatory Information (Continued)\*\*\*

#### US Federal Regulations (continued)

##### Labeling Information for Pesticide Use of Product (continued):

**USER SAFETY RECOMMENDATIONS:** Persons using this product should wash hands before eating, drinking, chewing gum, using tobacco or using the toilet. Remove clothing immediately if contaminated by the pesticide. Wash contaminated clothing thoroughly and put on clean clothing. Remove PPE immediately after use with this product. Wash outside of gloves and other equipment before removing. After removal of PPE, 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 the water increases. Do not contaminate water by cleaning of equipment or disposal of wastes. Consult 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 containers. Keep pesticide in original container. Do not put concentrate or dilutions of concentrate in food or drink containers. 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. Completely empty bag of product into application equipment. Dispose of empty bag in a sanitary landfill or by incineration, or if allowed by State and local authorities, by burning. If burned, avoid smoke.

**DIRECTIONS FOR USE:** It is a violation of Federal Law to use this product inconsistent with its labeling. Do not apply this product in a way that will contaminate 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, consult the agency responsible for your pesticide regulations.

**AGRICULTURAL USE REQUIREMENTS:** Use this product only in accordance with its labeling and with the Worker Protection Standard, CFR Part 170. This standard contains requirements for the protection of agricultural workers on farms, forests, nurseries and greenhouses, and handlers of agricultural pesticides. The Standard contains requirements for the 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. These requirements only apply to uses of this product that are covered under the Worker Protection Standard. Do not apply this product in a way that will contaminate workers or other persons, either directly or through drift. Only protected handlers may be in the area during application. Do not allow worker entry into treated areas during the restricted 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, waterproof gloves, shoes, plus socks and protective eyewear."

**GENERAL USE INSTRUCTIONS:** 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 water is hard. 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 until 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, allowing the solution to be sprayed directly on the algae. 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.

**ENDANGERED SPECIES RESTRICTION:** 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 to their habitat. The use of this product may pose a hazard to certain Federally Designated species known to occur in specific areas. Contact the EPA for information on these areas. Obtain a copy of the EPA Bulletin specific to your area. This bulletin identifies areas within specific State 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.

EPA REG. NO. 56576-

EPA EST. NO. 52117-MX-001

## Material Safety Data Sheet

**Material Name: Copper Sulfate Pentahydrate**

**ID: C1-121A**

\* \* \* Section 16 - Other Information \* \* \*

### Other Information

Chem One Ltd. ("Chem One") shall not be responsible for the use of any information, product, method, or apparatus herein presented ("Information"), and you must make your own determination as to its suitability and completeness for your own use, for the protection of the environment, and for health and safety purposes. You assume the entire risk of relying on this Information. In no event shall Chem One be responsible for damages of any nature whatsoever resulting from the use of this product or products, or reliance upon this Information. By providing this Information, Chem One neither can nor intends to control the method or manner by which you use, handle, store, or transport Chem One products. If any materials are mentioned that are not Chem One products, appropriate industrial hygiene and other safety precautions recommended by their manufacturers should be observed. Chem One makes no representations or warranties, either express or implied of merchantability, fitness for a particular purpose or of any other nature regarding this information, and nothing herein waives any of Chem One's conditions of sale. This information could include technical inaccuracies or typographical errors. Chem One may make improvements and/or changes in the product (s) and/or the program (s) described in this information at any time. If you have any questions, please contact us at Tel. 713-896-9966 or E-mail us at [Safety@chemone.com](mailto:Safety@chemone.com). Revision date: 05/31/01

### Key/Legend

EPA = Environmental Protection Agency; TSCA = Toxic Substance Control Act; ACGIH = American Conference of Governmental Industrial Hygienists; IARC = International Agency for Research on Cancer; NIOSH = National Institute for Occupational Safety and Health; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration

**Contact:** Sue Palmer-Koleman, PhD

**Contact Phone:** (713) 896-9966

### Revision log

07/24/00 4:24 PM SEP Changed company name, Sect 1 and 16, from Corporation to Ltd.  
07/27/00 2:49 PM SEP Added "Fine 200, FCC IV, Very High Purity" to synonyms, Section 1  
08/23/00 3:15 PM SEP Added "Copper Sulfate Crystals" to synonyms, Section 1  
05/31/01 9:31 AM HDF Checked exposure limits; made changes to Sect 9; overall review, add SARA 311/312 Haz Ratings.  
06/01/01 7:28 AM HDF Added text to label information from EPA Approved Label  
07/24/01 4:31 AM CLJ Add Shipments by Air information to Section 14, Changed contact to Sue, non-800 Chemtrec Num.  
09/18/01 11:34 AM SEP Added Domestic Transportation Exception, Sect 14  
10/05/01 3:30 PM SEP Deleted Alternate Shipping Name, Sect 14  
02/15/02 11:01 AM: HDF Revision of SARA Chronic Hazard Rating to "Yes".  
2/21/02 4:21 PM HDF Added more information on Marine Pollutant Markings and Limited Quantity Shipments  
223/03: 2:21 pm HDF Addition of chronic health hazard information. Addition of inhalation hazard information, Section 3. Section 4 – expansion of information on Information for Physicians. Up-graded Section 10 Reactivity Information. Up-Dated entire Section 14 Transportation Information to include IATA, IMO transport information.

This is the end of MSDS # C1-121A

**BAKER  
HUGHES**  
Baker Petrolite

ACTIVE INGREDIENT	BY WEIGHT
Acrolein	95%
INERT INGREDIENTS	5%
TOTAL	100%

This product contains the toxic inert ingredient hydroquinone.  
(MAGNACIDE® H Herbicide contains 6.7 pounds of active ingredient per gallon.)

**PRECAUTIONARY STATEMENTS  
HAZAROUS TO HUMANS AND DOMESTIC ANIMALS**

**DANGER**

**EXTREMELY FLAMMABLE AND IRRITATING VAPOR AND LIQUID. POISONOUS BY INHALATION. SKIN CONTACT OR SWALLOWING. DO NOT BREATHE VAPOR. CORROSIVE. CAUSES EYE AND SKIN DAMAGE. DO NOT GET IN EYES, ON SKIN OR ON CLOTHING. KEEP AWAY FROM FIRE, SPARKS AND HEATED SURFACES.**

When setting up and breaking down application equipment, a full-face air-purifying respirator with organic vapor (OV) cartridges (only approved by the Mine Safety and Health Administration (MSHA) and the National Institute of Occupational Safety and Health (NIOSH)) and safety rubber gloves must be worn. For visual inspection during treatment, chemical splash goggles must be worn. If spilled on clothing, gloves, or shoes, remove them immediately and wash thoroughly with soap and water before reuse. Use with adequate ventilation.

**ENVIRONMENTAL HAZARDS**

This product is toxic to fish and wildlife. Keep out of lakes, streams or ponds. Fish, shrimp and crabs will be killed at application rates recommended. Do not apply where they are important resources. Do not apply to water drainage areas where runoff or flooding will contaminate ponds, lakes, streams, tidal marshes and estuaries. Do not contaminate water by cleaning of equipment or disposal of wastes. Notify your State Fish and Game Agency before applying this product. Use only as directed.

**PHYSICAL AND CHEMICAL HAZARDS**

**DANGER: Extremely flammable.** Contents under pressure. Keep away from fire, sparks and heated surfaces. Do not puncture or incinerate container. Acrolein, the active ingredient in MAGNACIDE® H Herbicide, is highly reactive chemically and readily forms polymers. It polymerizes upon air exposure and causes air stinging acids are brought in contact with MAGNACIDE® H Herbicide in a closed system, the Herbicide can polymerize with sufficient violence to rupture the container. Do not apply with equipment used for acids and bases. Contamination of MAGNACIDE® H Herbicide with any foreign matter must be avoided.

A supply of sodium carbonate (soda ash) should be readily available for desulfurizing spilled MAGNACIDE® H Herbicide. All spills should be confined and desulfurized before disposal. See the MAGNACIDE® H Herbicide Application and Safety Manual for additional information.

**FIRST AID**

- 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 on skin or clothing:
  - Take off contaminated clothing.
  - Remove shoes immediately with plenty of water for 15-20 minutes.
  - Call a poison control center or doctor for treatment advice.
- If in eyes:
  - Hold eye open and flush slowly and gently with water for 15-20 minutes.
  - Remove contact lenses, if present, after 5 minutes. Then continue flushing eye.
  - 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 to do so by the poison control center or doctor.
    - Do not give anything by mouth to an unconscious person.

Have the product container, label or application manual with you when calling a poison control center or doctor, or going for treatment. CALL A PHYSICIAN IMMEDIATELY IN ALL CASES OF SUSPECTED POISONING.

**MAGNACIDE® H HERBICIDE  
(Acrolein, Inhibited)  
CONTENTS UNDER PRESSURE**

**DANGER**  **POISON**  
KEEP OUT OF REACH OF CHILDREN

**NOTE TO PHYSICIAN**

Probable mucosal damage may contraindicate the use of gastric lavage. Measures against circulatory shock, respiratory depression and convulsion may be required.

**WARNING SIGNS AND SYMPTOMS:** Liquid MAGNACIDE® H Herbicide is absorbed by the skin and is particularly irritating to any lesion and to the eye. The vapors act principally on the mucous membrane of the eyes and respiratory tract. Because of the extreme lachrymatory irritating effect, the concentration tolerable by man is far below the minimum lethal concentration.

**TREATMENT:** Treat exposed areas as a chemical burn. Thoroughly flush eyes with water, and treat symptomatically. Persons exposed to MAGNACIDE® H Herbicide vapors have a delayed reaction and experience irritation of the respiratory tract. In severe cases, this may progress to pulmonary edema. Therefore, it is advisable to keep persons exposed to MAGNACIDE® H Herbicide under observation for 24 hours following exposure.

**DIRECTIONS FOR USE**

It is a violation of Federal law to use this product in a manner inconsistent with its labeling. MAGNACIDE® H Herbicide is a water soluble material for the control of submersed and floating weeds and algae in irrigation canals. This material must be applied in accordance with directions in the MAGNACIDE® H Herbicide Application and Safety Manual by a certified applicator or under a certified applicator's supervision. Do not permit dairy animals to drink treated water. Do not use where waters will flow into potential sources of drinking water. Water treated with MAGNACIDE® H Herbicide must be used for irrigation of fields, after crop bearing, fallow or pasture, where the treated water remains on the field OR held for 6 days before being released into fish bearing waters or where it will drain into them.

**STORAGE AND DISPOSAL**

**STORAGE OF MAGNACIDE® H HERBICIDE TANKS**

All containers of MAGNACIDE® H Herbicide should be stored in a secured, well-ventilated area, away from all other chemicals. No alkalies or oxidizing materials should be near. Any electrical equipment should be Class 1, Division 2 and properly grounded. Do not reuse empty container. Return empty containers to Baker Petrolite Corporation.

**DISPOSAL**

Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide, spray mixture, or waste 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 representatives at the nearest EPA Regional Office for guidance.

**NOTICE OF WARRANTY**

BAKER PETROLITE CORPORATION MAKES NO WARRANTY OF MERCHANTABILITY FITNESS FOR ANY PURPOSE, OR OTHERWISE, EXPRESSED OR IMPLIED concerning this product or its uses which extend beyond the use of the product under normal conditions in accord with the statements made on this label.

