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Toxicity Report for the Sacramento River Watershed Program's Proposition 50 Monitoring

(Samples collected April 2006 – August 2007)

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Aquatic Toxicity of SRWP Ambient Waters

The results of the SRWP toxicity tests that were performed under the Proposition 50 funding are summarized in Table PER1, and are presented graphically in Figures PER1a, PER1b, and PER1c; the test results for each site and each event are summarized in Appendix PER1.

Selenastrum capricornutum

The test data indicated that ambient water toxicity to algae was infrequent - less than 2% of the samples tested exhibited a reduction in algal growth. Almost all of the ambient water samples exhibited biostimulation relative to the Lab Water (reverse-osmosis, de-ionized water spiked with nutrients, as per EPA test guidelines) that was used as the Control treatment for these tests. The observation of algal biostimulation is not surprising as ambient waters often exhibit biostimulation relative to Lab Water control treatments due to the background presence of a wider variety of nutrients at higher concentrations than occur in the Lab Water matrix.

While there was no consistent spatial or temporal trend in the algal growth response in these waters, there was the suggestion of a spatial pattern in **Event 54**, in which the 4 northernmost stations exhibited algal growth that was markedly less than was exhibited in the downstream waters, including 2 of the few waters that were toxic (there was toxicity at the Churn Creek at Knighton Road site, as well as the immediately downstream Sacramento River at Bend Bridge site).

Ceriodaphnia dubia

The frequency and magnitude of toxicity to *Ceriodaphnia dubia* was markedly greater than was observed for algae – approximately 10% of the samples exhibited significant reductions in *Ceriodaphnia* survival, with an additional 13% of the samples exhibiting a significant reduction in reproduction. Furthermore, 19 of the 20 samples that exhibited a significant reduction in survival resulted in ≤50% survival, with most of those causing complete mortality of the test organisms. In contrast, only 3 of the additional 28 samples that exhibited a reduction in reproduction resulted in ≤50% reduction in the number of offspring produced.

While there was no consistent spatial trend in the *Ceriodaphnia* responses in these waters, there was the suggestion of a spatial pattern in **Event 64**, in which there was complete mortality in the water from Feather River near Nicolaus, as well as the water from the immediately downstream Sacramento River at Veteran's Bridge site. There were no discernible trends in toxicity for different types of water body (tributary vs main stem vs urban drainage dominated vs ag drainage dominated). While not dramatic, there did seem to be a temporal trend for toxicity, with 31 of the 48 (65%) toxic samples being collected during the 5 rainy months (December through April), and only 17 toxic samples being collected in the remaining 13 months of the study period. This is not unexpected, as numerous studies have indicated that stormwater runoff can be a significant source of toxicity to receiving water ecosystems. Of particular note was **Event 58** (Dec 11-13, 2007) during which samples were collected just as a major storm system was raining

throughout the watershed (see Figures PER1a and 1b). Of the 12 water samples collected, 11 caused complete mortality of the test organisms in the initial tests.

Fathead Minnows

The frequency and magnitude of toxicity to fathead minnows was also markedly greater than was observed for algae although less than was observed for *Ceriodaphnia* – approximately 7% of the samples exhibited significant reductions in larval fish survival, with an additional 9% of the samples exhibiting a significant reduction in growth. Furthermore, 6 of the 14 samples that exhibited a significant reduction in survival resulted in ≤50% survival, with only one of those causing complete mortality of the test organisms. In contrast, none of the additional 22 samples that exhibited a significant reduction in growth resulted in a ≤50% reduction in that test response.

While there was no consistent spatial trend in the fathead minnow responses in these waters, there was the suggestion of a spatial pattern in **Event 58**, in which there were significant reductions in survival in the waters from the three northernmost contiguous main stem river sites (from Keswick Reservoir down to Hamilton City). There were no discernible trends in toxicity for different types of water body (tributary vs main stem vs urban drainage dominated vs ag drainage dominated). As with the *Ceriodaphnia*, there did seem to be a temporal trend for toxicity, with 16 of the 36 (44%) toxic samples being collected during the 5 rainy months (December through April) causing toxicity, with only 20 toxic samples being collected in the remaining 13 months of the study period.

Table PER1. Summary of SRWP ambient water toxicity tests (excluding all follow-up testing)

	Percentage of Samples that were Toxic			*Ceriodaphnia dubia*		Fathead Minnows	
Site	*Selenastrum capricornutum*	*Ceriodaphnia dubia*	Fathead Minnows	Percentage of Samples w/ <50% Reduction in Survival	Percentage of Samples w/ <50% Reduction in Survival or Reproduction	Percentage of Samples w/ <50% Reduction in Survival	Percentage of Samples w/ <50% Reduction in Survival or Growth
SRBKR	0	33.3	23.5	11.1	16.7	11.8	11.8
CHKNT	5.6	27.8	17.6	5.6	5.6	0	0
SRABB	5.6	27.8	47	5.6	5.6	11.8	11.8
SRHAM	0	27.8	11.8	5.6	5.6	5.9	5.9
SRCOL	11.1	27.8	23.5	5.6	5.6	0	0
COLDR	0	22.2	5.6	5.6	5.6	0	0
YRMRY	0	29.4	5.9	5.9	11.8	0	0
FRNIC	0	27.8	11.1	11.1	11.1	0	0
SACSL	0	33.3	11.1	11.1	16.7	0	0
SRVET	0	22.2	11.1	11.1	11.1	0	0
ARDPK	0	11.1	27.8	5.6	5.6	0	0
SRFPT	0	22.2	16.7	22.2	22.2	5.6	5.6

SRBKR	Sacramento River below Keswick Reservoir
CHKNT	Churn Creek at Knighton Road
SRABB	Sacramento River above Bend Bridge
SRHAM	Sacramento River near Hamilton
SRCOL	Sacramento River at Colusa
COLDR	Colusa Basin Drain above Knights Landing
YRMRY	Yuba River at Marysville
FRNIC	Feather River near Nicolaus
SACSL	Sacramento Slough
SRVET	Sacramento River at Veterans Bridge
ARDPK	American River at Discovery Park
SRFPT	Sacramento River at Freeport

Persistence of Ambient Water Toxicity in the Watershed

As per the Monitoring Plan, anytime that a toxicity test exhibited >50% reduction in organism response within the first 48 hrs of testing, a new sample would be collected from that site (and potentially from hydrologically-related sites) and tested to evaluate whether or not the toxicity was persistent in the water from that site. The results of the "site toxicity persistence" testing performed during this study are summarized in Table PER2.

In **Event 53**, water collected from Sacramento River at Freeport was significantly toxic to *Ceriodaphnia* survival, and the toxicity of water at that site appeared to persist during the re-sampling period. Interestingly, the **Event 54** water sample collected from this site was also toxic, suggesting that the site may have been toxic during the intervening period. However, by August 30, the toxicity at that site had diminished.

In **Event 54**, water collected from Sacramento Slough was significantly toxic to *Ceriodaphnia* survival; however, by August 30, water at this site was no longer toxic (there was no toxicity at the upstream Reclamation Slough site as well).

As mentioned previously, the **Event 58** samples were collected at the same time as a major storm was raining throughout the watershed, and many of the initial water samples caused complete mortality of the *Ceriodaphnia*; however, when re-sampled only 1 week later, only the Feather River at Nicolaus site water was still toxic.

In **Event 62**, water samples collected from Yuba River at Marysville and from Sacramento River at Freeport were significantly toxic to *Ceriodaphnia* survival; however, when re-sampled only 1 week later, neither site water was still toxic.

In **Event 64**, water samples collected from Feather River near Nicolaus and from Sacramento River at Veteran's Bridge were significantly toxic to *Ceriodaphnia* survival. When re-sampled ~1 week later, the Sacramento River at Veteran's Bridge water was still toxic.

Table PER2. Summary of "Site Toxicity Persistence" Testing		
Event 53	7/25/06 Sample	7/31/06 Sample
SRFPT	**20**	**22**
Event 54	8/23/06 Sample	8/30/06 Sample
RSAER	-	90
SACSL	**25**	100
SRFPT	**25**	70/**40**
Event 58	12/12/06 Sample	12/19/06 Sample
COLDR	**0**	100
ARDPK	**0**	100
FRNIC	**0**	**0**
RECSL	-	100
ECCSL	-	100
SACSL	**0**	100
Event 62	4/25/07 Sample	5/1/07 Sample
YRMRY	**10**	100
SRFPT	**30**	111
Event 64	6/6/07 Sample	6/12/07 Sample
YRMRY	-	100
FRYUB	-	100
FRNIC	**0**	90
SRVET	**0**	**30**
SRRMF	-	100
SRRIO	-	70/**65**

the survival response in this site water was significantly less than the corresponding Control treatment response.

there was no significant reduction in the survival response/however, there was a significant reduction in the reproduction response.

COLDR	Colusa Basin Drain above Knights Landing
YRMRY	Yuba River at Marysville
SACSL	Sacramento Slough
FRNIC	Feather River near Nicolaus
SRVET	Sacramento River at Veterans Bridge
ARDPK	American River at Discovery Park
SRFPT	Sacramento River at Freeport
RSAER	Reclamation Slough at Ensley Road (upstream of SACSL)
RECSL	Reclamation Slough at Karnack (upstream of SACSL)
ECCSL	East Slough above Sacramento Slough (upstream of SACSL)
FRYUB	Feather River above Yuba City (upstream of FRNIC)
SRRMF	Sacramento River at River Mile 44 (downstream of SRVET)
SRRIO	Sacramento River at Rio Vista (downstream of SRVET)
note -	the initial samples were collected over a 3-day period; for convenience, the date identified above is middle date of that 3-day sampling period.

Toxicity Identification Evaluations

Toxicity Identification Evaluations (TIEs) are experimental procedures that are applied to identify the toxicant(s) responsible for the toxicity in a sample. These procedures were developed by the US EPA, and are typically performed as follow-up testing after toxicity has been observed in an initial test. In order for the TIE procedures to successfully identify the toxicant causing toxicity, the compound/element/material causing the toxicity must be stable and not susceptible to rapid degradation. TIE procedures include three steps:

- Phase I (characterizes the physical/chemical properties of the toxicants),
- Phase II (identifies the specific toxicant(s) causing the toxicity), and
- Phase III (confirmation).

The Phase I TIEs work by performing physical and chemical manipulations on the toxic sample that can either remove or recover the toxicity; patterns of toxicity removal or recovery provide clues as to which type of contaminant(s) may be causing the toxicity.

The SRWP established the following framework for the initiation of a TIE:

- TIEs will be conducted on samples in which *Ceriodaphnia* or *Pimephales* survival is less than 50% of the Control at any time during the test, or when *Selenastrum* growth is less than 50% of the Control at the end of the test. TIEs may be conducted as acute or chronic tests, depending on the level of toxic response.
- TIEs will be initiated within 24 hours of observing the threshold response (>50% effect compared to Control).
- If the 50% effect threshold is observed within 48 hours of test initiation, additional samples will be collected from the same location and retested with the affected species, these follow-up samples may include samples collected at additional sites if these may assist in the determination of causes or sources of toxicity.
- If 100% mortality to a test species is observed at any time during the initial screening toxicity test, then a multiple dilution test using a minimum of five sample dilutions will be conducted with the same water sample to determine the magnitude of toxicity.

At two sites (Sacramento Slough and Colusa Basin Drain), the toxicity follow-up was conducted in coordination with SVWQC monitoring and generally adhered to the SVWQC strategy for conducting additional testing and TIEs for "acutely" toxic samples, within the constraints of the SRWP monitoring budget. The specific follow-up triggers and procedures for the SVWQC include the following:

- If 100% mortality is observed within 96 hrs of test initiation, then a follow-up test of site water dilutions will be conducted to determine the magnitude of toxicity.
- If *Ceriodaphnia* or *Pimephales* survival, or *Selenastrum* growth from any of the three aquatic toxicity tests are <50% of the Control after 96 hrs of the chronic toxicity tests, acute TIE procedures will be initiated (using the most sensitive species) to investigate the

cause of toxicity. At a minimum, an acute Phase 1 TIE will be conducted to determine the general class of constituent (i.e., metal, non-polar organics) responsible for acute toxicity.

- The decision to initiate an acute TIE will be made with consultation between the monitoring manager, the project manager for the laboratory responsible for performing toxicity testing, the SVWQC project manager, and any staff or consultants specifically identified by SVWQC as responsible for this decision.

TIEs were performed on 27 samples collected between April 2006 and August 2007: one for *Selenastrum*, 20 for *Ceriodaphnia*, and 6 for fathead minnows. The results of these TIEs are summarized in Tables PER3, PER4, and PER5, respectively.

Selenastrum capricornutum

The Event 60 Sacramento River at Colusa (SRCOL) water sample was not toxic during the TIE testing, indicating that the toxicity was not persistent, the magnitude of toxicity had decreased, and the contaminant that caused the toxicity was susceptible to rapid degradation. Metals and herbicides are two classes of contaminants that are of concern when algal toxicity is observed. As metals are typically conserved (i.e., toxicity from metals should not be expected to degrade over time), it is unlikely that metals could have caused the toxicity. There were no pesticides detected in the SRCOL sample, which was extracted for analyses by the analytical lab 1.6 days after sample collection.

Table PER3. Summary of *Selenastrum capricornutum* TIEs.

