San Francisco Estuary Institute Aquatic Pesticide Monitoring Program Phase 2 (2003) Final Conclusions for Weed Control Aquatic Pesticides

Use of the limited data gathered during the two pesticide application seasons that the APMP has existed should be limited to screening purposes only to identify where further risk characterization or research may be needed. APMP is not yet of sufficient spatial or temporal extent to directly inform regulatory change. Due to the limited time and budget of the project, no definitive conclusions can be drawn from the data accumulated to date. APMP generated chemical characterization, toxicity, and bioassessment data. The chemical characterization and toxicity data can be used for screening purposes. In complex field situations, bioassessments require multiple years of data before even preliminary conclusions can be drawn from them.

2,4-D
Only one application of 2,4-D (in the 2,4-D dimethylamine salt formulation) with added surfactant was monitored. At this single application, no toxicity was observed nor did risk quotients indicate the need for further information. Vitellogenin induction experiments indicate that 2,4-D may possibly cause endocrine disruptor at application rates in the laboratory.

The vitellogenin induction finding indicates the need for further study particularly under normal field conditions. This is a special study and not a routine monitoring recommendation.

Acrolein
Because of acrolein's rapid volatilization, work focused on development of a field sampling method that would allow for accurate determination of the pesticide in water. Current standard environmental sampling methods are inadequate for sampling of acrolein treated water. Due to acrolein's rapid volatilization, it is currently not possible to conduct standard water toxicity tests on it. Because of its' extremely low Lowest Observable Effect Concentration (LOEC) values, the detectable presence of acrolein indicates that very high mortality to EPA water and sediment toxicity test species can be assumed. APMP could find no toxicological data on acrolein's principle breakdown product 3-hydroxypropanal.

Further refinement of the sampling methodology begun in 2003 is warranted as is investigation of 3-hydroxypropanal. It is recognized that residue values for this pesticide may be difficult to determine. Therefore, development of diagnostic response tests (i.e. phytomonitoring, sentinel bivalves and fish, etc.) should be explored.

Copper Sulfate
Copper sulfate applications were monitored in two reservoirs. In one reservoir treatment area treated with dissolved copper sulfate, toxicity (in the form of mortality) was observed for at least 24 hours after application in juvenile trout. Lethal (mortality) and sublethal (reproduction) toxicity was observed in Ceriodaphnia (water flea) up to one week after application. Peak concentration risk quotients showed acute and chronic U.S. EPA Office Pesticide Programs Levels-of-Concern (LOC) exceedances. At 24 hours post application the risk quotients showed acute and chronic LOC exceedances. At one week post application the risk quotients showed acute LOC exceedances.

In the reservoir treated with granular copper sulfate applications, significant mortality was observed in Ceriodaphnia and juvenile trout water toxicity tests immediately after application within the treatment area. Follow up water sampling was not conducted and the reservoir received only one application in 2003. Mortality and growth inhibition was also observed in a number of the sediment samples. Sediment copper concentrations exceeded National Oceanographic and Atmospheric Administration (NOAA) Effect Ratio Low and Medium values. However, the limited toxicity observed in the sediments indicates that the majority of the copper is not bioavailable.

These findings indicate the need for further risk characterization associated with copper sulfate applications.

Chelated Copper
Chelated copper pesticides were monitored during applications in two irrigation canal systems. One system used a product of mixed copper ethanolamines and the other the same product of mixed copper ethanolamines in an emulsified formulation. Chelated copper formulations are likely to have distinct behavior from copper sulfate and each other in aquatic environments based on the chelating agent and other adjuvants.

In both systems where monitoring occurred, the water samples were almost uniformly toxic preapplication and post application. Therefore, no definitive conclusions can be drawn about the toxicity of mixed copper ethanolamines. Risk quotients showed some LOC exceedances depending on species sensitivity. It should be noted that copper carbonate is the active ingredient in other chelated copper products and no monitoring of copper carbonate based pesticides was conducted.

Based on the lack of definitive data, further risk characterization associated with chelated copper applications is warranted.

Glyphosate
Glyphosate was monitored at several locations. No toxicity was found to be associated with glyphosate applications. Risk quotients for *Selenastrum* indicate that immediately after application, when glyphosate concentrations are highest, Levels of Concern are exceeded. Glyphosate is often applied with a surfactant which may have much higher toxicity than the active ingredient.

Based on risk quotient calculations and toxicity data, no further risk characterization associated with glyphosate applications alone is warranted. Risk characterizations may be warranted to further investigate a surfactant used in conjunction with the glyphosate.

Diquat Dibromide
Diquat dibromide was sampled at two locations (one small pond and one Delta slough). At both sites, 100% mortality was observed in the acute and chronic Ceriodaphnia toxicity tests one hour after application. Twenty-four hours after application to the Delta slough, no toxicity was observed in the treatment area. Additional samples were not gathered from the pond site. Risk quotients almost uniformly exceeded Levels of Concern at all sampling periods in the Delta slough (including preapplication) and at one hour after application in the pond. Diquat may be applied with a surfactant which may have much higher toxicity than the active ingredient. Diquat sediment concentrations were not considered as diquat is irreversibly adsorbed to sediments and thereafter not bioavailable.

Toxicity test and risk quotient results indicate the need for further risk characterization.

Fluridone
Fluridone (applied in pellet or liquid form) was not found to be definitively toxic in USEPA three species water or sediment amphipod toxicity tests. The peak concentration risk quotient for Stonewort did exceed an Acute LOC. Risk quotients for other species did not exceed LOCs. Fluridone was found to cause sublethal toxicity (decreased shoot and root length) to Typha. This would indicate a potential for impacts on nontarget plants.

Further risk characterization of impacts on nontarget plants is warranted. There is also cause for concern over development of genetic resistance to fluridone which is emerging in plant populations in Florida.

Triclopyr
Triclopyr (in the triclopyr, triethylamine salt formulation) was monitored at one application only. Due to sampling error, the toxicity tests were rendered inconclusive and therefore no conclusions can be drawn as to the toxicity of triclopyr. Triclopyr peak concentration risk quotients show no LOC exceedances. Triclopyr is often applied with a surfactant which may have much higher toxicity than the active ingredient.

Limited further risk characterization is warranted to conduct toxicity testing. Risk characterizations may be warranted to further investigate a surfactant used with triclopyr.

Nonionic surfactants
The most commonly used surfactants at APMP monitoring sites were Target Prospreader Activator and R-11. Both are nonylphenolethoxylate surfactants. Peak concentration risk quotients indicate exceedances of LOCs for a wide range of animal species including Delta Smelt and Sacramento Splittail. Vitellogenin induction experiments in Rainbow trout indicate that these nonylphenol surfactants can be an endocrine disruptor at application rates. There are a wide range of surfactants available, each one having a different toxicological profile. There is only limited data available on surfactants.

Based on risk quotient calculations, endocrine disruption studies, and the general lack of data on them, further risk characterization of surfactant applications is warranted.