**NET WEIGHTS**

Cylinder-370 lbs. 5Gal Tank-2450 lbs

MANUFACTURED BY: BAKER PETROLITE CORPORATION 12645 W. Airport Blvd., Sugar Land, TX 77478 Customer Care: 800-872-1916

**RESTRICTED USE PESTICIDE**

**DUE TO A HIGH ACUTE TOXICITY**

For retail sale to and use only by Certified Applicators or persons under their direct supervision and only for those uses covered by the Certified Applicator's certification.



Acrolein,  
Inhibited, 6.1, (3),  
UN 1092,  
PG I,  
Toxic-Inhalation  
Hazard,  
Zone A, Marine  
Pollutant, RQ

Specimen MAGNACIDE® H Herbicide Label

APPENDIX D



Baker Petrolite

# Material Safety Data Sheet

## Section 1. Chemical Product and Company Identification

Product Name	<b>MAGNACIDE® H HERBICIDE</b>	Code	XCH
Supplier	Baker Petrolite A Baker Hughes Company 12645 W. Airport Blvd. (77478) P.O. Box 5050 Sugar Land, TX 77487-5050 For Product Information/MSDSs Call: 800-231-3606 (8:00 a.m. - 5:00 p.m. cst, Monday - Friday) 281-276-5400	Version	10.0
Material Uses	Herbicide	Effective Date	08/21/2009
24 Hour Emergency Numbers	CHEMTREC 800-424-9300 (U.S. 24 hour) Baker Petrolite 800-231-3606 (001)281-276-5400 CANUTEC 613-996-6666 (Canada 24 hours) CHEMTREC Int'l 01-703-527-3887 (International 24 hour)	Print Date	08/21/2009
National Fire Protection Association (U.S.A.)		® a trademark of Baker Hughes, Inc.	
		Flammability	
		Instability	
		Specific Hazard	
		Health	

## Section 2. Hazards Identification

Physical State and Appearance	State: Liquid., Color: Colorless to light yellow., Odor: Aldehyde like.
CERCLA Reportable Quantity	Acrolein, 0.15 gal. of this product. Hydroquinone, 4401 gal. of this product.
Hazard Summary	<b>DANGER.</b> May be highly toxic if inhaled.. May cause chronic effects. Flammable liquid. Vapors can form an ignitable or explosive mixture with air. Can form explosive mixtures at temperatures at or above the flash point. Vapors can flow along surfaces to a distant ignition source and flash back. Static discharges can cause ignition or explosion when container is not bonded. May be toxic by skin absorption. May cause skin sensitization (allergic reaction).
Routes of Exposure	Skin (Permeator), Skin (Contact), Eyes, Inhalation.
Potential acute health effects	<i>Eyes</i> May be severely irritating to the eyes. Prolonged contact may cause burns. <i>Skin</i> May be severely irritating to the skin. May cause burns on prolonged contact. Skin sensitizer. May cause allergic skin reactions with repeated exposure. May be toxic if absorbed through the skin. <i>Inhalation</i> May be highly toxic if inhaled. <i>Ingestion</i> Not considered a likely route of exposure, however, may be toxic if swallowed.
Medical Conditions aggravated by Exposure	Exposure to this product may aggravate medical conditions involving the following: cardiovascular system, respiratory tract, skin/epithelium, eyes.
See Toxicological Information (section 11)	

Continued on Next Page

**Additional Hazard Identification Remarks** Overexposure to vapors may be fatal. Inhalation exposure studies have determined the rat LC50 to be 26 ppm at one hour exposure and at four hour exposure to be 8.3 ppm. The NIOSH IDLH (Immediately Dangerous to Life and Health) value is 2 ppm. The primary route of exposure is inhalation; acute exposure may result in lacrimation, tracheobronchitis, pneumonia, and lung injury (at 20 ppm). The low odor detection (0.03 – 0.21 ppm) and irritation threshold (0.25 - 0.5 ppm) and acutely irritating effects of acrolein usually prevent chronic toxicity effects. Splashes to the eye may result in blepharconjunctivitis (bloodshot eyes), lid edema, fibrinous or pustular discharge, and deep or long-lasting corneal injury. See Section 11 for additional information.

**Section 3. Composition/Information on Ingredients**

Name	CAS #	% by Weight
Acrolein	107-02-8	95

See Section 8 for information on permissible exposure limits and threshold limit values.

**Section 4. First Aid Measures**

<b>Eye Contact</b>	Immediately flush the eye(s) continuously with lukewarm, gently flowing water for at least 20-60 minutes while holding the eyelid(s) open. Get medical attention immediately.
<b>Skin Contact</b>	Remove contaminated clothing and shoes immediately. Wash affected area with soap and mild detergent and large amounts of lukewarm, gently flowing water until no evidence of chemical remains (for at least 20-60 minutes). Get medical attention if irritation occurs.
<b>Inhalation</b>	Remove to fresh air. Oxygen may be administered if breathing is difficult. If not breathing, administer artificial respiration and seek medical attention. Get medical attention if symptoms appear.
<b>Ingestion</b>	Get medical attention immediately. If swallowed, do not induce vomiting unless directed to do so by medical personnel. Wash out mouth with water if person is conscious. If fully conscious promptly drink one to two glasses of water. Never induce vomiting or give anything by mouth to a victim who is unconscious or having convulsions.
<b>Notes to Physician</b>	Treatment of the irritative effects of acrolein should be symptomatic and supportive. Following inhalation of acrolein, signs of respiratory dysfunction should be sought and hypoxia corrected. Specific treatment for bronchospasm and non-cardiogenic pulmonary edema may be necessary. Hypoxia may also occur following the ingestion of acrolein if there is pulmonary aspiration and/or laryngeal edema. The extent and severity of the corrosive effects on the upper gastrointestinal mucosa should be determined, for example, by endoscopy, and advice should be sought regarding the need for surgical intervention. Probable mucosal damage may contraindicate the use of gastric lavage.
<b>Additional First Aid Remarks</b>	Persons exposed to vapors may have a delayed reaction and experience severe irritation of the respiratory tract and delayed pulmonary edema. Therefore, it is advisable to keep person exposed to high concentrations of vapor under observation for 24 hours following exposure. If fully conscious promptly drink one to two glasses of water. Get immediate medical attention. Probable mucosal damage may contraindicate the use of gastric lavage. Measures against circulatory shock, respiratory depression, and convulsion may be needed.

**Section 5. Fire Fighting Measures**

<b>Flammability of the Product</b>	Flammable liquid. Vapors can form an ignitable or explosive mixture with air. Can form explosive mixtures at temperatures at or above the flash point. Vapors can flow along surfaces to a distant ignition source and flash back. Static discharges can cause ignition or explosion when container is not bonded.
<b>OSHA Flammability Class</b>	IB

**Continued on Next Page**

Products of Combustion	These products are carbon oxides (CO, CO <sub>2</sub> ) Peroxides..
Fire Hazards in Presence of Various Substances	Open Flames/Sparks/Static. Heat.
Fire Fighting Media and Instructions	In case of fire, use alcohol-resistant foam, dry chemicals, or CO <sub>2</sub> fire extinguishers. Evacuate area and fight fire from a safe distance. Water spray may be used to keep fire-exposed containers cool. Keep water run off out of sewers and public waterways. Note that flammable vapors may form an ignitable mixture with air. Vapors may travel considerable distances and flash back if ignited.
Protective Clothing (Fire)	Do not enter fire area without proper personal protective equipment, including NIOSH approved self-contained breathing apparatus.
Special Remarks on Fire Hazards	Toxic gases and vapors (such as carbon monoxide and peroxides) may be released in a fire involving acrolein. In the presence of sufficient oxygen and complete combustion, the combustion products further breakdown to carbon dioxide and water.

**Section 6. Accidental Release Measures**

Spill	<p>General Information: Evacuate all personnel to an upwind area and determine medical treatment needs. If qualified to do so through appropriate training contain or mitigate the spill as outlined below. Put on appropriate personal protective equipment. See Section 8 for information on use of respiratory protection appropriate for dealing with small spills. For large spills, wear fully encapsulating, vapor protective clothing (Level A Suit) and seek assistance from local fire department hazardous materials response team. Keep personnel removed and upwind of spill. Shut off all ignition sources; no flares, smoking, or flames in spill area. Approach release from upwind. Ventilate the release area.</p> <p>Large Spill: Vapor suppression: if available, blanket spill area with alcohol-resistant foam to reduce the vapor concentration. Reapply foam as needed to counteract the rapid breakdown of the foam blanket. Pump bulk fluid to appropriate storage containers for proper disposal. After recovery of the bulk fluid, neutralization of any remaining material can be accomplished by covering with sodium carbonate (soda ash) and mixing with water. Ratio is 20 pounds of soda ash to each gallon of acrolein followed by 5 gallons of water per gallon of acrolein. The soda ash and acrolein will form a solid by-product after addition of water. When reactivation is complete scoop the solid material into properly marked containers for disposal. Contain all water for proper disposal. Prevent runoff from entering drains, sewers or waterways.</p> <p>Small Spill (&lt; 1 pound) Cover release with sodium carbonate (soda ash) and mix into spill with water. The soda ash and acrolein will form a solid by-product after addition of water. Alternately, absorb with paper towel, dry sand or other absorbent. For ground or surface contamination, remove contaminated media and dispose of properly. Contain all water for proper disposal. Waste must be disposed of in accordance with federal, provincial and local environmental control regulations.</p>
Other Statements	If RQ (Reportable Quantity) is exceeded, report to National Spill Response Office at 1-800-424-8802.
Additional Accidental Release Measures Remarks	Not available.

**Continued on Next Page**

**Section 7. Handling and Storage**

**Handling and Storage** Put on appropriate personal protective equipment. Avoid contact with eyes, skin and clothing. Avoid breathing vapors or spray mists. Use only with adequate ventilation. Store in a secure and well ventilated area. Keep away from heat, sparks and flame. Keep away from incompatible materials. Keep container tightly closed when not in use. To avoid fire or explosion, ensure containers and equipment are properly bonded and grounded prior to transferring product. This is normally accomplished through the use of Baker Petrolite-specified standard application procedures. When using product under non-routine conditions (e.g., laboratory samples), ensure material and container are properly bonded and grounded.

**Additional Handling and Storage Remarks** Do not reuse empty container. Return empty containers to Baker Petrolite Corporation, 19815 South Lake Road, Taft, CA 93268.

**Section 8. Exposure Controls/Personal Protection**

<b>Exposure Limits</b>	Acrolein	<b>ACGIH (United States). Skin</b> CEIL: 0.1 ppm <b>OSHA PEL 1989 (United States).</b> TWA: 0.1 ppm 8 hours. TWA: 0.25 mg/m <sup>3</sup> 8 hours.
------------------------	----------	---

**Additional Information on Exposure Limits** The STEL of 0.3 ppm for acrolein was vacated by Court order, but it is still in effect in AK, CA, MI, MN, NC, TN and WA. The OSHA permissible exposure levels shown above are the OSHA 1989 levels or from subsequent OSHA regulatory actions. Although the 1989 levels have been vacated the 11th Circuit Court of Appeals, Baker Petrolite Corporation recommends that these lower exposure levels be observed as reasonable worker protection.

**Engineering Controls** Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors or particles below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

**Personal Protection**

Personal Protective Equipment recommendations are based on anticipated known manufacturing and use conditions. These conditions are expected to result in only incidental exposure. A thorough review of the job tasks and conditions by a safety professional is recommended, however, to determine the level of personal protective equipment appropriate for these job tasks and conditions.

*Eyes* Chemical safety goggles.

*Body* Long sleeved shirts and work pants.