Site	Was Baseline Toxic?	Was Toxicity Magnitude Decreased?	Was Toxicity Delayed?	Was Toxicity Removed by the TIE Treatment?	
				C8 SPE	Chelex
Event 60					
Sacramento River at Colusa	No	***Yes***	-	-	-

Ceriodaphnia dubia

Of 20 TIEs performed with *Ceriodaphnia*, toxicity was not persistent for 9 samples. Of the 11 samples with persistent toxicity, toxicity was delayed (i.e., took longer to manifest/occur than in the original test) for 10 samples and the magnitude of toxicity was decreased for all 11 samples. These observations are consistent with contaminants that are degrading over time.

Of 11 samples with persistent toxicity, the following patterns occurred:

- particulate-associated contaminants and metabolically-activated substances, or a substance with both properties, caused the toxicity for 3 samples;
- dissolved non-polar organic contaminants and metabolically-activated substances, or a substance with both properties, caused the toxicity for 6 samples;
- dissolved non-polar organic contaminants caused the toxicity for 1 sample; and
- dissolved non-polar organic contaminants, divalent cations, and metabolically-activated substances, or a substance with all of these properties, caused the toxicity for 1 sample.

Without the performance of Phase II TIEs, it is impossible to identify the definitive cause of toxicity. However, a combination of Phase I TIE results (with persistent toxicity) and analytical chemistry results can provide possible explanations of the toxicity. The lack of persistent toxicity in many of the samples, coupled with the delayed onset and decreased magnitude of toxicity for many samples, suggests that contaminants that typically produce persistent toxicity profiles (e.g., metals) are not likely to be the cause of the toxicity in most of the samples that were toxic. Since organic contaminants have a history of causing toxicity in the Sacramento River watershed, the organic analytical results for the samples for which TIEs were performed were evaluated to determine if there were any contaminants that could have been responsible for the observed toxicity. The results of this evaluation were:

- Event 53 – As per the monitoring plan, the SRFPT sample was not analyzed for pesticides.;
- Event 54 – As per the monitoring plan, the SRFPT sample was not analyzed for pesticides. No analyte list pesticides were detected in the SACSL sample. The SACSL sample was extracted for organic analyses ~4 days after sample collection;
- Event 58 – As per the monitoring plan, the SRABB, SRFPT, and ARDPK samples were not analyzed for pesticides. No analyte list pesticides were detected in the SRBKR, CHKNT, SRHAM, SRCOL, SRVET, FRNIC, and SACSL samples. Diuron was detected in the COLDR sample, but far below reported effect levels for *Ceriodaphnia*. These samples were extracted for organic analyses between 1 and 3 days of sample collection;
- Event 60 – No analyte list pesticides were detected in the SRBKR sample. This sample was extracted for organic analyses within 1.5 days of sample collection;
- Event 62 – As per the monitoring plan, the SRFPT sample was not analyzed for pesticides. No analyte list pesticides detected in the YRMRY sample, which was extracted for organic analyses within 1.5 days of sample collection; and
- Event 64 – No analyte list pesticides were detected in the SRVET and FRNIC samples, which were extracted within 1 day of sample collection.

Table PER4. Summary of *Ceriodaphnia dubia* TIEs

Site	Was Baseline Toxic?	Was Toxicity Magnitude Decreased?	Was Toxicity Delayed?	Was Toxicity Removed by the TIE Treatment?			
				Cent.	C-8	Chelex	PBO
Event 53							
Sacramento River at Freeport	No	***Yes***	-	-	-	-	-
Event 54							
Sacramento Slough[b]	No	***Yes***	-	-	-	-	-
Sacramento River at Freeport[b]	No	***Yes***	-	-	-	-	-
Event 58							
Sacramento River below Keswick Reservoir	***Yes***	***Yes***	***Yes***	No	***Yes***	No	***Yes***
Sacramento River above Bend Bridge	***Yes***	***Yes***	***Yes***	No	***Yes***	No	***Yes***
Churn Creek at Knighton Road	***Yes***	***Yes***	***Yes***	No	***Yes***	No	No
Sacramento River near Hamilton City	***Yes***	***Yes***	***Yes***	No	***Yes***	No	***Yes***
Sacramento River at Colusa	***Yes***	***Yes***	***Yes***	***Yes***	N/A	N/A	***Yes***
Colusa Basin Drain[b]	***Yes***	***Yes***	No	No	***Yes***		***Yes***
Sacramento River at Veterans Bridge	***Yes***	***Yes***	***Yes***	No	***Yes***	***Yes***	***Yes***
Sacramento River at Freeport	***Yes***	***Yes***	***Yes***	***Yes***	N/A	N/A	***Yes***
Feather River near Nicolaus	***Yes***	***Yes***	***Yes***	No	***Yes***	No	***Yes***
American River at Discovery Park	***Yes***	***Yes***	***Yes***	No	***Yes***	No	***Yes***
Sacramento Slough[b]	No	***Yes***	-	-	-		-
Event 60							
Sacramento River below Keswick Reservoir	***Yes***	***Yes***	***Yes***	***Yes***	N/A	N/A	***Yes***
Event 62							
Yuba River at Marysville	No	***Yes***	-	-	-	-	-
Sacramento River at Freeport	No	***Yes***	-	-	-	-	-
Event 64							
Sacramento River at Veterans Bridge	No	***Yes***	-	-	-	-	-
Feather River near Nicolaus	No	***Yes***	-	-	-	-	-
Sacramento River at Veterans Bridge	No	***Yes***	-	-	-	-	-

N/A – Not applicable due to toxicity removal in centrifugation treatment.

a – An acute TIE was performed. As per SVWQC requirements, the TIEs performed on the COLDR and SACSL samples excluded the Chelex treatment.

Fathead Minnows

Of 6 TIEs performed with fathead minnows, toxicity was persistent for 5 samples and one could not be interpreted due to interferences from 'pathogen-related mortality' in the ambient water samples. The onset of toxicity was delayed (i.e., took longer to occur than in the original test) for 2 samples, and the magnitude of toxicity was decreased for 2 others. These observations are consistent with contaminants that are degrading over time. Of these 5 samples with persistent toxicity, the following patterns occurred:

- dissolved non-polar organic contaminants caused the toxicity for 1 sample;
- dissolved non-polar organic contaminants, divalent cations, and metabolically-activated substances, or a substance with all of these properties, caused the toxicity for 1 sample;
- particulate associated contaminants and/or divalent cations caused the toxicity for 1 sample; and
- none of the TIE treatments removed the toxicity for 2 samples.

An evaluation of the pesticide analyses data was performed to determine if any pesticides were detected in the samples at concentrations that may explain the cause of the toxicity. The results of this evaluation were:

- Event 57 - As per the monitoring plan, the SRABB sample was not analyzed for pesticides;
- Event 58 - As per the monitoring plan, the SRABB and SRFPT samples were not analyzed for pesticides. No analyte list pesticides were detected in the SRBKR and SRHAM samples. The SRBKR and SRHAM samples were extracted for organic analyses ~2.5 days after sample collection; and
- Event 59 - No analyte list pesticides were detected in the SRBKR sample. The SRBKR sample was extracted for organic analyses ~6.5 days after sample collection.

Table PER5. Summary of Fathead Minnow TIEs.

Site	Was Baseline Toxic?	Was Toxicity Magnitude Decreased?	Was Toxicity Delayed?	Was Toxicity Removed by the TIE Treatment?			
				Cent.	C-8	Chelex	PBO
Event 57							
Sacramento River above Bend Bridge[a]	No	***Yes***	-	-	-	-	-
Event 58							
Sacramento River below Keswick Reservoir	***Yes***	***Yes***	*No*	No	***Yes***	No	No
Sacramento River above Bend Bridge	***Yes***	***Yes***	***Yes***	No	***Yes***	***Yes***	***Yes***
Sacramento River near Hamilton City	***Yes***	No	No	No	No	No	No
Sacramento River at Freeport	***Yes***	No	***Yes***	No	No	No	No
Event 59							
Sacramento River below Keswick Reservoir	***Yes***	No	***Yes***	***Yes***	N/A	***Yes***	No

a – Pathogen-related mortality occurred in the TIE ambient water treatments, which interfered with the interpretation of the TIE.

TIE Profiles in Other Ambient Water Studies

There have been numerous previous ambient water toxicity studies performed in the Sacramento River watershed and the San Francisco Estuary that have identified the organophosphorus (OP) pesticides diazinon and chlorpyrifos as significant causes of observed toxicity. The patterns typically observed in the related TIEs are as follows:

- Baseline sample was toxic (i.e., toxicity was persistent);
- C8 or C18 solid phase extraction columns removed the toxicity (suggesting a dissolved non-polar organic caused the toxicity); and
- Piperonyl butoxide removed the toxicity (suggesting that the toxicant responsible for the toxicity is metabolically activated).

Similar TIE patterns have been reported for samples collected from other watersheds (e.g., the Salinas River watershed (Hunt *et al.,* 2003) and in the Calleguas Creek watershed in southern California (Anderson *et al*., 2002).

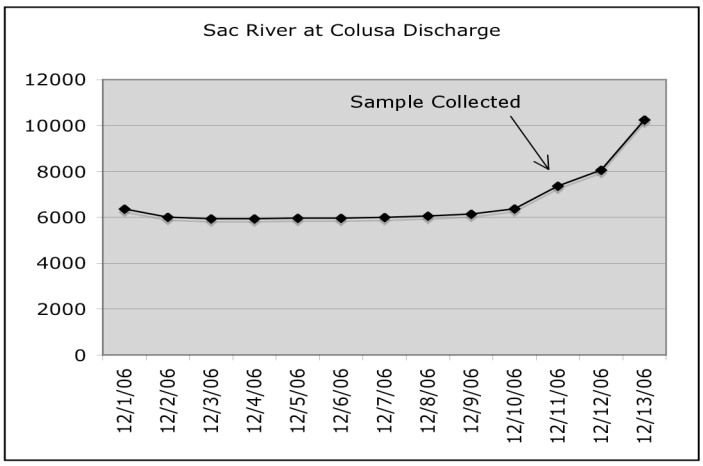
TIE profiles that suggested that the toxicity was due to a particulate-associated toxicant or a metabolically activated substance, or a compound with both properties, were observed for the SRWP monitoring. Similar TIE profiles have been reported in other watersheds, including the Salinas River watershed (Hunt *et al.,* 2003), Santa Maria River watershed (Anderson *et al*., 2006), and the New River in southern California (Phillips *et al.,* 2007).

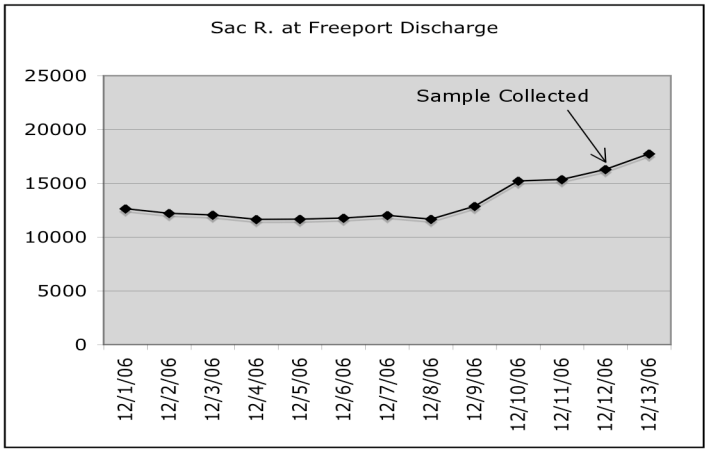
Timing to Onset of Toxicity

Although there are similarities in the TIE profiles with the previous studies and/or the studies being performed in other watersheds, the SRWP 2006-2007 data differs in the regularly observed reduced magnitude of toxicity and delay in the onset of toxicity in toxicity for the TIEs when compared to the initial toxicity test. This is in contrast to historical studies in which toxicity was often linked to chlorpyrifos and diazinon, with persistent toxicity from the time of the initial toxicity test through the TIE process. In the current study period, 26 of the 27 samples that qualified for TIEs exhibited a delay in the onset of toxicity, a decrease in the magnitude of toxicity, or both, relative to the initial toxicity test. This phenomenon seems recent, but is by no means unprecedented, as similar cases of "fugitive toxicity" have been observed by the UC Davis Aquatic Toxicology Laboratory (Linda Deanovic, personal communication), the CVRWQCB's Phase I Irrigated Lands Program (ILP), and more recent ILP testing in the Sacramento and the San Joaquin River watersheds.

Event 58 – Case Study

Event 58 was a fixed-date monitoring event scheduled during early wet season in the watershed. The monitoring event was initiated on Monday, December 11, and was preceded by a storm event that began on Saturday, December 9. The storm deposited upwards of 0.5" of rainfall throughout Sacramento watershed, which in turn resulted in increased flows at the SRWP monitoring sites (see plots for the Sacramento River at Freeport and at Colusa below).



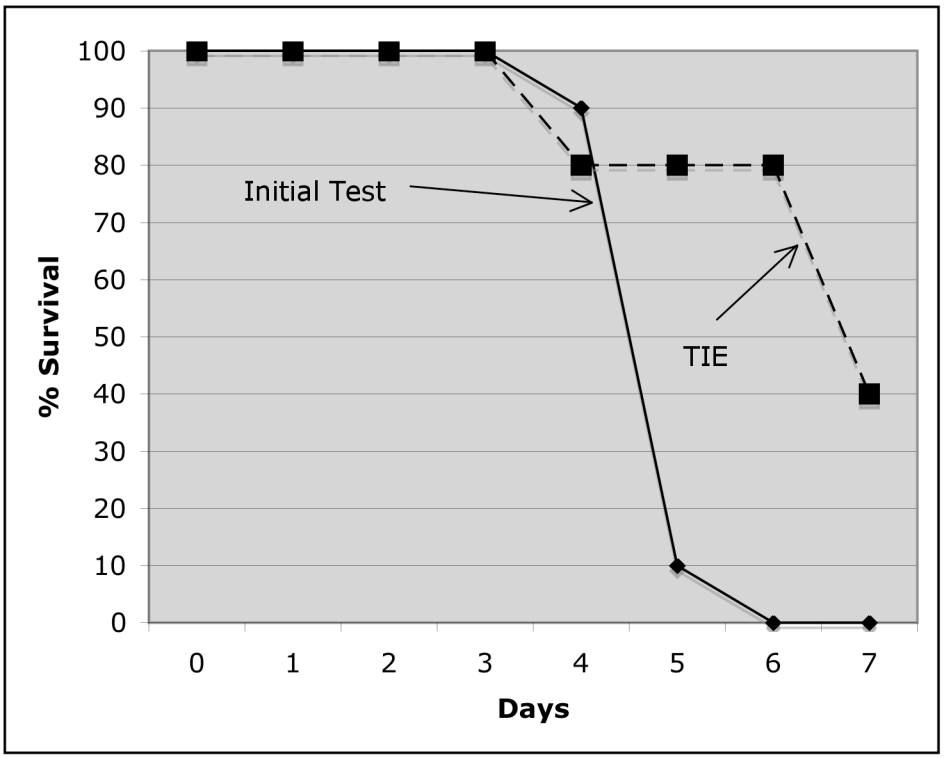


By chance, a "first flush" was captured during this event in a manner that has not occurred during previous SRWP monitoring events. During previous monitoring events targeting a first flush event, the field crews were typically tasked with mobilizing on the first day of rainfall and initiating sampling the following day. During **Event 58**, nearly 2 days had passed before sampling was initiated. As the majority of the SRWP monitoring stations are main-stem river sites or downstream integrator sites for major tributaries, the additional day that passed between the storm runoff and sample collection clearly resulted in increased runoff (see figures above), potentially more so than has occurred during previous monitoring activities.

The SRWP toxicity testing performed with **Event 58** samples collected December 11-13, 2006 resulted in a particularly unique and intriguing set of data compared to historical SRWP data, and provides a case study that warrants review. The initial toxicity testing for the 12 samples collected can be summarized as follows:

- None of the samples were toxic to *Selenastrum*;
- 11 samples were toxic to *Ceriodaphnia* survival and the remaining sample was toxic to *Ceriodaphnia* reproduction; and
- 5 samples were toxic to fathead minnow survival and 2 samples were toxic to fathead minnow growth.

For the majority of the **Event 58** samples, the magnitude of the toxicity was reduced and the time to the onset of the toxicity was delayed. The characteristic profile of delayed toxicity and reduced magnitude of toxicity to *Ceriodaphnia* that was observed is presented below for the Sacramento River at Keswick Reservoir sample.



This pattern suggests that the toxicity that occurred during **Event 58** was caused by contaminant(s) of relatively low stability that are susceptible to rapid degradation. The data from the vast majority of the TIEs suggest that the toxicant is a dissolved organic that is metabolically activated. Historically, this pattern of TIE toxicity removal has been associated with OP pesticides such as chlorpyrifos and diazinon; however these two pesticides are relatively stable through the performance of Phase I TIEs. **Event 58** water samples were analyzed for carbamate,

OP, pyrethroid, triazine, and organochlorine pesticides. With the exception of a low level of diuron in the Colusa Basin Drain sample, all of individual pesticides were reported as non-detect for this event. However, this is not entirely surprising since the toxicity profile of rapidly-degrading toxicity is not consistent with most of the pesticides analyzed in the aforementioned scans.

It should be noted that in evaluating the chemical analyses data that were performed for this program, the list of analytes does not cover the entire suite of chemicals that were applied in the watershed. A summary of the pesticides applied in seven of the SRWP counties during the one month period preceding **Event 58** (November 11 – December 11, 2006; from the CA DPR PUR database) are provided in Appendix PER2, and indicate that >200 different chemicals were applied. The application of such a diverse suite of chemicals provides for the possibility of a very dynamic and complex water chemistry matrix. The number of pesticides applied in this watershed in this one-month period alone illustrates the challenge in trying to evaluate toxicity causation on the basis of pesticide concentration data.

Data/Information Integration and Historical Overview

Sacramento River Watershed

Toxicity that was observed over such a large geographical scale during SRWP **Event 58** is not unprecedented in the Sacramento River watershed. Widespread toxicity was reported in May 1988 (i.e., fathead minnow mortality) and during several monitoring events in 1988 and 1989 (i.e., *Ceriodaphnia* mortality) throughout the Sacramento River watershed (Connor and Foe, 1993). Although the specific cause of the toxicity during the 1980s study varied, the authors hypothesized that much of the toxicity in the upper watershed was likely due to metals and that much of the toxicity in the agricultural drainages monitored may have been due to rice pesticides (i.e., for *Ceriodaphnia*). It is important to note that a clean up at the Iron Mountain Mine has occurred since the Connor and Foe study, resulting in dramatic improvements in metals-related water quality in the Sacramento River.

Toxicity within the Sacramento River watershed has been associated with specific land use activities. Foe and Connor (1991) reported *Ceriodaphnia* toxicity occurred over 19 days (from May to June) in 1989 in the Colusa Basin Drain, and toxicity occurred as far downstream as the Sacramento River at Rio Vista. The toxicity in the Colusa Basin Drain was attributed to carbofuran and methyl parathion (both of which were extensively used in rice cultivation), and malathion. Foe and Connor (1991) concluded that rice runoff water was the source of the toxicity. The rice industry has long since implemented pesticide management practices that have addressed the toxicity that occurred in the early 1990s, a success story of changes in management practices that resulted in changes in toxicity patterns in the watershed. Domagalski (2000) reported that significant reductions in the concentrations of rice pesticides occurred following the implementation of management practices.

Historical Role of Diazinon and Chlorpyrifos as Primary Toxicants

Toxicity to *Ceriodaphnia* from pulses of OP pesticides, such as chlorpyrifos and diazinon, were reported over a 10-year period throughout the Sacramento Valley in waters that receive pesticide runoff from orchards (de Vlaming *et al.,* 2000), as well as in tributaries that receive urban runoff following rainfall. As part of the U.S. Geological Survey's National Water Quality Assessment (NAWQA) Program, Domagalski (2000) reported that diazinon was present in stormwater runoff at a number of sites in 1994, and in non-storm flows during 1996 through 1998. Domagalski *et al.,* (2000) also reported that diazinon concentrations in a Sacramento River watershed urban drainage and agricultural drainages were among the highest in the nation. Larsen *et al.*, (1998) reported that for samples collected from the Sacramento River watershed in 1996-1997, diazinon and chlorpyrifos were responsible for toxicity observed in urban creek samples (i.e., Arcade Creek) and that diazinon from dormant spray applications was responsible for toxicity observed in agricultural drainage waters (i.e., Sacramento Slough). Bailey *et al.,* (2000) reported that diazinon and chlorpyrifos water quality criteria were exceeded regularly for samples collected from streams, sumps, and sloughs in city of Sacramento for samples collected between October 1994 and May 1995, and that TIEs identified one or both of these compounds as causing the toxicity.

In response to the observations of ambient water toxicity, the Central Valley Regional Board placed the Sacramento and Feather Rivers on the Clean Water Act Section 303(d) list due to toxicity caused by diazinon in 1994, and several Sacramento urban creeks on the 303(d) list due to toxicity caused by diazinon and chlorpyrifos in 1998. In 2003, a Basin Plan amendment for the control of diazinon in the Sacramento and feather Rivers was adopted (Karkoski et al. 2003); this was amended in 2007 to include chlorpyrifos (Hann et al. 2007). In addition, and in response to Food Quality Protection Act-required risk assessments, the US EPA banned the majority of non-agricultural uses of chlorpyrifos in 2001, and all non-agricultural sales of diazinon in 2004. Restrictions have also been placed on the use of diazinon and chlorpyrifos for some crops. These actions have been effective: the CVRWQCB has reported (Hann et al. 2007) that that there has been a 67% reduction in the agricultural use of diazinon from 1995-through 2004 (Figure PER4); similar analysis of chlorpyrifos is difficult due to previous analytical limitations and inconsistent analytical approaches.

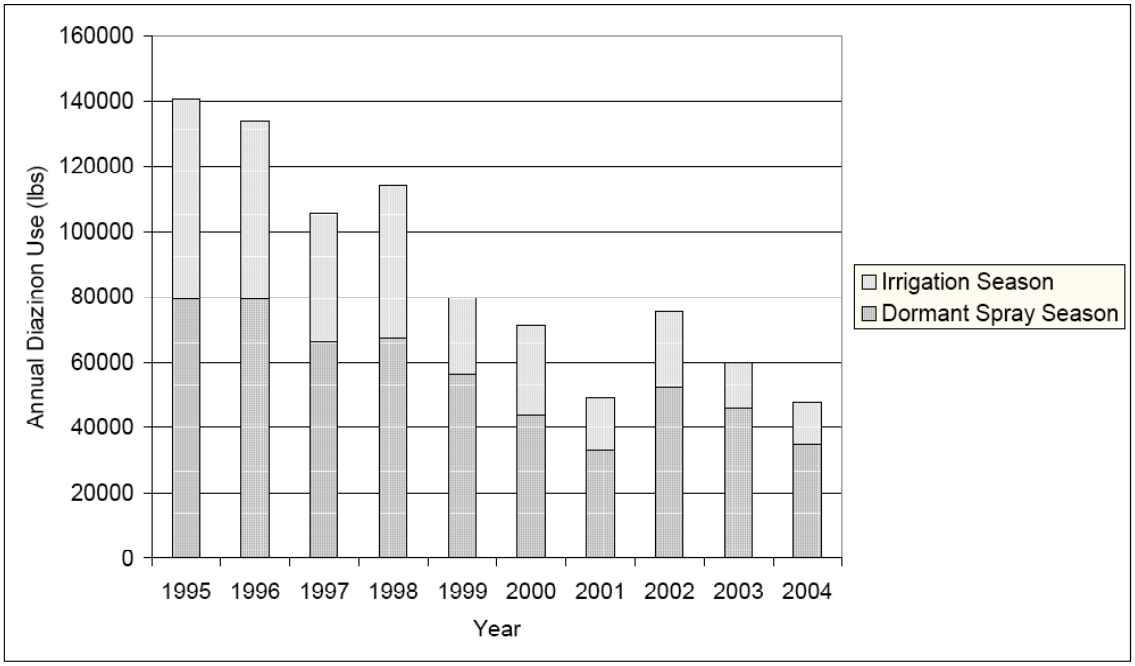


Figure PER4. Annual dormant spray season and irrigation season usage of diazinon in the Sacramento River and Feather River watersheds (from Hann et al. 2007).

As a result of these various regulatory actions, the concentrations of diazinon and chlorpyrifos in the Sacramento River system can be expected to have decreased significantly. Hall (2003) analyzed diazinon monitoring data from the Sacramento and Feather River watersheds, and reported that waterborne diazinon concentrations have decreased from 1994 to 2000, including a significant decrease during rain events. The corresponding reduced role of diazinon and chlorpyrifos (whose toxicity tends to persist through the duration of initial testing and follow-up TIEs) is consistent with the current observations of a more non-persistent toxicity.

As the usage of diazinon and chlorpyrifos has declined, the usage of other pesticides as alternatives has increased; of particular note is the increased use of pyrethroid pesticides (Amweg 2005; Oros and Werner 2005). The shift in pesticide applications from OP pesticides to pyrethroid pesticides has been hypothesized to result in concomitant shifts in the patterns of toxicity observed in monitoring programs. Relative to the OP pesticides, pyrethroid pesticides have a much greater affinity for binding with particulates, which should reduce the concentration of bioavailable pesticides in surface waters. However, scientists and regulators have become concerned that this partitioning of pyrethroids to particulates may be leading to increased sediment toxicity. Weston *et al*., (2004) reported significant toxicity was observed for sediment samples collected from Sacramento Valley agricultural-dominated water bodies and that increased pyrethroid concentration strongly correlated with the mortality. Amweg *et al*., (2005) reported similar findings, and that pyrethroids were primary contributors to toxicity in all but 20% of the samples collected in the Central Valley. Weston *et al*., (2005) reported that 9 of 21 sediment samples exhibited >90% mortality for samples collected from a suburban creek near Roseville, and that the mortality was highly correlated with pyrethroid concentrations. The

increase in the use of pyrethroid pesticides coupled with the reduction of the use of specific OP pesticides (e.g., chlorpyrifos and diazinon) may explain much of the change in the reduced observations of toxicity in water samples from the Sacramento River watershed. However, it is important to note that toxicity is still observed in water samples within this watershed, and that toxicity can be widespread (e.g., SRWP Event 58).

Hypothesis Regarding Source of SRWP Toxicity

One hypothesis for such changes in toxicity patterns is a change in land use activities. This could include a shift in pesticide use to compounds that are efficacious for pest control when sprayed on the plants, but have short half-lives in water so as to have little or no deleterious environmental affect on non-target organisms. There are quite a few examples of changes in pesticide applications that have resulted in quantifiable changes in patterns of toxicity. More often than not, the changes in the patterns of toxicity were observed and alter correlated with the changes in land use.