*Respiratory* Full-face respirator use is required when connecting or disconnecting containers to application equipment, or any situations where the permissible exposure limit may be exceeded. As per NIOSH, full-face air-purifying respirators may be worn to protect personnel up to 2 ppm (IDLH) acrolein. The air purifying respirators should have organic vapor cartridge(s) or canister and a protection factor of 50. Exposure levels of unknown concentrations or greater than 2 ppm acrolein require the use of full-face positive pressure supplied-air breathing apparatus with a protection factor of 10,000

*Hands* Chemical resistant gloves. Butyl rubber gloves. Replace as needed.

*Feet* Chemical resistant boots or overshoes.

*Other information* Not available.

**Additional Exposure Control Remarks** Persons exposed to vapors may have a delayed reaction and experience severe irritation of the respiratory tract and delayed pulmonary edema. Therefore, it is advisable to keep person exposed to high concentrations of vapor under observation for 24 hours following exposure.

**Continued on Next Page**

**Section 9. Physical and Chemical Properties**

Physical State and Appearance	Liquid.	Odor	Aldehyde like.
pH	Not available.	Color	Colorless to light yellow.
Specific gravity	0.846 - 0.858 @ 16°C (60°F)		
Density	7.05 - 7.15 lbs/gal @ 16°C (60°F)		
Flash Points	Closed cup: -25°C (-13°F). (TCC)		
Flammable Limits	L.E.L. 2.8% U.E.L. 31%		
Autoignition Temperature	220°C (428°F)		
Initial Boiling Point	Not available.		
Boiling Point	53°C (127°F)		
Vapor Density	1.93 (Air = 1)		
Vapor Pressure	234.9 - mm Hg @ 22°C (72°F)		
Evaporation Rate	>1 (compared with Ether (anhydrous)).		
VOC	Not available.		
Viscosity	0 - 0 cP @ 20°C (68°F)		
Pour Point	-86.7°C (-124°F)		
Solubility (Water)	Soluble (22% by weight @ 20°C)		
Physical Chemical Comments	Not available.		

**Section 10. Stability and Reactivity**

Stability and Reactivity	The product is stable.
Conditions of Instability	This product is stable unless there is loss of inhibitor.
Incompatibility with Various Substances	Alkalies, amines, light, and oxidizing materials. Alkaline or strong acid contamination can cause a reaction which can be rapid and violent. Prevent water contamination of acrolein storage containers.
Hazardous Decomposition Products	Carbon Oxides and peroxides.
Hazardous Polymerization	Hazardous polymerization may occur.
Special Stability & Reactivity Remarks	Loss of hydroquinone stabilizer may result in polymerization under certain conditions. Air introduced into closed containers may cause a slow polymerization, resulting in loss of product quality.

Continued on Next Page

**Section 11. Toxicological information**Component Toxicological Information

## Acute Animal Toxicity

## Acrolein

ORAL (LD50): Acute: 29 mg/kg [Rat]. 11.8 mg/kg [Female rat]. 10.3 mg/kg [Male rat]. DERMAL (LD50): Acute: 231.4 mg/kg [Rabbit]. VAPOR (LC50): Acute: 26 ppm 1 hours [Rat]. 8.3 ppm 4 hours [Rat]. 18 mg/m<sup>3</sup> 4 hours [Rat].

## Chronic Toxicity Data

## 1) Acrolein

A potential human health effect resulting from overexposure is the development of permanent lung damage in the form of decreased pulmonary (lung) function, and delayed pulmonary edema (fluid in the lungs) which can lead to chronic respiratory disease. As a highly reactive aldehyde, prolonged or repeated overexposures can produce long-term respiratory effects by significantly reducing ciliary action in the upper airways (i.e., interfering with the body's ability to clear mucous and foreign substances from the respiratory tract) and causing tissue damage throughout the lungs manifested as emphysema.

Acrolein levels of 0.4 to 4.9 ppm caused eye and nose irritation and structural changes in the respiratory system of hamsters, rats and rabbits (Ref. 1). Acrolein produced greater susceptibility to respiratory infections in mice (Ref. 2) and rats (Ref. 3).

## Developmental/Reproduction studies

Acrolein has been tested for developmental and reproductive health effects. Results from developmental studies (Ref. 4, 5) indicated this material did not cause teratogenic effects in rats or rabbits at doses that caused maternal toxicity. A two-generation rat reproductive study (Ref. 6) did not reveal any evidence of reproductive toxicity in either sex from any treatment group (maximum dose = 7.2 mg/kg). A second two-generation reproductive study in rats did not reveal any evidence of reproductive toxicity in either sex from any treatment group (maximum dose = 6 mg/kg) (Ref. 6).

## Dermal Testing

In a 21 day dermal toxicity test in rabbits dosed at 7, 21 and 63 mg/kg of acrolein, toxicity was evidenced by slight to significant reduction in body weight gain, nasal mucous discharge, lethargy, slight to moderately lowered food consumption and increased frequency of lesions of the skin and lungs. Slight mortality in female rabbits dosed at 21 and 63 mg/kg was observed. No notable effects in hematology, blood chemistry, organ weights or organ weight ratios were observed (Ref. 7).

## Inhalation toxicity study

Rats were exposed by inhalation (6h/day 5 d/week for 62 days) to 0, 0.4, 1.4 and 4.0 ppm acrolein. Mortality was only observed in the 4 ppm group and was due mainly to acute bronchopneumonia. Weight gain in the 4 ppm group was significantly slower than the control group. Examination of the 4 ppm group revealed bronchiolar epithelial necrosis and sloughing and edema (Ref. 8).

## Chronic toxicity/Oncogenicity studies

In a 12-month chronic toxicity test in dogs (Ref. 9), the highest dose (2 mg/kg) tested resulted in changes in blood chemistry, but no compound-related tumors or lesions were observed. An 18-month oncogenicity study in mice (Ref. 10) did not reveal any compound-related tumors or lesions; the highest dose tested (4.5 mg/kg) resulted in increased mortality in the test group. A 24-month chronic toxicity/oncogenicity study in rats (Ref. 11) also did not reveal any compound related tumors or lesions. The high dose, 2.5 mg/kg, caused an increased mortality in the test group. No indications of cancer were found in the tests.

## Other Studies

## Mutagenicity studies

**Continued on Next Page**

Effects of Acrolein on the In Vitro Induction of Chromosomal Aberrations in CHO Cells: No significant increase in the number of chromosomal aberrations above the background (Ref. 12).

Effects of Acrolein on the In Vivo Induction of Chromosomal Aberrations in Rat Bone Marrow Cells: No significant increase in the number of chromosomal aberrations above the background (Ref. 13).

Salmonella Liquid Suspension Mutant Fraction Assay: Acrolein did not induce concentration-dependent mutagenicity in any of the 5 Salmonella strains, either in the presence or absence of metabolic activation (Ref. 14).

**Metabolism Data**

Metabolism studies in freshwater fish, shellfish, goats, hens, rats and leaf lettuce indicate that acrolein is metabolized and does not accumulate in the tissue (Ref. 15-19).

**Product Toxicological Information**

Acute Animal Toxicity ORAL (LD50): Acute: 29 mg/kg [Rat]. 11.8 mg/kg [Female rat]. 10.3 mg/kg [Male rat].  
 DERMAL (LD50): Acute: 231.4 mg/kg [Rabbit]. VAPOR (LC50): Acute: 26 ppm 1 hours [Rat].  
 8.3 ppm 4 hours [Rat].

Target Organs cardiovascular system, respiratory tract, skin/epithelium, eyes.

**Other Adverse Effects**

**Section 12. Ecological Information**

Ecotoxicity Not available.

BOD5 and COD Not available.

Biodegradable/OECD In an aerobic aquatic metabolism study, the water phase revealed the rapid degradation of acrolein with all metabolites further mineralized to carbon dioxide. Results indicate hydration was an early step in acrolein degradation. The first-order kinetic half-life of acrolein was determined to be 33.7 hours in the water phase under laboratory conditions. Under field conditions, the half-life of acrolein in freshwater ranged from six to ten hours (Ref. 20). In an aerobic soil metabolism study the half-life of acrolein was found to be 4.2 hours in soil-water mixtures and was ultimately transformed into carbon dioxide (Ref.21).

Toxicity of the Products of Biodegradation Not available.

Special Remarks This product is very toxic to aquatic organisms:

Bluegill sunfish ( <i>Lepomis macrochirus</i> ):	96H LC50	24 ppb
Rainbow trout ( <i>Oncorhynchus mykiss</i> ):	6H LC50	24 ppb
Water flea ( <i>Daphnia magna</i> ):	48H LC50	22 ppb
Eastern oysters ( <i>Crassostrea virginica</i> ):	96H EC50	180 ppb
Mysid shrimp ( <i>Mysidopsis bahia</i> ):	96H LC50	500 ppb
Mysid shrimp ( <i>Holmesimysis costata</i> ):	96H LC50:	790 ppb
Sheepshead minnows ( <i>Cyprinodon variegatus</i> ):	96H LC50:	570 ppb
Marine copepod ( <i>Acartia tonsa</i> ):	48H LC50	55 ppb
Saltwater diatom ( <i>Skeletonema costatum</i> ):	120H EC50:	27 ppb

**Section 13. Disposal Considerations**

Responsibility for proper waste disposal rests with the generator of the waste. Dispose of any waste material in accordance with all applicable federal, state and local regulations. Note that these regulations may also apply to empty containers, liners and rinsate. Processing, use, dilution or contamination of this product may cause its physical and chemical properties to change.

**Continued on Next Page**

**Additional Waste Remarks** Do not reuse empty container. Return empty containers to Baker Petrolite Corporation, 19815 South Lake Road, Taft, CA 93268.

EPA Waste Code for acrolein is:  
 Waste Acrolein, stabilized  
 Waste Code – P003

**Section 14. Transport Information**

<b>DOT Classification</b>	Acrolein, stabilized, 6.1(3), UN1092, I	 
<b>DOT Reportable Quantity</b>	Acrolein, 0.15 gal. of this product. Hydroquinone, 4401 gal. of this product.	
<b>Marine Pollutant</b>	Acrolein.	
<b>Additional DOT Information</b>	Toxic-Inhalation Hazard, Zone A DOT SP-14341 (DOT: SP-14341 applies only to 4BW welded cylinders.)	
<b>Emergency Response Guide Number</b>	131P	

**Section 15. Regulatory Information**

<b>HCS Classification</b>	Target organ effects. Flammable liquid. Toxic.	
<b>U.S. Federal Regulations</b>		
<b>Environmental Regulations</b>	Extremely Hazardous Substances: Acrolein; SARA 313 Toxic Chemical Notification and Release Reporting: Acrolein; SARA 302/304 Emergency Planning and Notification substances: Acrolein; Hazardous Substances (CERCLA 302): Acrolein, 0 gal. of this product.; SARA 311/312 MSDS distribution - chemical inventory - hazard identification: fire; reactive; immediate health hazard; Clean Water Act (CWA) 307 Priority Pollutants: Acrolein; Clean Water Act (CWA) 311 Hazardous Substances: Acrolein; Clean Air Act (CAA) 112(r) Accidental Release Prevention Substances: Acrolein;	
<b>Threshold Planning Quantity (TPQ)</b>	Acrolein 74 gal.	
<b>TSCA Inventory Status</b>	All components are included or are exempted from listing on the US Toxic Substances Control Act Inventory.	
	This product does not contain any components that are subject to the reporting requirements of TSCA Section 12(b) if exported from the United States.	
<b>State Regulations</b>	State specific information is available upon request from Baker Petrolite.	