When the toxicity met the TIE trigger for samples collected from April 2006 – August 2007, there was a fairly consistent pattern of rapidly degrading toxicity. When toxicity was recovered during the TIE, there was often a reduction in the magnitude of the toxicity, as well as a delay in the time to the onset of toxicity. When toxicity was recovered, the TIE profile typically suggested that the toxicant was a dissolved non-polar organic that is metabolically activated. This pattern of degrading toxicity with a loss of magnitude of toxicity suggests that the toxicity was due to compounds that could rapidly degrade (i.e., have a short half-life) during the period of time that lapses between sample collection and the completion of a TIE; Sinclair and Boxall (203) reported that 41% of pesticide degradates were less toxic than their parent compounds.

Compounds that are volatile or readily adsorb to testing materials (e.g., sample container, exposure chambers, etc.) could also be responsible for the toxicity. The TIE pattern would typically exclude metals, and diazinon and chlorpyrifos (i.e., OP pesticides that persist for upwards of 30 days in laboratory storage conditions), both of which were responsible for toxicity historically observed within the Sacramento River watershed. An OP pesticide with a very short half-life would fit this TIE profile, as would any interactive toxicity that included an OP pesticide as one of the participating contaminants. In addition, the TIE profile of a dissolved non-polar organic that is metabolically activated may suggest OP pesticides, there may be many compounds that fit this set of chemical properties. Unfortunately, the California Department of Pesticide Use database for the entire period of this study is not yet available, and will need to be reviewed when this data is available.

QA/QC Data Review

Completeness

Data completeness is a measure of the amount of successfully collected and validated data relative to the amount of data planned to be collected for the project. Completeness is usually expressed as a percentage value. A project objective for percent completeness is typically based on the percentage of the data needed for the program or study to reach valid conclusions. The completeness objective for the SRWP is 90%. The completeness objective was met for all three species tested with over 200 samples (*i.e., Selenastrum* = 92.2%, *Ceriodaphnia* = 96.6%, and fathead minnow = 96.8%) for this study.

PRM method comparison

Test procedures for *Pimephales* were modified as described in Geis *et al*. (2003), to control pathogen-related mortality. These modifications consist of using smaller test containers (30 mL), including only two fish per container, and increasing the number of replicates to ten. The Geis modifications for controlling pathogen-related mortality have been incorporated into the EPA's 4th edition of the chronic testing procedures. The procedure used by SRWP differs from the pathogen control procedures in the *4th Edition* test in that it uses 10 replicates, instead of 20. Data provided in Geis *et al*. (2003) indicate that this modification produces results that are comparable with the unmodified EPA method, with some decrease in test statistical power to identify marginal toxicity. This modification was previously approved for the SRWP for several reasons: (1) The minor increase in statistical power gained by additional replicates did not warrant nearly doubling the test cost; (2) in the history of SRWP monitoring, toxicity to fathead minnows has been observed to be rare, but of significant magnitude when observed; (3) because the SRWP is a non-profit and non-regulatory program focused on baseline and trend assessment, it was considered that the minor deviation in this protocol and slight decrease in test sensitivity was acceptable to control costs. In order to evaluate the performance of the Geis modification under "real world" testing conditions, field replicate samples and an associated lab control were also analyzed using the EPA 4th edition procedure with 20 replicates per test, and compared to the results generated following the Geis *et al*. (2003) method. Two evaluations were used when comparing the two methods:

- was the relative percent difference (RPD) <25%? This benchmark is typically deemed acceptable for the comparison of duplicate samples.
- were there consistent conclusions drawn regarding the presence/absence of toxicity?

Of 18 comparisons of the Lab Control treatments, the RPD was acceptable for all comparisons of the survival endpoint and all but one comparison (RPD = 33.3%) of the fathead minnow growth endpoint; this equates to 100% of the Lab Control comparisons meeting the RPD criteria for the survival endpoint and 94% of the Lab Control comparisons meeting the RPD criteria for the growth.

Of 18 comparisons of the site water treatments, the survival RPD was acceptable for all but two comparisons (RPD = 33.3% and 51.9%) and the growth RPD was acceptable for all but five

comparisons (RPD ranged from = 25.9% and 49.5%); this equates to 89% of the Lab Control comparisons meeting the RPD criteria for the survival endpoint and 72% of the Lab Control comparisons meeting the RPD criteria for the growth. Given the consistency observed for the duplicate comparisons of the Lab Control treatment, it is unclear exactly what is driving the difference between the comparisons of the site water treatments using the two methods.

Of the 18 comparisons between the Lab Control and site water treatments, there were 6 instances of insistent interpretation between the 10 replicate approach and the 20 replicate approach:

- For events 56, 59, 60, and 65, the reduction in fathead minnow growth was significant when using the 10 replicate method, but not when using the 20 replicate method;
- For event 58, the reduction in fathead minnow survival was significant when using the 10 replicate method, but only a significant reduction in fathead minnow growth was observed when using the 20 replicate method;
- For event 66, the reduction in fathead minnow growth was significant using the 20 replicate EPA method, but not using the 10 replicate method.

The general trend in this data is that for 12 comparisons/events, the results were similar. For 3 comparisons/events, the Geis *et al*. (2003) method was more sensitive in terms of fathead minnow growth (i.e., detected growth toxicity when the EPA method did not); for 2 comparisons/events, the opposite was true. For one comparisons/events, the Geis *et al*. (2003) method was more sensitive in terms of fathead minnow survival (i.e., detected survival toxicity when the EPA method did not); in no case was the opposite was true. When the entire data set is considered, the data was fairly consistent, with primarily only minor differences in the finding of growth toxicity.

QC Conclusions & Recommendations

The QC data suggest that the testing performed under this study met programmatic quality assurance requirements, and that the data are acceptable. Although the comparison of the Geis *et al*. (2003) and EPA methods had considerable agreement, it appears prudent to continue to include a single comparison of the methods for all future SRWP monitoring events.

Recommendations

An important component of any monitoring program is to incorporate adaptive management strategies into the monitoring design. The SRWP has, through the Monitoring Committee, adapted the monitoring program to reflect changes in land use activities and pesticide applications since its inception. Clearly, toxicity is still occurring in the Sacramento River watershed, and further monitoring should be performed to determine the cause(s). However, it is critical that the toxicity and analytical monitoring be modified to address an emerging trend for the lack of persistent toxicity that is occurring for the SRWP and other monitoring programs (i.e., ILP monitoring). In addition to continuing to monitor for toxicity to *Selenastrum*, *Ceriodaphnia*, and fathead minnows, the following options should be strongly considered during the development of any future monitoring program:

- Sample collection timing during storm events should be targeted to result in sample collection during a rising hydrograph (i.e., during storm events) whenever possible so as to increase the likelihood that any runoff-related toxicity is captured;
- Require immediate extraction of all pesticide samples at the analytical labs so as to reduce the time available for any sample degradation and to sync up the pesticide analysis timing with that of the initiation of the toxicity testing (i.e., 36 hr holding time limit);
- Investigate additional organic analysis options since the toxicity data suggests that a rapidly degrading compound (or compounds) is causing toxicity. Options include performing library searches on the EPA 625 analysis to not only identify specific pesticides of interest, but to also identify unknown peaks and possible degradation products that may in fact be more toxic than the parent compounds;
- Complete a comprehensive pesticide use study from ~2002 to the present to determine which pesticides, if any, are experiencing increased use and if such pesticides have relatively short half lives. Expand the organic analysis list for the monitoring program to include compounds of interest;
- Immediate treatment of an aliquot of the samples using C8-SPE columns. If toxicity of the sample is observed, then the TIE would include testing and chemical analysis of the C8-SPE column eluate. If the budget permits, we also recommend side-by-side testing of the C8-treated sample with the initial test of the untreated sample; and
- Perform Phase II TIEs on samples that are determined to be toxic.

References

Amweg EL, Weston DP, Ureda NM (2005) Use and toxicity of pyrethroid pesticides in the Central Valley, California. *Environmental Toxicology and Chemistry*, 24:966-972 (erratum in Vol. 24, number 5).

Anderson BS, de Vlaming V, Larsen K, Deanovic, Birosik S, Smith DJ, Hunt JW, Phillips BM, Tjeerdema RS (2006) Evidence of pesticide impacts in the Santa Maria watershed, California, USA. *Environmental Toxicology and Chemistry*. 25(4): 1160-1170.

Anderson BS, Phillips BM, Hunt JW, Worcester K, Adams M, Kapellas N, Tjeerdema RS (2002) Ambient toxicity due to chlorpyrifos and diazinon in a central California coastal watershed. *Environmental Monitoring and Assessment*. 78: 131-151.

Connor V, Foe C (1993) Sacramento River Basin Biotoxicity Survey Results: 1988-1990. Staff Report. California Regional Water Quality Control Board. Central Valley Region. Sacramento, CA.

de Vlaming VV, Connor V, DiGiorgio C, Bailey HC, Deanovic LA, Hinton DE (2000) Application of whole effluent toxicity test procedures to ambient water quality assessment. *Environmental Toxicology and Chemistry*, 19: 953-964.

Domagalski JL (2000) Pesticides in surface water measured at selected sites in the Sacramento River Basin, California, 1996-1998. U.S. Geological Survey Water Resources Investigation Report 00-4203.

Domagalski JL, Knifong DL, Dileanis PD, Brown LR, May JT, Connor V, Alpers CN (2000) Water Quality in the Sacramento River Basin, California, 1994-1998. U.S. Geological Survey.

Foe C, Connor V (1991) Rice Season Toxicity Monitoring Results. Staff Report. California Regional Water Quality Control Board. Central Valley Region. Sacramento, CA.

Hall LH (2003) Analysis of diazinon monitoring data from the Sacramento and Feather River watersheds: 1991-2001. *Environmental Monitoring and Assessment*. 86: 233-253.

Hann P, Davis G, Karkoski J (2007) Basin Plan Amendments to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins for the Control of Diazinon and Chlorpyrifos Runoff Into the Sacramento and Feather Rivers. May 2007 Final Staff Report. Central Valley Regional Water Quality Control Board, Sacramento, CA.

Hunt JW, B.S. Anderson, B.M. Phillips, P.N. Nicely, R.S. Tjeerdema, H.M. Puckett, M. Stephenson, K. Worcester, and V. de Vlaming. 2002. Ambient toxicity due to chlorpyrifos and diazinon in a central California coastal watershed. *Environmental Monitoring and Assessment*. 82: 83-112.

Karkoski J, Davis G, Dyke J, McClure D, Menconi M (2003) Basin Plan Amendments to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins for the Control of Orchard Pesticide Runoff and Diazinon Runoff Into the Sacramento and Feather Rivers. 2007 Final Staff Report. Central Valley Regional Water Quality Control Board, Sacramento, CA.

Kuivila, K.M. and C.G. Foe. 1995. Concentrations, transport, and biological effects of dormant spray pesticides in the San Francisco Estuary, California. *Environmental Toxicology and Chemistry*, 14(7): 1141-1150.

Larsen K, Connor V, Deanovic LA, Hinton DE (1998) Sacramento River Watershed Project Toxicity Monitoring Results: 1996-1997. Davis, CA.

Oros DR, Werner I (2005) Pyrethroid Insecticides: An Analysis of Use Patterns, Distributions, Potential Toxicity and Fate in the Sacramento-San Joaquin Delta and Central Valley. Contribution 415, San Francisco Estuary Institute, Oakland, CA.

Sinclair CJ, Boxall ABA (2003) Assessing the ecotoxicity of pesticide transformation products. *Environmental Science and Technology* 37(20):4617-4625.

Weston DP, You J, Lydy MJ (2004) Distribution and toxicity of sediment-associated pesticides in agricultural-dominated water bodies of California's Central Valley. *Environmental Science and Technology*. 38: 2752-2759.

Weston, D.P., R.W. Holmes, J. You, and M.J. Lydy. 2005. Acute toxicity due to residential use of pyrethroid insecticides. *Environmental Science and Technology*. 39(24): 9778-9784.

Appendix PER1

Summary of Aquatic Toxicity Tests Performed for the Sacramento River Watershed Program During the Period of Proposition 50 Funding

***Selenastrum capicornutum* Growth**

(site water test response normalized to the Control treatment response [i.e., reported as a percentage of Control response])

	Event																	
	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67
Site	4/20/06	5/30/06	7/6/06	7/25/06	8/23/06	9/20/06	10/25/06	11/9/06	12/12/06	2/9/07	3/14/07	3/28/07	4/25/07	5/16/07	6/6/07	6/27/07	7/25/07	8/8/07
SRBKR	383	171	330	282	114	354	157	249	194	188	176	141	155	160	157	166	341	203
CHKNT	438	230	715	641	**51**	485	284	140	297	241	193	156	173	181	195	239	333	241
SRABB	486	188	418	330	**76**	322	191	300	286	207	194	159	179	167	173	175	349	186
SRHAM	506	208	402	354	107	194	154	262	222	200	213	158	171	181	165	223	306	199
SRCOL	414	276	500	**57**	557	189	295	304	267	247	**44**	189	190	181	391	243	331	192
COLDR	447	332	679	618	1143	243	449	335	125	288	117	193	197	178	455	341	242	200
YRMRY	606		354	247	619	216	341	291	129	218	107	151	200	172	383	399	213	174
FRNIC	309	260	549	311	599	277	562	242	92	226	134	143	203	167	294	279	163	149
SACSL	897	372	540	335	916	344	660	293	202	302	158	172	217	170	299	250	161	183
SRVET	338	288	235	533	477	184	568	276	123	259	133	145	197	162	179	237	154	179
ARDPK	306	215	247	449	485	173	272	198	142	173	101	130	184	202	370	261	325	180
SRFPT	332	222	220	452	493	150	289	415	123	243	113	165	194	220	346	228	337	232

The test response for this site water was significantly less than the corresponding Control treatment response.