**Continued on Next Page**

## International Regulations

Canada	All components are compliant with or are exempted from listing on the Canadian Domestic Substance List.
WHMIS (Canada)	B-2, D-1A, E
European Union	All components are included or are exempted from listing on the European Inventory of Existing Commercial Chemical Substances or the European List of Notified Chemical Substances.

International inventory status information is available upon request from Baker Petrolite for the following countries: Australia, China, Korea (TCCL), Philippines (RA6969), or Japan.

## Other Regulatory Information

No further regulatory information is available.

## Section 16. Other Information

## Other Special Considerations

## References:

1. Feron, J.V. et al.; *Toxicology* 9 (1-2): 47-58 (1978).
2. Jakab, G.J.; *Am Rev Resp Dis* 1977 155:33-38.
3. Bouley, G.; *Eur J Toxicol Eur Environ Hyg* 1975: 8:291-297.
4. Parent, R.A., Caravello, H.E., Christian, M.S., and Hoberman, A.M.. Developmental Toxicity of Acrolein in New Zealand White Rabbits. *Fundamental and Applied Toxicology*. 20, 248-256 (1993).
5. Teratology Study of Acrolein in Rats, Bioassay Systems Corporation, Woburn, MA (1982) (Unpublished Study).
6. Parent, R.A., Caravello, H.E., and Hoberman, A.M.. Reproductive Study of Acrolein on Two Generations of Rats. *Fundamental and Applied Toxicology*. 19:228-237 (1992).
7. 21 Day Dermal Test of Acrolein in Rabbits, Bioassay Systems Corporation, Woburn, MA, 1982 (Unpublished Study).
8. A Sub-Chronic Inhalation Study of Fischer 344 Rats Exposed to 0, 0.4, 1.4, or 4.0 ppm Acrolein. Brookhaven National Laboratory, Upton, NY, 1981.
9. Parent, R.A., Caravello, H.E., Balmer, M.F., Shellenberger, T.E., and J.E. Long, One Year Chronic Toxicity of Orally Administered Acrolein to Beagle Dogs. *J. Appl. Tox.* 12(0): 1-9 (1992).
10. Parent, R.A., Caravello, H.E., and Long, J.E.. Oncogenicity Study of Acrolein in Mice. *Journal of the American College of Toxicology*. 10(6), 647-659 (1991).
11. Parent, R.A., Caravello, H.E. and Long, J.E.. Two-year Toxicity and Carcinogenicity Study of Acrolein in Rats. *Journal of Applied Toxicology*, Vol. 12(2), 131-139 (1992).
12. Effects of Acrolein on the In Vitro Induction of Chromosomal Aberrations in CHO Cells, Bioassay Systems, Woburn, MA, 1982 (Unpublished Study).
13. Effects of Acrolein on the In Vivo Induction of Chromosomal Aberrations in Rat Bone Marrow Cells, Bioassay Systems, Woburn, MA, 1982 (Unpublished Study).
14. Salmonella Liquid Suspension Mutant Fraction Assay, Bioassay Systems, Woburn, MA, 1980 (Unpublished Study).
15. Nordone, A.J., Dotson, T.A., Kovacs, M.F., Doane, R.A., and Biever, R.C.. Metabolism of [14C] Acrolein (MAGNACIDE® H Herbicide): Nature and Magnitude of Residues Using Freshwater Fish and Shellfish. *Environ. Toxicol. And Chemistry*. 17(2): 276-281 (1998).
16. Nordone, A.J., Dotson, T.A., Kovacs, and Doane, R.A.. [14C] Acrolein: Accumulation and Metabolism in Leaf Lettuce. *Bull. Environ. Contam. Toxicol.* (58):787-792 (1997).
17. Sharp, D.E., Berge, M.A., Paust, D.E., Talaat, R.E., Wilkes, L.C., Servatius, L.J., Loftus, M.L., Caravello, H.E., and Parent, R.A.. Metabolism and Distribution of [2,3-14C]Acrolein in Lactating Goats. *J. of Agric. and Food Chem.* 49(3): 1630-1638 (2001).
18. Sharp, D.E., Berge, M.A., Hennes, M.G., Wilkes, L.C., Servatius, L.J., Loftus, M.L., Caravello, H.E., and Parent, R.A.. Metabolism and Distribution of [2,3-14C]Acrolein in Laying Hens. *J. of Agric. and Food Chem.* 49(3): 1639-1647 (2001).
19. Parent, R.A., Caravello, H.E., and Sharp, D.E.. Metabolism and Distribution of [2,3-14C]Acrolein in

Continued on Next Page

Sprague-Dawley rats. Journal of Applied Toxicology, Vol 16(5), 449-457 (1994).  
20. Smith, A.M., Mao, J., Doane, R.A., and Kovacs, M.F.. Metabolic Fate of [14C]Acrolein Under Aerobic and Anaerobic Aquatic Conditions. J. of Agric. and Food Chem. 43(9): 2497-2503 (1995).  
21. Estimation of the Aerobic Biotransformation Rates of Acrolein (MAGNACIDE® H Herbicide, MAGNACIDE® B Biocide) in Soil, SRI International, Menlo Park, CA, (1990) (Unpublished Study).

10/07/02 - Update to Section 3  
10/31/02 - Update to Section 14  
11/06/02 - Update to sections 5, 8, 14, and 15 (Canada)  
04/29/03 - Update to Section 2  
05/05/03 - Update to Section 7  
12/30/03 - Changes to Sections 2, 3, 8, 10, and 11.  
05/18/04 - Changes to Sections 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 and 16.  
01/25/05 - Changes to Sections 3 and 11.  
01/08/07 - Changes to Section 15.  
03/18/09 - Changes to sections 2, 3, 5, 8, 9, and 15.  
08/21/09 - Changes to section 5 and 6.

**Baker Petrolite Disclaimer**

*NOTE: The information on this MSDS is based on data which is considered to be accurate. Baker Petrolite, however, makes no guarantees or warranty, either expressed or implied of the accuracy or completeness of this information.*

*The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage or expense arising out of or in any way connected with the handling, storage, use or disposal of this product.*

*This MSDS was prepared and is to be used for this product. If the product is used as a component in another product, this MSDS information may not be applicable.*

# Specimen Label

## Nautique\*

### Aquatic Herbicide



For control of floating, emersed, and submersed vegetation in still or flowing aquatic sites such as 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 aquaculture including fish and shrimp.

#### Active Ingredient

Copper Carbonate <sup>1</sup> .....	15.9%
Inert Ingredients .....	84.1%
TOTAL .....	100.0%

<sup>1</sup>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 burn. May be fatal if absorbed through skin. Harmful if swallowed. Do not get in eyes on skin or on clothing. Wear goggles, face shield, or safety glasses, protective clothing and chemical-resistant gloves. Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals. Wash thoroughly with soap and water after handling and before eating, drinking and using tobacco. 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 waters containing trout or other sensitive species if the carbonate hardness of the

water is less than 50 ppm. Fish toxicity generally decreases when the hardness of water increases. Do not treat more than one-half of lake or pond at one time to avoid depletion of oxygen levels due to decaying vegetation. Consult State Fish and Game Agency or other responsible Agency before applying this product to public waters.

First Aid	
<b>If in eyes</b>	<ul style="list-style-type: none"><li>• 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.</li><li>• Call poison control center or doctor for treatment advice.</li></ul>
<b>If on skin or clothing</b>	<ul style="list-style-type: none"><li>• Take off contaminated clothing.</li><li>• Rinse skin immediately with plenty of water for 15 - 20 minutes.</li><li>• Call a poison control center or doctor for treatment advice.</li></ul>
<b>If swallowed</b>	<ul style="list-style-type: none"><li>• Call a poison control center or doctor immediately for treatment advice.</li><li>• Have person sip a glass of water if able to swallow.</li><li>• Do not induce vomiting unless told to do so by a poison control center or doctor.</li><li>• Do not give anything by mouth to an unconscious person.</li></ul>
<b>If inhaled</b>	<ul style="list-style-type: none"><li>• Move person to fresh air.</li><li>• If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible.</li><li>• Call a poison control center or doctor for further treatment advice.</li></ul>
<b>Note to Physician:</b> Probable mucosal damage may contraindicate the use of gastric lavage. 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 <b>INFOTRAC</b> at <b>1-800-535-5053</b> .	

**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](http://www.sepro.com).

EPA Reg. No. 67690-10  
FPL 070705

\*Trademark of SePRO Corporation.  
SePRO Corporation 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

Nautique may be applied to potable water sources, lakes, rivers, reservoirs, ponds, slow-flowing or quiescent water bodies, crop and non-crop irrigation systems (ditches, canals, and laterals), fish, golf course, ornamental, swimming, and fire ponds, and aquaculture including fish and shrimp. In waters with greater calcium carbonate hardness, the higher use rates are recommended for improved plant control.

#### Target Species

Nautique Aquatic Herbicide is a double chelated copper formulation that provides effective control of floating, submersed, and emersed aquatic plants having a sensitivity to copper absorption including:

Coontail  
 Curlyleaf Pondweed  
 Egeria (*Brazilian Elodia*)  
 Elodea  
 Eurasian Watermilfoil<sup>1</sup>  
 Horned Pondweed<sup>1</sup>  
 Hydrilla  
 Naiads  
 Thin Leaf Pondweed  
 Vallisneria  
 Water Lettuce  
 Water Hyacinth  
 Widgeon Grass  
 Pondweed (e.g., Sago, American,)<sup>1</sup>

<sup>1</sup>Variable control may be obtained in waters with greater calcium carbonate hardness.

#### Timing of Treatments

When target vegetation is actively growing, apply Nautique Aquatic Herbicide to the area of greatest concentration of foliage in such a way as to evenly distribute the herbicide. In lakes, reservoirs, ponds, and static canals, the application site is defined by this label as the specific location where Nautique 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. In order to maximize effectiveness, apply Nautique early in the day under bright or sunny conditions when water temperatures are at least 60° F (15° C). The activity of this product may be reduced if there is insufficient penetration of light into the water or if the plants and weeds are covered with silt, scale, or algae. If algae mats are thick, use high pressure when spraying to break up the algae mats.

#### Dissolved Oxygen Consideration

Treatment of aquatic plants and weeds can result in a reduction of dissolved oxygen due to the decomposition of the dead vegetation. This loss of dissolved oxygen can cause fish suffocation. To minimize this possible hazard treat 1/3 to 1/2 of the water area in a single operation, then wait 10 - 12 days before treating the remaining area. Begin treatment in the shallow areas, gradually proceeding outward in bands to permit the fish to move into the untreated area.

### Application Options

Nautique Aquatic Herbicide can be applied directly as a surface spray, subsurface through trailing weighted hoses, or in combination with other aquatic herbicides and algacides, surfactants, sinking agents, polymers, or penetrants. These products are used to improve the retention time, sinking, and distribution of the herbicide. For surface application, this product may be applied diluted or undiluted, whichever is most suitable to insure uniform coverage of the area to be treated.

Aquatic plants and weeds will typically drop below the surface within 4 - 7 days after treatment. The complete results of treatment will be observed in 3 - 4 weeks in most cases. In heavily infested areas a second application may be necessary after 10 - 12 weeks. Repeating application of this product too soon after initial application may have no effect.

Use the lower rates for treating shallow water and the higher rates for treating deeper water and heavier infestations. Surface applications may be made from shore into shallow water along the shoreline.

Nautique Aquatic Herbicide inverts easily using either tank-mix or multi-fluid mixer techniques. For submersed plants invert applications should be made through weighted hoses dragged below the water surface; for heavy infestations, direct application is preferable.

### NO RESTRICTIONS ON WATER USE

Waters treated with Nautique may be used immediately after application for swimming, fishing, drinking, livestock watering, or irrigating turf and ornamental plants.