The test response reported here was for a re-test.

SRBKR Sacramento River below Keswick Reservoir
SRABB Sacramento River above Bend Bridge
CHKNT Churn Creek at Knighton Road
SRHAM Sacramento River near Hamilton
SRCOL Sacramento River at Colusa
COLDR Colusa Basin Drain above Knights Landing
YRMRY Yuba River at Marysville
SACSL Sacramento Slough
FRNIC Feather River near Nicolaus
SRVET Sacramento River at Veterans Bridge
ARDPK American River at Discovery Park
SRFPT Sacramento River at Freeport

***Ceriodaphia dubia* Survival**

(site water test response normalized to the Control treatment response [i.e., reported as a percentage of Control response])

	Event																	
	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67
Site	4/20/06	5/30/06	7/6/06	7/25/06	8/23/06	9/20/06	10/25/06	11/9/06	12/12/06	2/9/07	3/14/07	3/28/07	4/25/07	5/16/07	6/6/07	6/27/07	7/25/07	8/8/07
SRBKR	100	100	100	100	100	100	100	100	**0/11**	90	**33**	100	90	100	100	100	100	100
CHKNT	100	100	100	100	100	100	100	100	**0/40**	90	100	100	100	100	100	100	100	100
SRABB	100	100	90	100	100	100	100	90	**0/50**	100	100	100	100	100	100	89	100	100
SRHAM	100	100	100	100	100	100	100	100	**0/40**	100	100	100	100	100	100	100	100	100
SRCOL	100	80	100	100	100	100	100	100	**0/40**	100	100	100	100	90	100	100	100	100
COLDR	80	100	100	100	100	90	100	100	**0**	100	100	100	100	100	100	100	100	100
YRMRY	90		100	100	100	100	100	100	70	90	100	100	**10**	100	100	100	100	100
FRNIC	100	100	100	100	113	100	100	100	**0**	111	100	100	90	100	**0**	90	90	100
SACSL	100	**60**	90	100	**25**	100	90	90	**0**	111	90	100	80	100	90	89	90	100
SRVET	90	100	89	100	100	100	100	100	**0**	111	100	100	100	100	**0**	100	100	100
ARDPK	100	100	70	100	100	100	100	100	**0**	100	100	100	100	100	100	90	100	90
SRFPT	100	100	80	**20**	**25**	100	100	100	**0**	100	100	100	**30**	100	100	100	100	90

The test response for this site water was significantly less than the corresponding Control treatment response.

The test responses reported here are for the 'initial test/immediate re-test' of the sample.

SRBKR Sacramento River below Keswick Reservoir
SRABB Sacramento River above Bend Bridge
CHKNT Churn Creek at Knighton Road
SRHAM Sacramento River near Hamilton
SRCOL Sacramento River at Colusa
COLDR Colusa Basin Drain above Knights Landing
YRMRY Yuba River at Marysville
SACSL Sacramento Slough
FRNIC Feather River near Nicolaus
SRVET Sacramento River at Veterans Bridge
ARDPK American River at Discovery Park
SRFPT Sacramento River at Freeport

***Ceriodaphia dubia* Reproduction**

(site water test response normalized to the Control treatment response [i.e., reported as a percentage of Control response])

	Event																	
	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67
Site	4/20/06	5/30/06	7/6/06	7/25/06	8/23/06	9/20/06	10/25/06	11/9/06	12/12/06	2/9/07	3/14/07	3/28/07	4/25/07	5/16/07	6/6/07	6/27/07	7/25/07	8/8/07
SRBKR	102	106	**65**	99	99	94	84	88	17/88	**67**	7	92	**32**	98	91	98	91	108
CHKNT	116	113	134	124	114	107	85	89	13/99	104	111	96	**85**	94	102	94	**86**	101
SRABB	110	107	94	107	107	98	**77**	75	17/88	113	**86**	93	**60**	98	99	114	97	100
SRHAM	114	115	113	103	123	104	**82**	106	24/117	110	98	92	**74**	98	90	123	104	105
SRCOL	**83**	78	160	**75**	131	93	101	139	31/111	91	99	108	**82**	84	**83**	104	101	116
COLDR	120	115	178	**57**	141	97	109	109	2	103	131	108	**71**	95	**86**	122	102	103
YRMRY	89		133	92	132	106	112	144	**42**	**65**	**65**	110	7	99	90	107	101	101
FRNIC	124	96	177	98	152	**80**	114	102	0	**84**	92	88	81	103	0	96	102	104
SACSL	128	31	108	100	20	95	107	96	0	**79**	85	104	**75**	117	**65**	116	98	106
SRVET	103	118	**34**	82	146	107	104	113	3	96	101	96	**77**	113	0	113	102	106
ARDPK	102	102	103	122	152	103	109	89	0	**85**	98	110	89	109	96	108	106	91
SRFPT	96	115	89	9	27	102	98	128	11	91	106	122	27	107	93	110	106	100

The test response for this site water was significantly less than the corresponding Control treatment response.

The test responses reported here are for the 'initial test/immediate re-test' of the sample.

SRBKR Sacramento River below Keswick Reservoir
SRABB Sacramento River above Bend Bridge
CHKNT Churn Creek at Knighton Road
SRHAM Sacramento River near Hamilton
SRCOL Sacramento River at Colusa
COLDR Colusa Basin Drain above Knights Landing
YRMRY Yuba River at Marysville
SACSL Sacramento Slough
FRNIC Feather River near Nicolaus
SRVET Sacramento River at Veterans Bridge
ARDPK American River at Discovery Park
SRFPT Sacramento River at Freeport

Fathead Minnow Survival

(site water test response normalized to the Control treatment response [i.e., reported as a percentage of Control response])

	Event																	
	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67
Site	4/20/06	5/30/06	7/6/06	7/25/06	8/23/06	9/20/06	10/25/06	11/9/06	12/12/06	2/9/07	3/14/07	3/28/07	4/25/07	5/16/07	6/6/07	6/27/07	7/25/07	8/8/07
SRBKR	100	105	100	95	105	90	95	95	**40**	**21**	84	95	35	105	70	95	100	118
CHKNT	100	100	100	100	89	100	105	100	70	95	100	90	25	100	100	95	100	118
SRABB	100	105	100	**55**	105	95	105	**35**	**0**	79	**53**	85	10	95	80	90	100	106
SRHAM	89	95	100	90	100	95	105	95	**45**	79	100	100	35	105	90	95	100	112
SRCOL	100	100	95	105	95	84	95	68	85	100	90	90	70	100	94	90	80	112
COLDR	100	100	100	105	105	89	100	119	100	105	90	95	85	118	125	95	106	118
YRMRY	100		95	105	95	89	75	100	95	89	90	100	95	118	119	95	106	106
FRNIC	100	100	100	105	111	**71**	106	113	100	83	90	100	100	118	79	90	100	82
SACSL	100	100	100	105	106	76	106	125	95	100	**70**	85	100	118	89	100	111	118
SRVET	95	95	100	100	105	82	111	113	**55**	83	75	95	100	118	95	100	111	94
ARDPK	100	100	88	95	105	100	70	119	89	106	**75**	100	**75**	90	119	100	111	100
SRFPT	100	100	100	100	111	82	**70**	105	**5**	100	95	100	95	95	113	100	94	100

the survival response in this site water was significantly less than the corresponding Control treatment response

the test response reported here was for a re-test.

the test organisms in this site water exhibited "pathogen-related mortalities", and were excluded from evaluation of ambient toxicity.

SRBKR Sacramento River below Keswick Reservoir
SRABB Sacramento River above Bend Bridge
CHKNT Churn Creek at Knighton Road
SRHAM Sacramento River near Hamilton
SRCOL Sacramento River at Colusa
COLDR Colusa Basin Drain above Knights Landing
YRMRY Yuba River at Marysville
SACSL Sacramento Slough
FRNIC Feather River near Nicolaus
SRVET Sacramento River at Veterans Bridge
ARDPK American River at Discovery Park
SRFPT Sacramento River at Freeport

Fathead Minnow Growth

(site water test response normalized to the Control treatment response [i.e., reported as a percentage of Control response])

	Event																	
	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67
Site	4/20/06	5/30/06	7/6/06	7/25/06	8/23/06	9/20/06	10/25/06	11/9/06	12/12/06	2/9/07	3/14/07	3/28/07	4/25/07	5/16/07	6/6/07	6/27/07	7/25/07	8/8/07
SRBKR	90	100	114	105	109	98	87	**81**	37	24	89	86	32	90	**64**	92	103	118
CHKNT	92	103	114	102	93	96	102	**86**	81	108	111	92	29	**79**	91	**80**	118	115
SRABB	**79**	114	110	64	107	102	98	36	0	73	50	**76**	86	**74**	82	**72**	112	106
SRHAM	89	111	122	126	98	103	98	86	48	88	97	100	32	85	98	106	109	106
SRCOL	86	**87**	**81**	107	90	91	100	67	**79**	115	103	102	64	90	71	**86**	85	115
COLDR	95	102	90	109	109	106	**75**	150	116	105	92	111	95	123	74	98	100	127
YRMRY	98		87	98	90	103	109	82	**80**	93	95	116	95	119	71	106	105	109
FRNIC	91	94	86	98	94	57	106	110	89	79	**85**	86	107	110	72	98	98	85
SACSL	93	96	97	109	110	**63**	89	133	98	114	76	90	107	129	76	102	120	124
SRVET	100	89	98	97	94	77	103	117	61	91	**73**	100	102	139	88	96	105	103
ARDPK	94	**86**	88	98	100	100	**68**	110	89	95	84	102	92	105	81	**84**	112	95
SRFPT	92	95	90	95	135	80	75	97	6	95	95	96	92	105	86	**79**	90	92

The growth response for this site water was significantly less than the corresponding Control treatment response

The test response reported here was for a re-test.

The test organisms in this site water exhibited "pathogen-related mortalities", and were excluded from evaluation of ambient toxicity.

SRBKR Sacramento River below Keswick Reservoir
SRABB Sacramento River above Bend Bridge
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SRVET Sacramento River at Veterans Bridge
ARDPK American River at Discovery Park
SRFPT Sacramento River at Freeport

Appendix PER2

Summary of Pesticide Applications in Seven Sacramento River Watershed Counties During the Period of November 11 – December 11, 2006

County	Type of Application	Chemical	Total lbs Applied
Sacramento	Agriculture	1,3-DICHLORO-5-ETHYL-5-METHYLHYDANTOIN	193.8
Butte	Agriculture	1,3-DICHLOROPROPENE	17978.7
Tehama	Agriculture	1,3-DICHLOROPROPENE	54545.1
Yuba	Agriculture	1,3-DICHLOROPROPENE	8493.6
Sacramento	Agriculture	1-BROMO-3-CHLORO-5,5-DIMETHYL HYDANTOIN	312.9
Sacramento	Agriculture	1-BROMO-3-CHLORO-5,5-DIMETHYL HYDANTOIN	8.8
Sacramento	Agriculture	2,2-DIBROMO-3-NITRILOPROPIONAMIDE	241.7
Butte	Landscape Maintenance	2,4-D, 2-ETHYLHEXYL ESTER	1.4
Colusa	Landscape Maintenance	2,4-D, 2-ETHYLHEXYL ESTER	0.2
Glenn	Structural Pest Control	2,4-D, 2-ETHYLHEXYL ESTER	0.3
Sacramento	Landscape Maintenance	2,4-D, 2-ETHYLHEXYL ESTER	28.1
Sacramento	Structural Pest Control	2,4-D, 2-ETHYLHEXYL ESTER	3.5
Shasta	Structural Pest Control	2,4-D, 2-ETHYLHEXYL ESTER	2.3
Tehama	Landscape Maintenance	2,4-D, 2-ETHYLHEXYL ESTER	0.4
Yuba	Structural Pest Control	2,4-D, 2-ETHYLHEXYL ESTER	0.1
Shasta	Agriculture	2,4-D, BUTOXYETHANOL ESTER	2.6
Tehama	Agriculture	2,4-D, DIETHANOLAMINE SALT	6.1
Butte	Agriculture	2,4-D, DIMETHYLAMINE SALT	1871.4
Butte	Landscape Maintenance	2,4-D, DIMETHYLAMINE SALT	30.4
Butte	Rights of Way	2,4-D, DIMETHYLAMINE SALT	4.7
Colusa	Agriculture	2,4-D, DIMETHYLAMINE SALT	22.9
Colusa	Rights of Way	2,4-D, DIMETHYLAMINE SALT	6.8
Glenn	Agriculture	2,4-D, DIMETHYLAMINE SALT	2556.8
Glenn	Landscape Maintenance	2,4-D, DIMETHYLAMINE SALT	0.4
Glenn	Rights of Way	2,4-D, DIMETHYLAMINE SALT	65.8
Sacramento	Agriculture	2,4-D, DIMETHYLAMINE SALT	0.2
Sacramento	Landscape Maintenance	2,4-D, DIMETHYLAMINE SALT	4.2
Sacramento	Structural Pest Control	2,4-D, DIMETHYLAMINE SALT	0.3
Shasta	Agriculture	2,4-D, DIMETHYLAMINE SALT	65.3
Shasta	Landscape Maintenance	2,4-D, DIMETHYLAMINE SALT	1.3
Tehama	Agriculture	2,4-D, DIMETHYLAMINE SALT	163.3
Tehama	Landscape Maintenance	2,4-D, DIMETHYLAMINE SALT	1.0
Tehama	Rights of Way	2,4-D, DIMETHYLAMINE SALT	9.3
Yuba	Rights of Way	2,4-D, DIMETHYLAMINE SALT	2.3
Butte	Landscape Maintenance	2,4-D, ISOOCTYL ESTER	18.0
Butte	Rights of Way	2,4-D, ISOOCTYL ESTER	0.9
Glenn	Landscape Maintenance	2,4-D, ISOOCTYL ESTER	0.5
Glenn	Rights of Way	2,4-D, ISOOCTYL ESTER	28.3
Sacramento	Structural Pest Control	2,4-DP-P, DIMETHYLAMINE SALT	<0.0