### Permits

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

### APPLICATION RATES

Recommended application rates in the chart below are based on minimal water flow in ponds, lakes, reservoirs, and irrigation conveyance or drainage systems. Treatments that extend chemical contact time with target vegetation will generally result in improved efficacy. In lakes, reservoirs, ponds, and static canals, the application site is defined by this label as the specific location where Nautique is applied. In conveyance systems where significant water flow results in rapid off-site movement of copper, consult the Flowing Water Treatment Instructions for the recommended application instructions.

APPLICATION RATES		GALLONS PER SURFACE ACRE				LITERS PER SURFACE HECTARE			
		Depth in Feet				Depth in meters			
Relative Density	ppm	1	2	3	4 <sup>2</sup>	0.5	0.75	1.0	1.25 <sup>2</sup>
Low	.5	1.5	3.0	4.5	6.0	12.0	24.1	36.1	48.2
Density	.6	1.8	3.6	5.4	7.2	14.9	29.8	44.7	59.6
Medium	.7	2.1	4.2	6.3	8.4	17.2	34.4	51.6	68.8
Density	.8	2.4	4.8	7.3	9.6	19.5	39.0	58.5	78.0
High	.9	2.7	5.4	8.1	10.8	21.8	43.6	65.4	87.2
Density	1.0 <sup>2</sup>	3.0	6.0	9.0	12.0	24.1	48.2	72.3	96.4

<sup>1</sup> For depths greater than 4 ft. (1.25 m) add rates given for the sum of the corresponding depths in the chart.

<sup>2</sup> Do not apply more than 1.0 ppm copper per application.

**Free-Floating Plants** Apply Nautique at a rate of 8 - 12 gallons/acre for control of water hyacinth and salvinia and 4 - 6 gallons/acre for control of water lettuce. Add Nautique and appropriate surfactant to 100 gallons of water and use an adequate spray volume to insure good coverage of the plant.

## TANK-MIX

### Nautique + Sonar® A.S. Tank-Mix (Except CA)

The following mixture can be used to provide rapid control of dense infestations of coontail, duckweed, egeria, elodea, Eurasian watermilfoil, hydrilla, sago and American pondweed, naiads, and other susceptible species. Apply 1 to 4 gallons of Nautique per surface acre in conjunction with normal Sonar rates. Observe all cautions and restrictions on the labels of both products used in this mixture.

### Nautique + Reward® Tank-Mix

The following mixture can be used to enhance control of coontail, duckweed, egeria, elodea, Eurasian watermilfoil, hydrilla, pondweeds (Potamogeton species), salvinia, water lettuce, water hyacinth, and other susceptible species. Tank-mix a ratio of 2:1 or 1.5:1 Nautique to Reward. This can be applied as a tank mix or metered in as a concentrate. The addition of a surfactant is recommended to enhance performance on floating plants. Observe all cautions and restrictions on the labels of both products used in this mixture. **DO NOT MIX CONCENTRATES IN TANK WITHOUT FIRST ADDING WATER.**

## FLOWING WATER TREATMENT:

### Drip System or Metering Pump Application for Canals, Ditches, and Laterals

This product should be applied as soon as submersed macrophytes begin to interfere with normal delivery of water (clogging of lateral head gates, suction screens, weed screens, and siphon tubes). Delaying treatment could perpetuate the problem causing massing and compacting of plants. Heavy infestations and low flows may result in pooling or uneven chemical distribution resulting in unsatisfactory control. Under these conditions increasing the water flow rate during application may be necessary. In flowing canals the application site is defined by this label as the target location for aquatic plant control.

To achieve desired control with Nautique herbicide in flowing waters, it is recommended that a minimum exposure period of three hours be maintained. Other factors to consider include: plant species and density of infestation and water temperature and hardness. Treatment on bright sunny days will tend to enhance efficacy of this product.

1. Treatment with Nautique requires accurate calculations of water flow rates. Devices that provide accurate flow measurements such as weirs or orifices are the preferred method, however, the volume of water to be treated may also be estimated using the following formula:

$$\text{Average width (ft.)} \times \text{Average Depth (ft.)} \times \text{Average Velocity (ft./sec.)} = \text{Cubic Feet per Second (CFS)}$$

The velocity can be estimated by determining the length of time it takes a floating object to travel a defined distance. Divide the distance (ft.) by the time (sec.) to estimate velocity (ft./sec). This measure should be repeated 3 times at the intended application site and then calculate the average velocity.

2. 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		ppm Copper	Chemical Drip Rate	
C.F.S.	Gal/Min.		Quart/Hr.	MI/Min.
1	450	0.5 - 1.0	0.5 - 1.0	8.0 - 16.0
2	900	0.5 - 1.0	1.0 - 2.0	16.0 - 32.0
3	1350	0.5 - 1.0	1.5 - 3.0	23.5 - 47.0
4	1800	0.5 - 1.0	2.0 - 4.0	31.5 - 63.0
5	2250	0.5 - 1.0	2.5 - 5.0	39.5 - 79.0

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 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.

### Irrigation Ponds

When applying to irrigation ponds, it is best to hold water for a minimum of 3 hours before irrigating to ensure proper exposure of Nautique at targeted rates to plants. If water is to be continually pumped from the treated system during application, application techniques (drip, injection, or multiple spray applications) should be made to compensate for dilution of Nautique within the targeted area.

## 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).

### Storage and Disposal

Store in a cool, dry place.

**PESTICIDE DISPOSAL:** Do not contaminate water, food or feed by storage and disposal. Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility. 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 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.

# Material Safety Data Sheet



## Nautique\* Aquatic Herbicide

### 1. Product and company identification

Product name : Nautique\* Aquatic Herbicide  
EPA Registration Number : 67690-10  
Material uses : Aquatic plant herbicide.  
Supplier/Manufacturer : **SePRO Corporation**  
11550 North Meridian Street  
Suite 600  
Carmel, IN 46032 U.S.A.  
Tel: 317-580-8282  
Toll free: 1-800-419-7779  
Fax: 317-428-4577  
Monday - Friday, 8am to 5pm E.S.T.  
**www.sepro.com**

Responsible name : KMK Regulatory Services inc.  
In case of emergency : **INFOTRAC - 24-hour service 1-800-535-5053**

### 2. Hazards identification

Physical state : Liquid.  
Odor : Ammoniacal. [Slight]  
OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).  
Emergency overview : **DANGER!**  
**CAUSES RESPIRATORY TRACT, EYE AND SKIN BURNS. MAY CAUSE SEVERE ALLERGIC RESPIRATORY AND SKIN REACTION. HARMFUL IF ABSORBED THROUGH SKIN. MAY BE HARMFUL IF SWALLOWED. CONTAINS MATERIAL THAT CAN CAUSE TARGET ORGAN DAMAGE.**  
Harmful if absorbed through the skin. Corrosive to the eyes, skin and respiratory system. Causes burns. May be harmful if swallowed. May cause sensitization by inhalation and skin contact. Avoid exposure - obtain special instructions before use. Do not breathe vapor or mist. Do not ingest. Do not get in eyes or on skin or clothing. Contains material that can cause target organ damage. Use only with adequate ventilation. Keep container tightly closed and sealed until ready for use. Wash thoroughly after handling.

Routes of entry : Dermal contact. Eye contact. Inhalation. Ingestion.  
Potential acute health effects  
Inhalation : Corrosive to the respiratory system. May cause sensitization by inhalation. Exposure to decomposition products may cause a health hazard. Serious effects may be delayed following exposure.  
Ingestion : Harmful if swallowed. May cause burns to mouth, throat and stomach.  
Skin : Corrosive to the skin. Causes burns. Toxic in contact with skin. May cause sensitization by skin contact.  
Eyes : Corrosive to eyes. Causes burns.  
Potential chronic health effects  
Chronic effects : Contains material that can cause target organ damage.  
Carcinogenicity : No known significant effects or critical hazards.  
Mutagenicity : No known significant effects or critical hazards.  
Teratogenicity : No known significant effects or critical hazards.  
Developmental effects : No known significant effects or critical hazards.  
Fertility effects : No known significant effects or critical hazards.  
Target organs : Contains material which causes damage to the following organs: kidneys, liver, upper respiratory tract, skin, eye, lens or cornea.  
Over-exposure signs/symptoms

\* indicates trademark of SePRO Corporation.

- Inhalation** : Adverse symptoms may include the following:  
respiratory tract irritation  
coughing  
wheezing and breathing difficulties  
asthma
- Ingestion** : Adverse symptoms may include the following:  
stomach pains
- Skin** : Adverse symptoms may include the following:  
pain or irritation  
redness  
blistering may occur
- Eyes** : Adverse symptoms may include the following:  
pain  
watering  
redness
- Medical conditions aggravated by over-exposure** : Pre-existing respiratory and skin disorders and disorders involving any other target organs mentioned in this MSDS as being at risk may be aggravated by over-exposure to this product.

See toxicological information (section 11)

## 3. Composition/information on ingredients

United States			
Name	CAS number	%	
1,2-Diaminoethane	107-15-3	10 - 30	
Triethanolamine	102-71-6	10 - 30	
Copper (II) Carbonate Basic	12069-69-1	10 - 30	

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

## 4. First aid measures

- Eye contact** : Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 20 minutes. Get medical attention immediately.
- Skin contact** : In case of contact, immediately flush skin with plenty of water for at least 20 minutes. Get medical attention immediately.
- Inhalation** : If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.
- Ingestion** : Do not induce vomiting. Never give anything by mouth to an unconscious person. Get medical attention immediately.
- Protection of first-aiders** : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.
- Notes to physician** : In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

## 5. Fire-fighting measures

- Flammability of the product** : Flammable.
- Extinguishing media**
- Suitable** : Use an extinguishing agent suitable for the surrounding fire.
- Not suitable** : None known.
- Hazardous thermal decomposition products** : Decomposes above 390°F (200°C). May form oxides of carbon and nitrogen.
- Special protective equipment for fire-fighters** : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

## 6. Accidental release measures

- Personal precautions** : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Avoid breathing vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment (see section 8).
- Environmental precautions** : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).
- Methods for cleaning up**
- Small spill** : Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble or absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.
- Large spill** : Stop leak if without risk. Move containers from spill area. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see section 1 for emergency contact information and section 13 for waste disposal.

## 7. Handling and storage

- Handling** : Put on appropriate personal protective equipment (see section 8). Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Persons with a history of skin sensitization problems or asthma, allergies or chronic or recurrent respiratory disease should not be employed in any process in which this product is used. Do not get in eyes or on skin or clothing. Do not breathe vapor or mist. Do not ingest. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container.
- Storage** : Store in accordance with local regulations. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see section 10) and food and drink. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

## 8. Exposure controls/personal protection

	United States
<b>Product name</b>	<b>Exposure limits</b>
1,2-Diaminoethane	<b>ACGIH TLV (United States, 1/2006). Skin</b> TWA: 25 mg/m <sup>3</sup> 8 hour(s). <b>NIOSH REL (United States, 12/2001).</b> TWA: 25 mg/m <sup>3</sup> 10 hour(s). <b>OSHA PEL (United States, 11/2006).</b> TWA: 25 mg/m <sup>3</sup> 8 hour(s).
Triethanolamine	<b>ACGIH TLV (United States, 1/2006).</b> TWA: 5 mg/m <sup>3</sup> 8 hour(s).

Consult local authorities for acceptable exposure limits.