County	Type of Application	Chemical	Total lbs Applied
Sacramento	Agriculture	2-METHYL-4-ISOTHIAZOLIN-3-ONE	23.4
Shasta	Structural Pest Control	2-METHYL-4-ISOTHIAZOLIN-3-ONE	1.8
Colusa	Agriculture	4(2,4-DB), DIMETHYLAMINE SALT	58.5
Glenn	Agriculture	4(2,4-DB), DIMETHYLAMINE SALT	217.7
Sacramento	Agriculture	4(2,4-DB), DIMETHYLAMINE SALT	0.7
Butte	Structural Pest Control	4-AMINOPYRIDINE	<0.0
Colusa	Structural Pest Control	4-AMINOPYRIDINE	<0.0
Sacramento	Structural Pest Control	4-AMINOPYRIDINE	0.3
Tehama	Structural Pest Control	4-AMINOPYRIDINE	<0.0
Sacramento	Agriculture	5-CHLORO-2-METHYL-4-ISOTHIAZOLIN-3-ONE	1.4
Shasta	Structural Pest Control	5-CHLORO-2-METHYL-4-ISOTHIAZOLIN-3-ONE	5.2
Butte	Structural Pest Control	ABAMECTIN	<0.0
Colusa	Structural Pest Control	ABAMECTIN	<0.0
Glenn	Structural Pest Control	ABAMECTIN	<0.0
Sacramento	Landscape Maintenance	ABAMECTIN	<0.0
Sacramento	Structural Pest Control	ABAMECTIN	0.1
Shasta	Landscape Maintenance	ABAMECTIN	<0.0
Shasta	Structural Pest Control	ABAMECTIN	<0.0
Tehama	Structural Pest Control	ABAMECTIN	<0.0
Yuba	Landscape Maintenance	ABAMECTIN	<0.0
Yuba	Structural Pest Control	ABAMECTIN	<0.0
Butte	Structural Pest Control	ACEPHATE	1.7
Glenn	Structural Pest Control	ACEPHATE	0.2
Sacramento	Structural Pest Control	ACEPHATE	2.8
Shasta	Structural Pest Control	ACEPHATE	5.1
Tehama	Structural Pest Control	ACEPHATE	0.5
Yuba	Structural Pest Control	ACEPHATE	0.2
Butte	Agriculture	ACETAMIPRID	0.2
Sacramento	Structural Pest Control	ALKYL DIMETHYLBENZYL AMMONIUM CHLORIDE	0.9
Sacramento	Agriculture	ALKYL DIMETHYLETHYLBENZYL AMMONIUM CHLORIDE	406.7
Butte	Agriculture	ALUMINUM PHOSPHIDE	82.8
Butte	Landscape Maintenance	ALUMINUM PHOSPHIDE	4.6
Colusa	Agriculture	ALUMINUM PHOSPHIDE	1356.5
Glenn	Agriculture	ALUMINUM PHOSPHIDE	43.3
Sacramento	Agriculture	ALUMINUM PHOSPHIDE	6.6
Sacramento	Landscape Maintenance	ALUMINUM PHOSPHIDE	14.4
Sacramento	Structural Pest Control	ALUMINUM PHOSPHIDE	2.8
Tehama	Agriculture	ALUMINUM PHOSPHIDE	108.4
Yuba	Agriculture	ALUMINUM PHOSPHIDE	80.6
Yuba	Landscape Maintenance	AMINOPYRALID, TRIISOPROPANOLAMINE SALT	0.2
Yuba	Rights of Way	AMINOPYRALID, TRIISOPROPANOLAMINE SALT	26.6

County	Type of Application	Chemical	Total lbs Applied
Butte	Agriculture	AZADIRACHTIN	<0.0
Sacramento	Landscape Maintenance	AZADIRACHTIN	0.1
Colusa	Agriculture	AZOXYSTROBIN	1.5
Glenn	Agriculture	AZOXYSTROBIN	2.0
Sacramento	Landscape Maintenance	AZOXYSTROBIN	4.8
Shasta	Landscape Maintenance	AZOXYSTROBIN	3.0
Butte	Landscape Maintenance	BENEFIN	1.5
Sacramento	Agriculture	BENEFIN	7.7
Butte	Structural Pest Control	BETA-CYFLUTHRIN	7.4
Colusa	Structural Pest Control	BETA-CYFLUTHRIN	0.3
Glenn	Structural Pest Control	BETA-CYFLUTHRIN	1.4
Sacramento	Landscape Maintenance	BETA-CYFLUTHRIN	<0.0
Sacramento	Structural Pest Control	BETA-CYFLUTHRIN	8.7
Shasta	Agriculture	BETA-CYFLUTHRIN	0.9
Shasta	Landscape Maintenance	BETA-CYFLUTHRIN	0.9
Shasta	Structural Pest Control	BETA-CYFLUTHRIN	5.6
Tehama	Structural Pest Control	BETA-CYFLUTHRIN	0.9
Yuba	Structural Pest Control	BETA-CYFLUTHRIN	0.6
Butte	Landscape Maintenance	BIFENTHRIN	<0.0
Butte	Structural Pest Control	BIFENTHRIN	22.7
Colusa	Structural Pest Control	BIFENTHRIN	5.8
Glenn	Structural Pest Control	BIFENTHRIN	0.4
Sacramento	Agriculture	BIFENTHRIN	1.1
Sacramento	Landscape Maintenance	BIFENTHRIN	2.4
Sacramento	Structural Pest Control	BIFENTHRIN	362.8
Shasta	Landscape Maintenance	BIFENTHRIN	<0.0
Shasta	Structural Pest Control	BIFENTHRIN	4.9
Tehama	Structural Pest Control	BIFENTHRIN	6.3
Yuba	Structural Pest Control	BIFENTHRIN	4.9
Butte	Structural Pest Control	BORAX	0.2
Colusa	Structural Pest Control	BORAX	<0.0
Glenn	Structural Pest Control	BORAX	<0.0
Sacramento	Landscape Maintenance	BORAX	<0.0
Sacramento	Structural Pest Control	BORAX	55.9
Shasta	Agriculture	BORAX	97.2
Shasta	Structural Pest Control	BORAX	1.0
Tehama	Structural Pest Control	BORAX	0.1
Yuba	Rights of Way	BORAX	100.9
Yuba	Structural Pest Control	BORAX	<0.0
Butte	Structural Pest Control	BORIC ACID	10.1
Colusa	Structural Pest Control	BORIC ACID	<0.0

County	Type of Application	Chemical	Total lbs Applied
Glenn	Structural Pest Control	BORIC ACID	0.6
Sacramento	Structural Pest Control	BORIC ACID	117.8
Shasta	Structural Pest Control	BORIC ACID	5.9
Tehama	Structural Pest Control	BORIC ACID	3.1
Yuba	Structural Pest Control	BORIC ACID	2.2
Colusa	Agriculture	BOSCALID	30.5
Butte	Structural Pest Control	BRODIFACOUM	<0.0
Colusa	Landscape Maintenance	BRODIFACOUM	<0.0
Colusa	Structural Pest Control	BRODIFACOUM	<0.0
Glenn	Structural Pest Control	BRODIFACOUM	<0.0
Sacramento	Landscape Maintenance	BRODIFACOUM	<0.0
Sacramento	Structural Pest Control	BRODIFACOUM	<0.0
Shasta	Structural Pest Control	BRODIFACOUM	<0.0
Tehama	Structural Pest Control	BRODIFACOUM	<0.0
Butte	Rights of Way	BROMACIL	468.0
Colusa	Rights of Way	BROMACIL	489.2
Glenn	Rights of Way	BROMACIL	410.4
Shasta	Rights of Way	BROMACIL	31.9
Tehama	Rights of Way	BROMACIL	312.0
Butte	Agriculture	BROMADIOLONE	<0.0
Butte	Landscape Maintenance	BROMADIOLONE	<0.0
Butte	Structural Pest Control	BROMADIOLONE	<0.0
Colusa	Structural Pest Control	BROMADIOLONE	<0.0
Glenn	Structural Pest Control	BROMADIOLONE	<0.0
Sacramento	Agriculture	BROMADIOLONE	<0.0
Sacramento	Landscape Maintenance	BROMADIOLONE	<0.0
Sacramento	Structural Pest Control	BROMADIOLONE	0.1
Shasta	Structural Pest Control	BROMADIOLONE	<0.0
Tehama	Structural Pest Control	BROMADIOLONE	<0.0
Yuba	Rights of Way	BROMADIOLONE	<0.0
Yuba	Structural Pest Control	BROMADIOLONE	<0.0
Butte	Structural Pest Control	BROMETHALIN	<0.0
Sacramento	Landscape Maintenance	BROMETHALIN	<0.0
Sacramento	Structural Pest Control	BROMETHALIN	<0.0
Shasta	Landscape Maintenance	BROMETHALIN	<0.0
Shasta	Structural Pest Control	BROMETHALIN	<0.0
Sacramento	Agriculture	BROMINE CHLORIDE	87.4
Glenn	Agriculture	BROMOXYNIL HEPTANOATE	18.0
Yuba	Landscape Maintenance	CALCIUM HYPOCHLORITE	1.3
Butte	Agriculture	CAPTAN	25.0
Colusa	Agriculture	CAPTAN	352.7

County	Type of Application	Chemical	Total lbs Applied
Glenn	Agriculture	CAPTAN	179.1
Tehama	Agriculture	CAPTAN	3.2
Butte	Structural Pest Control	CARBARYL	0.5
Colusa	Structural Pest Control	CARBARYL	<0.0
Sacramento	Rights of Way	CARBON	0.6
Butte	Agriculture	CARBON DIOXIDE	4055.2
Colusa	Agriculture	CARBON DIOXIDE	266.6
Glenn	Agriculture	CARBON DIOXIDE	923.5
Sacramento	Agriculture	CARBON DIOXIDE	127.4
Tehama	Agriculture	CARBON DIOXIDE	1665.0
Butte	Agriculture	CARFENTRAZONE-ETHYL	0.1
Butte	Landscape Maintenance	CARFENTRAZONE-ETHYL	<0.0
Colusa	Landscape Maintenance	CARFENTRAZONE-ETHYL	<0.0
Glenn	Agriculture	CARFENTRAZONE-ETHYL	1.0
Glenn	Structural Pest Control	CARFENTRAZONE-ETHYL	<0.0
Sacramento	Agriculture	CARFENTRAZONE-ETHYL	4.8
Sacramento	Landscape Maintenance	CARFENTRAZONE-ETHYL	2.4
Sacramento	Structural Pest Control	CARFENTRAZONE-ETHYL	0.1
Shasta	Structural Pest Control	CARFENTRAZONE-ETHYL	0.1
Tehama	Landscape Maintenance	CARFENTRAZONE-ETHYL	<0.0
Yuba	Agriculture	CARFENTRAZONE-ETHYL	0.8
Yuba	Structural Pest Control	CARFENTRAZONE-ETHYL	<0.0
Butte	Structural Pest Control	CHLORFENAPYR	3.0
Colusa	Structural Pest Control	CHLORFENAPYR	<0.0
Glenn	Structural Pest Control	CHLORFENAPYR	0.1
Sacramento	Landscape Maintenance	CHLORFENAPYR	<0.0
Sacramento	Structural Pest Control	CHLORFENAPYR	9.2
Shasta	Structural Pest Control	CHLORFENAPYR	2.6
Tehama	Structural Pest Control	CHLORFENAPYR	0.1
Yuba	Structural Pest Control	CHLORFENAPYR	<0.0
Butte	Landscape Maintenance	CHLOROPHACINONE	0.0
Sacramento	Landscape Maintenance	CHLOROPHACINONE	<0.0
Sacramento	Structural Pest Control	CHLOROPHACINONE	<0.0
Shasta	Structural Pest Control	CHLOROPHACINONE	<0.0
Yuba	Agriculture	CHLOROPHACINONE	<0.0
Butte	Agriculture	CHLOROPICRIN	145.6
Glenn	Agriculture	CHLOROPICRIN	68.8
Shasta	Agriculture	CHLOROPICRIN	2.0
Tehama	Agriculture	CHLOROPICRIN	540.1
Butte	Agriculture	CHLOROTHALONIL	0.1
Butte	Landscape Maintenance	CHLOROTHALONIL	29.3