- Recommended monitoring procedures** : If this product contains ingredients with exposure limits, personal, workplace atmosphere or biological monitoring may be required to determine the effectiveness of the ventilation or other control measures and/or the necessity to use respiratory protective equipment. **Applicators should refer to the product label for personal protective clothing and equipment.**

- Engineering measures** : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapor or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

# Nautique\* Aquatic Herbicide



**Hygiene measures** : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

## Personal protection

**Applicators should refer to the product label for personal protective clothing and equipment.**

**Eyes** : Face shield.  
**Skin** : Synthetic apron. Boots.  
**Respiratory** : Vapor respirator.  
**Hands** : Nitrile gloves.

**Personal protective equipment (Pictograms)** :



**HMIS Code/Personal protective equipment** : D

**Environmental exposure controls** : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

## 9 . Physical and chemical properties

**Physical state** : Liquid.  
**Color** : Purple. [Dark]  
**Odor** : Ammoniacal. [Slight]  
**pH** : 12.03 [Conc. (% w/w): 1%]Typical  
**Relative density** : 1.2

## 10 . Stability and reactivity

**Stability** : The product is stable.  
**Hazardous polymerization** : Under normal conditions of storage and use, hazardous polymerization will not occur.  
**Conditions to avoid** : No specific data.  
**Materials to avoid** : Reactive or incompatible with the following materials: Strong acids and nitrites. Should not be used in water where the pH is less than 6.0 due to the possible breakdown of the copper chelate, which could form copper ions, which would precipitate. Should not be applied to water when temperature of the water is below 60°F (15°C).  
**Hazardous decomposition products** : Under normal conditions of storage and use, hazardous decomposition products should not be produced.  
Highly flammable in the presence of the following materials or conditions: open flames, sparks and static discharge.  
Flammable in the presence of the following materials or conditions: heat.

## 11 . Toxicological information

### Acute toxicity

Product/ingredient name	Species	Dose	Result	Exposure
Nautique* Aquatic Herbicide	Rabbit - Male, Female	700 mg/kg	LD50 Dermal	-
	Rat - Male, Female	0.68 g/kg	LD50 Oral	-
	Rat - Male, Female	2100 g/m <sup>3</sup>	LC50 Inhalation Vapor	4 hours

- Inhalation** : Corrosive to the respiratory system. May cause sensitization by inhalation. Exposure to decomposition products may cause a health hazard. Serious effects may be delayed following exposure.
- Ingestion** : Harmful if swallowed. May cause burns to mouth, throat and stomach.
- Skin** : Corrosive to the skin. Causes burns. Toxic in contact with skin. May cause sensitization by skin contact.
- Eyes** : Corrosive to eyes. Causes burns.

## Carcinogenicity

### Classification

Product/ingredient name	ACGIH	IARC	EPA	NIOSH	NTP	OSHA
1,2-Diaminoethane	A4	-	-	-	-	-
Triethanolamine	-	3	-	-	-	-

## 12 . Ecological information

**Environmental effects** : No known significant effects or critical hazards.

### Aquatic ecotoxicity

Product/ingredient name	Test	Species	Exposure	Result
1,2-Diaminoethane	Population	Algae	48 hours	Acute EC50 >100 mg/L
	Mortality	Fish	96 hours	Acute LC50 275 mg/L
	Mortality	Fish	96 hours	Acute LC50 220 mg/L
	Mortality	Fish	96 hours	Acute LC50 115.7 mg/L
	Mortality	Fish	96 hours	Acute LC50 1544.7 mg/L

**Remark:** It is reasonable to assume that Copper compounds contain Arsenic, Cadmium, Chromium, and Lead in concentrations ranging from a few parts per billion to several hundred parts per million.

## 13 . Disposal considerations

**Waste disposal** : The generation of waste should be avoided or minimized wherever possible. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe way. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Disposal should be in accordance with applicable regional, national and local laws and regulations.

Refer to Section 7: HANDLING AND STORAGE and Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION for additional handling information and protection of employees.

## 14 . Transport information

**AERG** : 153

Regulatory information	UN number	Proper shipping name	Classes	PG*	Label	Additional information
<b>DOT Classification</b>	UN2735	AMINES, LIQUID, CORROSIVE, N.O.S. (1,2-Diaminoethane)	8	III		-
<b>IMDG Class</b>	UN2735	AMINES, LIQUID, CORROSIVE, N.O.S. (1,2-Diaminoethane)	8	III		-
<b>IATA-DGR Class</b>	UN2735	AMINES, LIQUID, CORROSIVE, N.O.S. (1,2-Diaminoethane)	8	III		-

PG\* : Packing group

## 15 . Regulatory information

### United States

- HCS Classification** : Toxic material  
Corrosive material  
Sensitizing material  
Target organ effects
- U.S. Federal regulations** : **United States inventory (TSCA 8b)**: All components listed.  
TSCA precursor chemical list: Triethanolamine  
**SARA 302/304/311/312 extremely hazardous substances**: 1,2-Diaminoethane  
**SARA 302/304 emergency planning and notification**: 1,2-Diaminoethane  
**SARA 302/304/311/312 hazardous chemicals**: Copper (II) Carbonate Basic; 1,2-Diaminoethane; Triethanolamine  
**SARA 311/312 MSDS distribution - chemical inventory - hazard identification**:  
Copper (II) Carbonate Basic: Delayed (chronic) health hazard; 1,2-Diaminoethane: Fire hazard, Immediate (acute) health hazard, Delayed (chronic) health hazard;  
Triethanolamine: Immediate (acute) health hazard, Delayed (chronic) health hazard  
**Clean Water Act (CWA) 307**: Copper (II) Carbonate Basic  
**Clean Water Act (CWA) 311**: 1,2-Diaminoethane  
**Clean Air Act (CAA) 112 accidental release prevention**: 1,2-Diaminoethane  
**Clean Air Act (CAA) 112 regulated flammable substances**: No products were found.  
**Clean Air Act (CAA) 112 regulated toxic substances**: 1,2-Diaminoethane

### SARA 313

	Product name	CAS number	Concentration
<b>Form R - Reporting requirements</b>	: Copper (II) Carbonate Basic	12069-69-1	10 - 30
<b>Supplier notification</b>	: Copper (II) Carbonate Basic	12069-69-1	10 - 30

SARA 313 notifications must not be detached from the MSDS and any copying and redistribution of the MSDS shall include copying and redistribution of the notice attached to copies of the MSDS subsequently redistributed.

### State regulations

- : **Connecticut Carcinogen Reporting**: None of the components are listed.  
**Connecticut Hazardous Material Survey**: None of the components are listed.  
**Florida substances**: None of the components are listed.  
**Illinois Chemical Safety Act**: None of the components are listed.  
**Illinois Toxic Substances Disclosure to Employee Act**: None of the components are listed.  
**Louisiana Reporting**: None of the components are listed.  
**Louisiana Spill**: None of the components are listed.  
**Massachusetts Spill**: None of the components are listed.  
**Massachusetts Substances**: The following components are listed: 1,2-Diaminoethane  
**Michigan Critical Material**: None of the components are listed.  
**Minnesota Hazardous Substances**: None of the components are listed.  
**New Jersey Hazardous Substances**: The following components are listed: 1,2-Diaminoethane; Copper (II) Carbonate Basic  
**New Jersey Spill**: None of the components are listed.  
**New Jersey Toxic Catastrophe Prevention Act**: None of the components are listed.  
**New York Acutely Hazardous Substances**: The following components are listed: 1,2-Diaminoethane  
**New York Toxic Chemical Release Reporting**: None of the components are listed.  
**Pennsylvania RTK Hazardous Substances**: The following components are listed: 1,2-Diaminoethane; Copper (II) Carbonate Basic  
**Rhode Island Hazardous Substances**: None of the components are listed.

**California Prop. 65** : No products were found.

### International regulations

- International lists** : This product, (and its ingredients) is (are) listed on national inventories, or is (are) exempted from being listed, in Australia (AICS), in Europe (EINECS/ELINCS), in Korea (TCCL), in Japan (METI), in the Philippines (RA6969).

**16 . Other information**

Label requirements : CAUSES RESPIRATORY TRACT, EYE AND SKIN BURNS. MAY CAUSE SEVERE ALLERGIC RESPIRATORY AND SKIN REACTION. HARMFUL IF ABSORBED THROUGH SKIN. MAY BE HARMFUL IF SWALLOWED. CONTAINS MATERIAL THAT CAN CAUSE TARGET ORGAN DAMAGE.

Hazardous Material Information System (U.S.A.) :

HAZARD RATINGS

Health	*	3
Fire hazard		0
Physical Hazard		0
Personal protection		D

4- Extreme  
 3- Serious  
 2- Moderate  
 1- Slight  
 0- Minimal  
 See section 8 for more detailed information on personal protection.

The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.) :



References : ANSI Z400.1, MSDS Standard, 2004. - Manufacturer's Material Safety Data Sheet. - 29CFR Part1910.1200 OSHA MSDS Requirements. - 49CFR Table List of Hazardous Materials, UN#, Proper Shipping Names, PG.

Date of issue : 07/15/2009  
 Date of previous issue : 01/15/2009  
 Version : 2.1

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above named supplier nor any of its subsidiaries assumes any liability whatsoever for the accuracy or completeness of the information contained herein. Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist. The data in this MSDS relates only to the specific material designated herein. Possible adverse effects (see Section 2, 11 and 12) may occur if this material is not handled in the recommended manner.

**This page has  
been intentionally  
left blank**

# Appendix F

(CEQA Documentation)

SIP Exception Info Sheet  
CEQA NOC  
CEQA NOI  
CEQA NOD  
JID Board Resolution  
State Clearinghouse Letter, Comments, Responses  
DFW Filing Fee Receipts

**State Implementation Plan (SIP) Section 5.3 Exception Information Sheet**  
**Use of Copper and Acrolein To Control Aquatic Vegetation In Canals, Laterals,**  
**and Basins**

**James Irrigation District**

**June 16, 2014**

1. **Description of the Proposed Action.** The proposed action is James Irrigation District (District)'s application of acrolein- and copper-containing aquatic herbicides to irrigation canals for the purposes of controlling aquatic vegetation and algae. For a more detailed description, see the District's Initial Study/Mitigated Negative Declaration (IS/MND) dated April 3, 2014.
2. **Method of Completing the Action.** The action (the application of acrolein- and copper-containing aquatic herbicides) will be completed according to the pesticide manufacturer's product label directions. Refer to the aforementioned IS/MND.
3. **Schedule.** The schedule for the action will be according to Integrated Pest Management (IPM) principles. For example, the application of aquatic pesticides will be done at times and frequencies when the concentration of aquatic vegetation equals or exceeds thresholds established by the District. Aquatic herbicide applications typically take place annually between March 1 and November 30.
4. **Discharge and Receiving Water Quality Monitoring Plan.** The District has prepared and will use its Aquatic Pesticide Application Plan (APAP) as required in the Statewide General NPDES Permit for Residual Aquatic Pesticide Discharges to Waters of the United States from Algae and Aquatic Weed Control Applications #CAG990005 (#2013-0002-DWQ). The APAP describes in detail the requirements for sampling, analysis, and reporting before, during, and after the project. Further, the APAP contains a Quality Assurance Project Plan (QAPP) that describes in detail the quality assurance and quality control procedures used for the project.
5. **Contingency Plans.** The District will maintain its ability to use other herbicides and/or manual removal of aquatic vegetation and aquatic herbicides that do not contain acrolein or copper. Alternative aquatic weed and algae control methods are not always as cost-effective, easy to apply, or efficacious as acrolein or copper. Refer to the aforementioned IS/MND for a discussion of the use of acrolein- and copper-containing aquatic herbicides.
6. **CEQA Documentation and Notification.** The District will notify potentially affected public and governmental agencies of the project. The project is described in the District's aforementioned IS/MND. All CEQA Documentation can be found in Appendix F of the IS/MND.
7. **Certification by a Qualified Biologist.** At the annual completion of the project, the District will provide certification by a qualified biologist that the receiving water beneficial uses have been maintained. Pre- and post-project certification will take into account natural variations in project site conditions and the influence these conditions have on beneficial uses.