County	Type of Application	Chemical	Total lbs Applied
Colusa	Landscape Maintenance	CHLOROTHALONIL	15.0
Sacramento	Agriculture	CHLOROTHALONIL	19.8
Sacramento	Landscape Maintenance	CHLOROTHALONIL	154.2
Sacramento	Structural Pest Control	CHLOROTHALONIL	0.6
Shasta	Landscape Maintenance	CHLOROTHALONIL	7.4
Tehama	Landscape Maintenance	CHLOROTHALONIL	15.0
Butte	Puclic Health Pest Control	CHLORPYRIFOS	0.5
Butte	Structural Pest Control	CHLORPYRIFOS	3.7
Sacramento	Agriculture	CHLORPYRIFOS	737.9
Sacramento	Landscape Maintenance	CHLORPYRIFOS	2.9
Shasta	Structural Pest Control	CHLORPYRIFOS	<0.0
Yuba	Structural Pest Control	CHLORPYRIFOS	1.0
Butte	Landscape Maintenance	CHLORSULFURON	0.1
Butte	Rights of Way	CHLORSULFURON	29.3
Colusa	Rights of Way	CHLORSULFURON	27.8
Glenn	Rights of Way	CHLORSULFURON	26.2
Sacramento	Landscape Maintenance	CHLORSULFURON	14.4
Sacramento	Rights of Way	CHLORSULFURON	49.0
Shasta	Rights of Way	CHLORSULFURON	44.8
Tehama	Landscape Maintenance	CHLORSULFURON	0.2
Tehama	Rights of Way	CHLORSULFURON	3.9
Yuba	Rights of Way	CHLORSULFURON	5.6
Butte	Structural Pest Control	CHOLECALCIFEROL	<0.0
Sacramento	Structural Pest Control	CHOLECALCIFEROL	<0.0
Colusa	Agriculture	CLETHODIM	11.6
Glenn	Agriculture	CLETHODIM	78.3
Sacramento	Landscape Maintenance	CLETHODIM	<0.0
Sacramento	Landscape Maintenance	CLOPYRALID, MONOETHANOLAMINE SALT	8.2
Yuba	Landscape Maintenance	CLOPYRALID, MONOETHANOLAMINE SALT	0.1
Yuba	Structural Pest Control	CLOPYRALID, MONOETHANOLAMINE SALT	0.2
Sacramento	Landscape Maintenance	COPPER	0.3
Sacramento	Landscape Maintenance	COPPER AMMONIUM COMPLEX	7.0
Butte	Agriculture	COPPER HYDROXIDE	7000.4
Butte	Landscape Maintenance	COPPER HYDROXIDE	2.4
Colusa	Agriculture	COPPER HYDROXIDE	92.0
Glenn	Agriculture	COPPER HYDROXIDE	5916.6
Sacramento	Agriculture	COPPER HYDROXIDE	1324.0
Sacramento	Landscape Maintenance	COPPER HYDROXIDE	35.5
Sacramento	Structural Pest Control	COPPER HYDROXIDE	1.0
Shasta	Agriculture	COPPER HYDROXIDE	1.0
Shasta	Landscape Maintenance	COPPER HYDROXIDE	3.8

County	Type of Application	Chemical	Total lbs Applied
Tehama	Agriculture	COPPER HYDROXIDE	5826.2
Yuba	Agriculture	COPPER HYDROXIDE	61.6
Yuba	Rights of Way	COPPER HYDROXIDE	7.2
Butte	Structural Pest Control	COPPER NAPHTHENATE	4.2
Glenn	Structural Pest Control	COPPER NAPHTHENATE	0.2
Sacramento	Rights of Way	COPPER NAPHTHENATE	573.6
Sacramento	Structural Pest Control	COPPER NAPHTHENATE	141.8
Shasta	Landscape Maintenance	COPPER NAPHTHENATE	16.3
Shasta	Structural Pest Control	COPPER NAPHTHENATE	5.6
Tehama	Structural Pest Control	COPPER NAPHTHENATE	1.9
Sacramento	Agriculture	COPPER OXIDE (OUS)	52.4
Tehama	Agriculture	COPPER OXIDE (OUS)	26.2
Tehama	Agriculture	COPPER OXYCHLORIDE	100.0
Butte	Agriculture	COPPER SALTS OF FATTY AND ROSIN ACIDS	14.6
Sacramento	Agriculture	COPPER SALTS OF FATTY AND ROSIN ACIDS	3.3
Butte	Agriculture	COPPER SULFATE	9860.4
Yuba	Agriculture	COPPER SULFATE (BASIC)	376.3
Glenn	Agriculture	COPPER SULFATE (PENTAHYDRATE)	539.1
Sacramento	Agriculture	COPPER SULFATE (PENTAHYDRATE)	14.4
Sacramento	Landscape Maintenance	COPPER SULFATE (PENTAHYDRATE)	0.6
Yuba	Agriculture	COUMAPHOS	0.8
Butte	Agriculture	CYFLUTHRIN	<0.0
Butte	Structural Pest Control	CYFLUTHRIN	18.9
Colusa	Structural Pest Control	CYFLUTHRIN	3.7
Glenn	Structural Pest Control	CYFLUTHRIN	3.8
Sacramento	Agriculture	CYFLUTHRIN	0.4
Sacramento	Landscape Maintenance	CYFLUTHRIN	3.3
Sacramento	Structural Pest Control	CYFLUTHRIN	125.5
Shasta	Structural Pest Control	CYFLUTHRIN	13.5
Tehama	Structural Pest Control	CYFLUTHRIN	5.0
Yuba	Structural Pest Control	CYFLUTHRIN	6.1
Butte	Landscape Maintenance	CYPERMETHRIN	0.1
Butte	Structural Pest Control	CYPERMETHRIN	215.4
Colusa	Structural Pest Control	CYPERMETHRIN	34.3
Glenn	Structural Pest Control	CYPERMETHRIN	42.5
Sacramento	Structural Pest Control	CYPERMETHRIN	2892.5
Shasta	Structural Pest Control	CYPERMETHRIN	859.1
Tehama	Structural Pest Control	CYPERMETHRIN	24.7
Yuba	Structural Pest Control	CYPERMETHRIN	1085.6
Glenn	Agriculture	CYPRODINIL	13.5
Sacramento	Agriculture	DAMINOZIDE	0.4

County	Type of Application	Chemical	Total lbs Applied
Colusa	Structural Pest Control	DDVP	15.2
Butte	Structural Pest Control	DELTAMETHRIN	5.3
Colusa	Structural Pest Control	DELTAMETHRIN	0.3
Glenn	Structural Pest Control	DELTAMETHRIN	0.6
Sacramento	Landscape Maintenance	DELTAMETHRIN	0.5
Sacramento	Structural Pest Control	DELTAMETHRIN	85.7
Shasta	Landscape Maintenance	DELTAMETHRIN	<0.0
Shasta	Structural Pest Control	DELTAMETHRIN	3.3
Tehama	Landscape Maintenance	DELTAMETHRIN	<0.0
Tehama	Structural Pest Control	DELTAMETHRIN	0.8
Yuba	Structural Pest Control	DELTAMETHRIN	0.7
Butte	Agriculture	DIAZINON	562.7
Glenn	Agriculture	DIAZINON	99.2
Sacramento	Structural Pest Control	DIAZINON	0.6
Shasta	Landscape Maintenance	DIAZINON	1.4
Shasta	Structural Pest Control	DIAZINON	<0.0
Tehama	Agriculture	DIAZINON	21.8
Tehama	Landscape Maintenance	DIAZINON	1.3
Yuba	Agriculture	DIAZINON	690.6
Yuba	Landscape Maintenance	DIAZINON	<0.0
Butte	Landscape Maintenance	DICAMBA	0.1
Colusa	Landscape Maintenance	DICAMBA	<0.0
Glenn	Structural Pest Control	DICAMBA	<0.0
Sacramento	Landscape Maintenance	DICAMBA	7.1
Sacramento	Structural Pest Control	DICAMBA	0.3
Shasta	Structural Pest Control	DICAMBA	0.1
Tehama	Landscape Maintenance	DICAMBA	<0.0
Yuba	Structural Pest Control	DICAMBA	0.1
Glenn	Agriculture	DICAMBA, DIMETHYLAMINE SALT	4.4
Glenn	Rights of Way	DICAMBA, DIMETHYLAMINE SALT	0.2
Shasta	Agriculture	DICAMBA, DIMETHYLAMINE SALT	5.7
Shasta	Landscape Maintenance	DICAMBA, DIMETHYLAMINE SALT	0.1
Butte	Structural Pest Control	DIFETHIALONE	<0.0
Sacramento	Structural Pest Control	DIFETHIALONE	<0.0
Shasta	Structural Pest Control	DIFETHIALONE	<0.0
Tehama	Structural Pest Control	DIFETHIALONE	<0.0
Yuba	Structural Pest Control	DIFETHIALONE	<0.0
Butte	Structural Pest Control	DIFLUBENZURON	<0.0
Colusa	Structural Pest Control	DIFLUBENZURON	<0.0
Glenn	Structural Pest Control	DIFLUBENZURON	5.9
Sacramento	Structural Pest Control	DIFLUBENZURON	<0.0

County	Type of Application	Chemical	Total lbs Applied
Shasta	Structural Pest Control	DIFLUBENZURON	6.0
Tehama	Structural Pest Control	DIFLUBENZURON	9.2
Yuba	Structural Pest Control	DIFLUBENZURON	<0.0
Glenn	Agriculture	DIGLYCOLAMINE SALT OF 3,6-DICHLORO-O-ANISIC ACID	10.9
Glenn	Rights of Way	DIGLYCOLAMINE SALT OF 3,6-DICHLORO-O-ANISIC ACID	29.6
Sacramento	Rights of Way	DIGLYCOLAMINE SALT OF 3,6-DICHLORO-O-ANISIC ACID	35.5
Glenn	Rights of Way	DIKEGULAC SODIUM	0.2
Sacramento	Agriculture	DIMETHOMORPH	1.6
Sacramento	Structural Pest Control	DIMETHOMORPH	2.1
Sacramento	Agriculture	DINOTEFURAN	0.5
Butte	Agriculture	DIPHACINONE	<0.0
Butte	Structural Pest Control	DIPHACINONE	<0.0
Colusa	Structural Pest Control	DIPHACINONE	<0.0
Glenn	Structural Pest Control	DIPHACINONE	<0.0
Sacramento	Landscape Maintenance	DIPHACINONE	<0.0
Sacramento	Rights of Way	DIPHACINONE	<0.0
Sacramento	Structural Pest Control	DIPHACINONE	<0.0
Shasta	Landscape Maintenance	DIPHACINONE	<0.0
Shasta	Structural Pest Control	DIPHACINONE	<0.0
Tehama	Landscape Maintenance	DIPHACINONE	<0.0
Tehama	Structural Pest Control	DIPHACINONE	<0.0
Yuba	Structural Pest Control	DIPHACINONE	<0.0
Butte	Landscape Maintenance	DIQUAT DIBROMIDE	7.2
Colusa	Landscape Maintenance	DIQUAT DIBROMIDE	0.1
Glenn	Structural Pest Control	DIQUAT DIBROMIDE	<0.0
Sacramento	Landscape Maintenance	DIQUAT DIBROMIDE	41.3
Sacramento	Rights of Way	DIQUAT DIBROMIDE	51.0
Sacramento	Structural Pest Control	DIQUAT DIBROMIDE	0.6
Shasta	Landscape Maintenance	DIQUAT DIBROMIDE	0.2
Yuba	Structural Pest Control	DIQUAT DIBROMIDE	<0.0
Butte	Structural Pest Control	DISODIUM OCTABORATE TETRAHYDRATE	25.3
Glenn	Structural Pest Control	DISODIUM OCTABORATE TETRAHYDRATE	0.3
Sacramento	Structural Pest Control	DISODIUM OCTABORATE TETRAHYDRATE	66.9
Shasta	Structural Pest Control	DISODIUM OCTABORATE TETRAHYDRATE	72.8
Tehama	Structural Pest Control	DISODIUM OCTABORATE TETRAHYDRATE	1.0
Yuba	Structural Pest Control	DISODIUM OCTABORATE TETRAHYDRATE	0.7
Butte	Landscape Maintenance	DITHIOPYR	0.8
Glenn	Landscape Maintenance	DITHIOPYR	0.1
Sacramento	Landscape Maintenance	DITHIOPYR	18.2
Sacramento	Rights of Way	DITHIOPYR	42.7

County	Type of Application	Chemical	Total lbs Applied
Shasta	Landscape Maintenance	DITHIOPYR	22.0
Tehama	Landscape Maintenance	DITHIOPYR	0.1
Tehama	Rights of Way	DITHIOPYR	50.8
Butte	Agriculture	DIURON	4840.9
Butte	Landscape Maintenance	DIURON	68.2
Butte	Rights of Way	DIURON	3219.5
Colusa	Agriculture	DIURON	2245.3
Colusa	Rights of Way	DIURON	646.7
Glenn	Agriculture	DIURON	2801.8
Glenn	Landscape Maintenance	DIURON	2.9
Glenn	Rights of Way	DIURON	1939.6
Sacramento	Agriculture	DIURON	1857.8
Sacramento	Rights of Way	DIURON	101.5
Sacramento	Structural Pest Control	DIURON	20.0
Shasta	Agriculture	DIURON	542.8
Shasta	Landscape Maintenance	DIURON	50.0
Shasta	Rights of Way	DIURON	39.6
Tehama	Agriculture	DIURON	1408.5
Tehama	Rights of Way	DIURON	576.2
Yuba	Landscape Maintenance	DIURON	17.0
Butte	Structural Pest Control	D-TRANS ALLETHRIN	<0.0
Colusa	Structural Pest Control	D-TRANS ALLETHRIN	<0.0
Glenn	Structural Pest Control	D-TRANS ALLETHRIN	<0.0
Sacramento	Structural Pest Control	D-TRANS ALLETHRIN	0.2
Shasta	Structural Pest Control	D-TRANS ALLETHRIN	<0.0
Tehama	Structural Pest Control	D-TRANS ALLETHRIN	<0.0
Yuba	Structural Pest Control	D-TRANS ALLETHRIN	<0.0
Butte	Agriculture	ESFENVALERATE	66.1
Butte	Structural Pest Control	ESFENVALERATE	0.4
Glenn	Agriculture	ESFENVALERATE	24.7
Glenn	Structural Pest Control	ESFENVALERATE	<0.0
Sacramento	Agriculture	ESFENVALERATE	1.5
Sacramento	Structural Pest Control	ESFENVALERATE	<0.0
Tehama	Agriculture	ESFENVALERATE	21.8
Tehama	Structural Pest Control	ESFENVALERATE	<0.0
Yuba	Agriculture	ESFENVALERATE	24.3
Yuba	Structural Pest Control	ESFENVALERATE	<0.0
Glenn	Agriculture	ETHOFUMESATE	289.9
Sacramento	Landscape Maintenance	ETHOFUMESATE	<0.0
Shasta	Agriculture	ETHOFUMESATE	72.5
Sacramento	Agriculture	FENHEXAMID	<0.0