2014041028

Notice of Completion & Environmental Document Transmittal

Mail to: State Clearinghouse, P.O. Box 3044, Sacramento, CA 95812-3044 (916) 445-0613
For Hand Delivery/Street Address: 1400 Tenth Street, Sacramento, CA 95814

SCH #

Project Title: Use of Copper and Acrolein to Control Aquatic Vegetation in Canals, Laterals, and Basins

Lead Agency: James Irrigation District

Contact Person: John Mallyon

Mailing Address: 8749 9th Street, P.O. Box 757

Phone: (559) 693-4653

City: San Joaquin

Zip: 93660

County: Fresno

Project Location: County: Fresno City/Nearest Community: San Joaquin

Cross Streets: Various Zip Code: 93660

Longitude/Latitude (degrees, minutes and seconds): 36 ° 36 ' 28.59" N / -120 ° 11 ' 24.64" W Total Acres: 25,000

Assessor's Parcel No.: Various Section: Various Twp.: 13S Range: 19-21 E Base: Mt Diablo

Within 2 Miles: State Hwy #: 180 Waterways: Kings and San Joaquin Rivers

Airports: San Joaquin Railways: Southern Pacific Schools: San Joaquin Elementary

Document Type:

- CEQA: [ ] NOP [ ] Draft EIR [ ] Supplement/Subsequent EIR [ ] Joint Document [ ] Early Cons [ ] Neg Dec [ ] Mit Neg Dec [ ] Other: [ ] Final Document [ ] Other: [ ] NEPA [ ] NOI [ ] EA [ ] Draft EIS [ ] FONSI



Local Action Type:

- [ ] General Plan Update [ ] Specific Plan [ ] Rezone [ ] Annexation
[ ] General Plan Amendment [ ] Master Plan [ ] Prezone [ ] Redevelopment
[ ] General Plan Element [ ] Planned Unit Development [ ] Use Permit [ ] Coastal Permit
[ ] Community Plan [ ] Site Plan [ ] Land Division (Subdivision, etc.) [ ] Other: NPDES Permit

Development Type:

- [ ] Residential: Units \_\_\_\_\_ Acres \_\_\_\_\_
[ ] Office: Sq.ft. \_\_\_\_\_ Acres \_\_\_\_\_ Employees \_\_\_\_\_
[ ] Commercial: Sq.ft. \_\_\_\_\_ Acres \_\_\_\_\_ Employees \_\_\_\_\_
[ ] Industrial: Sq.ft. \_\_\_\_\_ Acres \_\_\_\_\_ Employees \_\_\_\_\_
[ ] Educational: \_\_\_\_\_
[ ] Recreational: \_\_\_\_\_
[ ] Water Facilities: Type Irrigate&Recharge MGD [ ] Other: Aquatic Weed Mgt with Herbicides

Project Issues Discussed in Document:

- [x] Aesthetic/Visual [ ] Fiscal [x] Recreation/Parks [x] Vegetation
[x] Agricultural Land [ ] Flood Plain/Flooding [x] Schools/Universities [x] Water Quality
[x] Air Quality [ ] Forest Land/Fire Hazard [ ] Septic Systems [x] Water Supply/Groundwater
[x] Archeological/Historical [x] Geologic/Seismic [ ] Sewer Capacity [x] Wetland/Riparian
[x] Biological Resources [x] Minerals [ ] Soil Erosion/Compaction/Grading [ ] Growth Inducement
[ ] Coastal Zone [x] Noise [ ] Solid Waste [ ] Land Use
[ ] Drainage/Absorption [x] Population/Housing Balance [x] Toxic/Hazardous [ ] Cumulative Effects
[ ] Economic/Jobs [x] Public Services/Facilities [x] Traffic/Circulation [ ] Other:

Present Land Use/Zoning/General Plan Designation:

Urban and Agriculture

Project Description: (please use a separate page if necessary)

The use of acrolein and/or copper to treat algae and aquatic weeds in water conveyances, including irrigation canals and ditches. James Irrigation District is preparing this Initial Study/Mitigated Negative Declaration to meet requirements of 1) The State Implementation Plan (SIP) Section 5.3 and 2) NPDES Permit #CAG990005. See CEQA Initial Study and Mitigated Negative Declaration for details.

Note: The State Clearinghouse will assign identification numbers for all new projects. If a SCH number already exists for a project (e.g. Notice of Preparation or previous draft document) please fill in.

8507404300

### Reviewing Agencies Checklist

Lead Agencies may recommend State Clearinghouse distribution by marking agencies below with an "X".  
If you have already sent your document to the agency please denote that with an "S".

- |   |  |
|---|--|
| <input type="checkbox"/> Air Resources Board                              | <input type="checkbox"/> Office of Historic Preservation                     |
| <input type="checkbox"/> Boating & Waterways, Department of               | <input type="checkbox"/> Office of Public School Construction                |
| <input type="checkbox"/> California Emergency Management Agency           | <input type="checkbox"/> Parks & Recreation, Department of                   |
| <input type="checkbox"/> California Highway Patrol                        | <input checked="" type="checkbox"/> Pesticide Regulation, Department of      |
| <input type="checkbox"/> Caltrans District # _____                        | <input type="checkbox"/> Public Utilities Commission                         |
| <input type="checkbox"/> Caltrans Division of Aeronautics                 | <input checked="" type="checkbox"/> Regional WQCB #5 _____                   |
| <input type="checkbox"/> Caltrans Planning                                | <input type="checkbox"/> Resources Agency                                    |
| <input checked="" type="checkbox"/> Central Valley Flood Protection Board | <input type="checkbox"/> Resources Recycling and Recovery, Department of     |
| <input type="checkbox"/> Coachella Valley Mtns. Conservancy               | <input type="checkbox"/> S.F. Bay Conservation & Development Comm.           |
| <input type="checkbox"/> Coastal Commission                               | <input type="checkbox"/> San Gabriel & Lower L.A. Rivers & Mtns. Conservancy |
| <input type="checkbox"/> Colorado River Board                             | <input type="checkbox"/> San Joaquin River Conservancy                       |
| <input type="checkbox"/> Conservation, Department of                      | <input type="checkbox"/> Santa Monica Mtns. Conservancy                      |
| <input type="checkbox"/> Corrections, Department of                       | <input type="checkbox"/> State Lands Commission                              |
| <input type="checkbox"/> Delta Protection Commission                      | <input type="checkbox"/> SWRCB: Clean Water Grants                           |
| <input type="checkbox"/> Education, Department of                         | <input checked="" type="checkbox"/> SWRCB: Water Quality                     |
| <input type="checkbox"/> Energy Commission                                | <input type="checkbox"/> SWRCB: Water Rights                                 |
| <input checked="" type="checkbox"/> Fish & Game Region #4 _____           | <input type="checkbox"/> Tahoe Regional Planning Agency                      |
| <input checked="" type="checkbox"/> Food & Agriculture, Department of     | <input type="checkbox"/> Toxic Substances Control, Department of             |
| <input type="checkbox"/> Forestry and Fire Protection, Department of      | <input type="checkbox"/> Water Resources, Department of                      |
| <input type="checkbox"/> General Services, Department of                  | <input checked="" type="checkbox"/> Other: <u>Fresno Co Ag Commissioner</u>  |
| <input type="checkbox"/> Health Services, Department of                   | <input type="checkbox"/> Other: _____  |
| <input type="checkbox"/> Housing & Community Development                  |  |
| <input type="checkbox"/> Native American Heritage Commission              |  |

-----  
**Local Public Review Period (to be filled in by lead agency)**

Starting Date 04/04/2014 Ending Date 05/05/2014

-----  
**Lead Agency (Complete if applicable):**

Consulting Firm: <u>Blankinship &amp; Associates, Inc.</u>	Applicant: <u>James Irrigation District</u>
Address: <u>1590 Drew Ave, Ste 120</u>	Address: <u>8794 9th Street, P.O. Box 757</u>
City/State/Zip: <u>Davis, CA 95618</u>	City/State/Zip: <u>San Joaquin, CA 93660</u>
Contact: <u>Stephen Burkholder</u>	Phone: <u>(559) 693-4653</u>
Phone: <u>(530) 757-0941</u>	

-----  
Signature of Lead Agency Representative: \_\_\_\_\_

Date: 4-3-2014

Authority cited: Section 21083, Public Resources Code. Reference: Section 21161, Public Resources Code.

# NOTICE OF INTENT

To Adopt a Mitigated Negative Declaration for  
James Irrigation District

## Use of Copper & Acrolein to Control Aquatic Vegetation in Canals, Laterals, and Basins

James Irrigation District (JID) is proposing to begin to use acrolein and copper-based aquatic pesticides to control aquatic weeds in its canals, laterals, and basins in Fresno County, California.

The proposed project would include the following elements:

- Application of acrolein and copper-based aquatic herbicides; and
- Monitoring and reporting to the State Water Resource Control Board (SWRCB) and the Regional Water Quality Control Board (RWQCB)

To comply with the requirements of the California Environmental Quality Act (CEQA), JID authorized Blankinship & Associates, Inc. to prepare an Initial Study for the proposed project. The Initial Study includes an environmental checklist that evaluates the potential environmental impacts of the proposed project. Based on the results of the Initial Study, JID has determined that the proposed project can be carried out without significant impacts on the environment. Therefore, JID proposes to adopt a Mitigated Negative Declaration in order to meet its obligation under CEQA.

Prior to taking final action on the proposed Mitigated Negative Declaration, JID will consider public comments on the Initial Study and proposed Mitigated Negative Declaration. All interested parties are invited to submit written comments to:

John Mallyon  
James Irrigation District  
8749 9<sup>th</sup> Street  
P.O. Box 757  
San Joaquin, CA 93660

The Initial Study and proposed Mitigated Negative Declaration are available for public review at the above address during normal working hours, 8:00 a.m. to 5:00 p.m. The public review period begins on 4/04/14 and ends on 5/05/14. **All written comments must be received by 5:00 p.m. on 5/05/14.**

A public hearing on the proposed Negative Declaration will be held during the JID Board Meeting scheduled for **Tuesday, 6/10/2014 at 12:00 p.m.** at the District's Office located at 8749 9<sup>th</sup> Street, San Joaquin, CA 93660. After consideration of all comments, the JID Board of Directors will either certify or reject the proposed Mitigated Negative Declaration.

E201410000086

## Notice of Determination

**To:** Fresno County Clerk  
2221 Kern St  
Fresno, CA 93721

**From:** James Irrigation District  
8794 9<sup>th</sup> Street  
P.O. Box 757  
San Joaquin, CA 93660

**Subject:** Filing of Notice of Determination in Compliance with Section 21108 of the Public Resources Code

**Project Title:** Use of Copper & Acrolein to Control Aquatic Vegetation in Canals, Laterals, and Basins

**Contact:** John Mallyon, phone: (559) 693-4653

A copy of the Mitigated Negative Declaration adopted for this project and related documents are available for public examination at the District office at the above address and telephone number.

**Location:** Within Fresno, County

**Description:** Aquatic herbicides containing acrolein and/or copper will be used to control aquatic vegetation in its canals, laterals, and basins. Control of this vegetation is necessary in order to efficiently convey water. James Irrigation District has prepared the Initial Study/Mitigated Negative Declaration to meet requirements of 1) The State Implementation Policy (SIP) Section 5.3 and 2) NPDES Permit #CAG990005 (#2013-0002-DWQ).

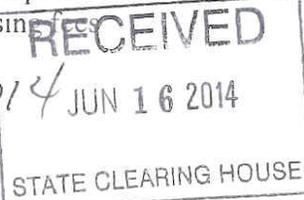
**Determination:** This notice is to advise that James Irrigation District approved the above-described project on June 10, 2014 and has made the following determinations:

1. The project  will  will not have a significant effect on the environment.
2.  An Environmental Impact Report was prepared for this project pursuant to the provisions of CEQA.  
 A Mitigated Negative Declaration was prepared for this project pursuant to the provisions of CEQA.
3. Mitigation measures  were,  were not, made a condition of the approval of this project.
4. A statement of Overriding Considerations  was,  was not, adopted for this project.
5. California State Department of Fish & Wildlife fees (AB 3158)
  - a)  The project has been found to be de minimis thus not subject to the provisions of AB 3158
  - b)  The project is not de minimis and is, therefore, subject to the following fees:
    - \$2,181.25 for review of a Negative Declaration
    - \$2,995.25 for review of an Environmental Impact Report
    - \$50.00 for County Fish and Game program processing

  
John Mallyon, General Manager

Date

6-10-2014 JUN 16 2014



## RESOLUTION 2014-02

Resolution  
of the  
Board of Directors  
**JAMES IRRIGATION DISTRICT**

**ADOPTING A CEQA MITIGATED NEGATIVE DECLARATION  
FOR THE USE OF COPPER AND ACROLEIN  
TO CONTROL AQUATIC VEGETATION IN CANALS, LATERALS AND BASINS**

At a meeting of the Board of Directors of the JAMES IRRIGATION DISTRICT ("DISTRICT"), a public Irrigation District duly organized and existing under the Irrigation District Law (California Water Code, Division 11, Section 20,500 *et seq.*) of the State of California, held on the 10<sup>th</sup> day of June, 2014, the following resolution was adopted:

**WHEREAS**, JAMES IRRIGATION DISTRICT (herein referred to as "DISTRICT") proposes to apply copper and/or acrolein to its conveyances under its jurisdiction in order to control a variety of aquatic weeds and algae for purposes of maintaining adequate water conveyance capacity (the "Project");

**WHEREAS**, pursuant to the California Environmental Quality Act (CEQA) guidelines, the DISTRICT has prepared a CEQA Initial Study and Mitigated Negative Declaration for the Project dated April 3, 2014;

**WHEREAS**, the DISTRICT's Initial Study concluded that with the implementation of mitigation measures described in the Initial Study, the Project will not have a significant effect on the environment;

**WHEREAS**, the DISTRICT therefore has proposed to adopt a CEQA Mitigated Negative Declaration for the Project;

**WHEREAS**, pursuant to CEQA guidelines, the DISTRICT has circulated for public review and comment a Notice of Intent to Adopt the Mitigated Negative Declaration and the Initial Study;

**WHEREAS**, the DISTRICT has received and responded to public comments concerning the Mitigated Negative Declaration and the Initial Study;

**WHEREAS**, the DISTRICT's General Manager has recommended that the DISTRICT Board of Directors adopt the Mitigated Negative Declaration and authorize the filing of a CEQA Notice of Determination.

NOW, THEREFORE, BE IT RESOLVED by the Board of Directors of the JAMES IRRIGATION DISTRICT as follows:

1. **Mitigated Negative Declaration.** The DISTRICT hereby adopts this Mitigated Negative Declaration for the Project pursuant to CEQA.
2. **Findings.** The Board has reviewed the proposed Project, Initial Study, Mitigated Negative Declaration, public comments received, and other information provided by DISTRICT and Blankinship & Associates, Inc., staff. On the basis of this information and the whole record before the DISTRICT, the Board hereby finds and determines as follows:
  - a. The Initial Study and Mitigated Negative Declaration reflect the DISTRICT's independent judgment and analysis;
  - b. Although the Project could have significant effect on the environment without mitigation, there will not be a significant effect because the DISTRICT has put appropriate mitigation measures in place; and
  - c. There is no substantial evidence, in light of the whole record in front of the DISTRICT, that the Project may have a significant effect on the environment.
3. **Location and Custodian of Documents.** The Mitigated Negative Declaration, the Initial Study, Notice of Intent to Adopt the Initial Study are on file and available for public review at the DISTRICT office located at 8749 9<sup>th</sup> Street, San Joaquin, California. The DISTRICT's General Manager at this address is the custodian of these documents that constitute the record of proceedings upon which the decision in this matter is based.
4. **Project Approval.** The DISTRICT Board hereby approves the Project and authorizes the DISTRICT General Manager to proceed with Project implementation in accordance with DISTRICT policies and requirements.
5. **Notice of Determination.** The DISTRICT Board hereby authorizes and directs the DISTRICT's General Manager to prepare, sign and file a CEQA Notice of Determination with the Fresno County Clerk and the State clearinghouse within five (5) days from the date of this Mitigated Negative Declaration, and to pay the California Department of Fish and Game fee for review of the Mitigated Negative Declaration in accordance with Fish and Game Code Section 711.4.

The foregoing Resolution was introduced and adopted at a Regular Meeting of the Board of Directors of the JAMES IRRIGATION DISTRICT conducted June 10<sup>th</sup>, 2014, on motion of Director Riley Chaney, and seconded by Director Thomas Chaney, was hereby authorized by the following vote, to wit:

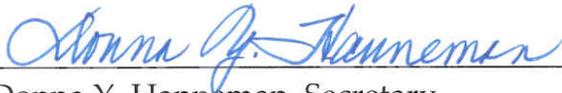
AYES:	3	(R.Chaney, T.Chaney, R.Motte)
NOES:	0	
ABSTAIN:	0	
EXCUSED:	1	(M.Carvalho)
ABSENT:	1	(M.Combs)



---

Robert Motte, Vice-President  
BOARD OF DIRECTORS  
JAMES IRRIGATION DISTRICT

ATTEST:



---

Donna Y. Hanneman, Secretary  
BOARD OF DIRECTORS  
JAMES IRRIGATION DISTRICT

---

**CERTIFICATION OF SECRETARY**

---

The undersigned certifies that she is the Secretary of JAMES IRRIGATION DISTRICT and that the foregoing Resolution was adopted by the Board of Directors of said District at a meeting thereof, duly and regularly held on June 10<sup>th</sup>, 2014, at which meeting a quorum of the Board of Directors was at all times present and acting.

IN WITNESS WHEREOF, I have set my hand and seal of the Board of Directors this 10<sup>th</sup> day of June, 2014.

{ SEAL }



\_\_\_\_\_  
Donna Y. Hanneman, Secretary

BOARD OF DIRECTORS

JAMES IRRIGATION DISTRICT



Edmund G. Brown Jr.  
Governor

STATE OF CALIFORNIA  
Governor's Office of Planning and Research  
State Clearinghouse and Planning Unit



Ken Alex  
Director

May 6, 2014

John Mallyon  
James Irrigation District  
8749 9th Street  
PO Box 757  
San Joaquin, CA 93660

Subject: Use of Copper and Acrolein to Control Aquatic Vegetation in Canals, Laterals, and Basins  
SCH#: 2014041028

Dear John Mallyon:

The State Clearinghouse submitted the above named Mitigated Negative Declaration to selected state agencies for review. The review period closed on May 5, 2014, and no state agencies submitted comments by that date. This letter acknowledges that you have complied with the State Clearinghouse review requirements for draft environmental documents, pursuant to the California Environmental Quality Act.

Please call the State Clearinghouse at (916) 445-0613 if you have any questions regarding the environmental review process. If you have a question about the above-named project, please refer to the ten-digit State Clearinghouse number when contacting this office.

Sincerely,

Scott Morgan  
Director, State Clearinghouse

RECEIVED  
MAY 9 2014  
JAMES IRR DIST

**Document Details Report  
State Clearinghouse Data Base**

**SCH#** 2014041028  
**Project Title** Use of Copper and Acrolein to Control Aquatic Vegetation in Canals, Laterals, and Basins  
**Lead Agency** James Irrigation District

---

**Type** MND Mitigated Negative Declaration

**Description** The use of acrolein and/or copper to treat algae and aquatic weeds in water conveyances, including irrigation canals and ditches. James Irrigation District is preparing this Initial Study/MND to meet requirements of 1) The State Implementation Plan (SIP) Section 5.3 and 2) NPDES Permit #CAG990005.

---

**Lead Agency Contact**

**Name** John Mallyon  
**Agency** James Irrigation District  
**Phone** 559 693 4653 **Fax**  
**email**  
**Address** 8749 9th Street  
PO Box 757  
**City** San Joaquin **State** CA **Zip** 93660

---

**Project Location**

**County** Fresno  
**City** San Joaquin  
**Region**  
**Lat / Long** 36° 36' 28.53" N / 120° 11' 24.61" W  
**Cross Streets** Various  
**Parcel No.** Various  
**Township** 13S **Range** 19-21E **Section** Varies **Base** MDB&M

---

**Proximity to:**

**Highways** Hwy 180  
**Airports** San Joaquin  
**Railways** SPRR  
**Waterways** Kings and San Joaquin Rivers  
**Schools** San Joaquin ES  
**Land Use** Urban and Agriculture

---

**Project Issues** Aesthetic/Visual; Agricultural Land; Air Quality; Archaeologic-Historic; Biological Resources; Geologic/Seismic; Minerals; Noise; Population/Housing Balance; Public Services; Recreation/Parks; Schools/Universities; Toxic/Hazardous; Traffic/Circulation; Vegetation; Water Quality; Water Supply; Wetland/Riparian

---

**Reviewing Agencies** Resources Agency; Department of Fish and Wildlife, Region 4; Department of Parks and Recreation; Central Valley Flood Protection Board; Department of Water Resources; Caltrans, Division of Aeronautics; California Highway Patrol; Caltrans, District 6; Air Resources Board; State Water Resources Control Board, Division of Financial Assistance; Regional Water Quality Control Bd., Region 5 (Fresno); Department of Toxic Substances Control; Native American Heritage Commission; Public Utilities Commission

---

**Date Received** 04/04/2014 **Start of Review** 04/04/2014 **End of Review** 05/05/2014

STATE OF CALIFORNIA - THE RESOURCES AGENCY  
DEPARTMENT OF FISH AND GAME  
**ENVIRONMENTAL FILING FEE CASH RECEIPT**

**Receipt # E201410000152**

Lead Agency: JAMES IRRIGATION DISTRICT Date: 06/13/2014

County Agency of Filing: FRESNO COUNTY CLERK Document No: E201410000152

Project Title: USE OF COPPER & ACROLEIN TO CONTROL AQUATIC VEGETATION IN CANALS, LATE

Project Applicant Name: JAMES IRRIGATION DISTRICT Phone Number: (559) 693-4653

Project Applicant Address: 8794 9TH STREET, PO BOX 757, SAN JOAQUIN, CA 93660

Project Applicant: PRIVATE ENTITY

<b>ADMINISTRATION FEE</b>	\$	50.00
<b>NOTICE OF DETERMINATION</b>	\$	2181.25
<b>Total Received</b>	\$	<b>2231.25</b>

Signature and title of person receiving payment: \_\_\_\_\_

*A. Sanders*