County	Type of Application	Chemical	Total lbs Applied
Tehama	Agriculture	FENHEXAMID	0.9
Butte	Structural Pest Control	FIPRONIL	63345.7
Colusa	Structural Pest Control	FIPRONIL	1.4
Glenn	Structural Pest Control	FIPRONIL	1.1
Sacramento	Landscape Maintenance	FIPRONIL	0.4
Sacramento	Structural Pest Control	FIPRONIL	1061.7
Shasta	Structural Pest Control	FIPRONIL	16.0
Tehama	Structural Pest Control	FIPRONIL	46.0
Yuba	Structural Pest Control	FIPRONIL	5.7
Butte	Landscape Maintenance	FLUAZIFOP-P-BUTYL	<0.0
Sacramento	Landscape Maintenance	FLUAZIFOP-P-BUTYL	0.6
Glenn	Agriculture	FLUDIOXONIL	35.6
Sacramento	Agriculture	FLUDIOXONIL	5.8
Sacramento	Landscape Maintenance	FLUDIOXONIL	0.4
Tehama	Landscape Maintenance	FLUDIOXONIL	3.1
Butte	Agriculture	FLUMIOXAZIN	158.8
Butte	Rights of Way	FLUMIOXAZIN	7.5
Colusa	Agriculture	FLUMIOXAZIN	1107.7
Colusa	Landscape Maintenance	FLUMIOXAZIN	3.4
Colusa	Rights of Way	FLUMIOXAZIN	4.1
Glenn	Agriculture	FLUMIOXAZIN	365.3
Glenn	Rights of Way	FLUMIOXAZIN	80.5
Sacramento	Agriculture	FLUMIOXAZIN	141.4
Sacramento	Rights of Way	FLUMIOXAZIN	208.9
Shasta	Agriculture	FLUMIOXAZIN	2.4
Shasta	Landscape Maintenance	FLUMIOXAZIN	1.2
Shasta	Rights of Way	FLUMIOXAZIN	4.9
Tehama	Agriculture	FLUMIOXAZIN	55.5
Tehama	Landscape Maintenance	FLUMIOXAZIN	1.4
Tehama	Rights of Way	FLUMIOXAZIN	5.4
Yuba	Landscape Maintenance	FLUMIOXAZIN	4.8
Yuba	Rights of Way	FLUMIOXAZIN	1.7
Sacramento	Landscape Maintenance	FLUTOLANIL	37.8
Yuba	Landscape Maintenance	FLUTOLANIL	13.3
Yuba	Landscape Maintenance	FORAMSULFURON	0.9
Sacramento	Agriculture	FOSETYL-AL	55.4
Sacramento	Landscape Maintenance	FREE FATTY ACIDS AND/OR AMINE SALTS	0.6
Glenn	Agriculture	GLUFOSINATE-AMMONIUM	239.9
Sacramento	Agriculture	GLUFOSINATE-AMMONIUM	985.6
Sacramento	Agriculture	GLUTARALDEHYDE	158.1
Butte	Agriculture	GLYPHOSATE	1082.4

County	Type of Application	Chemical	Total lbs Applied
Butte	Landscape Maintenance	GLYPHOSATE	270.8
Sacramento	Landscape Maintenance	GLYPHOSATE	0.6
Tehama	Agriculture	GLYPHOSATE	4905.4
Yuba	Agriculture	GLYPHOSATE	2369.6
Yuba	Rights of Way	GLYPHOSATE	341.6
Sacramento	Agriculture	GLYPHOSATE, DIAMMONIUM SALT	11.2
Shasta	Landscape Maintenance	GLYPHOSATE, DIAMMONIUM SALT	<0.0
Butte	Agriculture	GLYPHOSATE, ISOPROPYLAMINE SALT	7688.5
Butte	Structural Pest Control	GLYPHOSATE, ISOPROPYLAMINE SALT	23.9
Colusa	Agriculture	GLYPHOSATE, ISOPROPYLAMINE SALT	7269.3
Colusa	Landscape Maintenance	GLYPHOSATE, ISOPROPYLAMINE SALT	7.6
Colusa	Rights of Way	GLYPHOSATE, ISOPROPYLAMINE SALT	1336.4
Glenn	Agriculture	GLYPHOSATE, ISOPROPYLAMINE SALT	7595.9
Glenn	Landscape Maintenance	GLYPHOSATE, ISOPROPYLAMINE SALT	47.8
Glenn	Rights of Way	GLYPHOSATE, ISOPROPYLAMINE SALT	2633.9
Glenn	Structural Pest Control	GLYPHOSATE, ISOPROPYLAMINE SALT	7.1
Sacramento	Agriculture	GLYPHOSATE, ISOPROPYLAMINE SALT	2959.0
Sacramento	Landscape Maintenance	GLYPHOSATE, ISOPROPYLAMINE SALT	1449.7
Sacramento	Rights of Way	GLYPHOSATE, ISOPROPYLAMINE SALT	4932.6
Sacramento	Structural Pest Control	GLYPHOSATE, ISOPROPYLAMINE SALT	277.4
Shasta	Agriculture	GLYPHOSATE, ISOPROPYLAMINE SALT	10.3
Shasta	Landscape Maintenance	GLYPHOSATE, ISOPROPYLAMINE SALT	115.2
Shasta	Rights of Way	GLYPHOSATE, ISOPROPYLAMINE SALT	3227.2
Yuba	Landscape Maintenance	GLYPHOSATE, ISOPROPYLAMINE SALT	127.2
Colusa	Landscape Maintenance	GLYPHOSATE, MONOAMMONIUM SALT	3.2
Sacramento	Landscape Maintenance	GLYPHOSATE, MONOAMMONIUM SALT	229.9
Sacramento	Rights of Way	GLYPHOSATE, MONOAMMONIUM SALT	50.9
Yuba	Structural Pest Control	GLYPHOSATE, MONOAMMONIUM SALT	4.1
Butte	Agriculture	GLYPHOSATE, POTASSIUM SALT	3535.7
Butte	Rights of Way	GLYPHOSATE, POTASSIUM SALT	0.7
Colusa	Agriculture	GLYPHOSATE, POTASSIUM SALT	1874.5
Colusa	Rights of Way	GLYPHOSATE, POTASSIUM SALT	37.2
Glenn	Agriculture	GLYPHOSATE, POTASSIUM SALT	3141.7
Glenn	Landscape Maintenance	GLYPHOSATE, POTASSIUM SALT	9.7
Sacramento	Agriculture	GLYPHOSATE, POTASSIUM SALT	1608.7
Sacramento	Rights of Way	GLYPHOSATE, POTASSIUM SALT	89.6
Tehama	Landscape Maintenance	GLYPHOSATE, POTASSIUM SALT	67.7
Tehama	Rights of Way	GLYPHOSATE, POTASSIUM SALT	379.2
Sacramento	Landscape Maintenance	HALOSULFURON-METHYL	0.2
Sacramento	Structural Pest Control	HALOSULFURON-METHYL	0.2
Butte	Agriculture	HEXAZINONE	79.9

County	Type of Application	Chemical	Total lbs Applied
Colusa	Agriculture	HEXAZINONE	1705.3
Glenn	Agriculture	HEXAZINONE	1080.2
Sacramento	Agriculture	HEXAZINONE	209.7
Shasta	Agriculture	HEXAZINONE	1202.8
Shasta	Landscape Maintenance	HEXAZINONE	47.3
Butte	Structural Pest Control	HYDRAMETHYLNON	705.4
Colusa	Structural Pest Control	HYDRAMETHYLNON	<0.0
Glenn	Structural Pest Control	HYDRAMETHYLNON	<0.0
Sacramento	Landscape Maintenance	HYDRAMETHYLNON	<0.0
Sacramento	Structural Pest Control	HYDRAMETHYLNON	1.2
Shasta	Structural Pest Control	HYDRAMETHYLNON	0.2
Tehama	Structural Pest Control	HYDRAMETHYLNON	<0.0
Yuba	Structural Pest Control	HYDRAMETHYLNON	0.4
Butte	Agriculture	HYDROGEN PEROXIDE	4.9
Butte	Structural Pest Control	HYDROPRENE	0.6
Colusa	Structural Pest Control	HYDROPRENE	<0.0
Glenn	Structural Pest Control	HYDROPRENE	0.1
Sacramento	Structural Pest Control	HYDROPRENE	2.1
Shasta	Structural Pest Control	HYDROPRENE	1.0
Tehama	Structural Pest Control	HYDROPRENE	0.1
Yuba	Structural Pest Control	HYDROPRENE	0.1
Colusa	Agriculture	IMAZAMOX, AMMONIUM SALT	4.0
Glenn	Agriculture	IMAZAMOX, AMMONIUM SALT	2.0
Sacramento	Agriculture	IMAZAMOX, AMMONIUM SALT	7.9
Butte	Rights of Way	IMAZAPYR, ISOPROPYLAMINE SALT	0.7
Shasta	Rights of Way	IMAZAPYR, ISOPROPYLAMINE SALT	96.4
Colusa	Agriculture	IMAZETHAPYR	1.4
Glenn	Agriculture	IMAZETHAPYR, AMMONIUM SALT	31.9
Butte	Agriculture	IMIDACLOPRID	<0.0
Butte	Landscape Maintenance	IMIDACLOPRID	53.4
Butte	Structural Pest Control	IMIDACLOPRID	23.9
Colusa	Landscape Maintenance	IMIDACLOPRID	10.5
Colusa	Structural Pest Control	IMIDACLOPRID	2.1
Glenn	Structural Pest Control	IMIDACLOPRID	1.4
Sacramento	Agriculture	IMIDACLOPRID	2.3
Sacramento	Agriculture	IMIDACLOPRID	30.6
Sacramento	Landscape Maintenance	IMIDACLOPRID	23.1
Sacramento	Structural Pest Control	IMIDACLOPRID	57.0
Shasta	Landscape Maintenance	IMIDACLOPRID	0.2
Shasta	Structural Pest Control	IMIDACLOPRID	2.9
Tehama	Landscape Maintenance	IMIDACLOPRID	0.9

County	Type of Application	Chemical	Total lbs Applied
Tehama	Structural Pest Control	IMIDACLOPRID	5.0
Yuba	Landscape Maintenance	IMIDACLOPRID	0.2
Yuba	Structural Pest Control	IMIDACLOPRID	0.6
Sacramento	Agriculture	IPRODIONE	10.3
Sacramento	Landscape Maintenance	IPRODIONE	18.2
Tehama	Agriculture	IPRODIONE	1.6
Butte	Structural Pest Control	IRON PHOSPHATE	0.2
Glenn	Structural Pest Control	IRON PHOSPHATE	0.1
Sacramento	Landscape Maintenance	IRON PHOSPHATE	0.1
Sacramento	Structural Pest Control	IRON PHOSPHATE	0.7
Shasta	Structural Pest Control	IRON PHOSPHATE	0.1
Tehama	Structural Pest Control	IRON PHOSPHATE	<0.0
Yuba	Structural Pest Control	IRON PHOSPHATE	0.1
Butte	Agriculture	ISOXABEN	17.3
Butte	Landscape Maintenance	ISOXABEN	3.7
Butte	Rights of Way	ISOXABEN	6.0
Colusa	Rights of Way	ISOXABEN	70.5
Glenn	Rights of Way	ISOXABEN	135.5
Sacramento	Agriculture	ISOXABEN	922.0
Sacramento	Landscape Maintenance	ISOXABEN	72.5
Sacramento	Rights of Way	ISOXABEN	191.7
Sacramento	Structural Pest Control	ISOXABEN	0.9
Shasta	Rights of Way	ISOXABEN	84.3
Tehama	Landscape Maintenance	ISOXABEN	0.3
Tehama	Rights of Way	ISOXABEN	95.2
Yuba	Rights of Way	ISOXABEN	6.1
Butte	Agriculture	LAMBDA-CYHALOTHRIN	1.5
Butte	Structural Pest Control	LAMBDA-CYHALOTHRIN	4.2
Colusa	Structural Pest Control	LAMBDA-CYHALOTHRIN	0.1
Glenn	Structural Pest Control	LAMBDA-CYHALOTHRIN	0.1
Sacramento	Structural Pest Control	LAMBDA-CYHALOTHRIN	138.5
Shasta	Structural Pest Control	LAMBDA-CYHALOTHRIN	2.4
Tehama	Structural Pest Control	LAMBDA-CYHALOTHRIN	0.1
Yuba	Structural Pest Control	LAMBDA-CYHALOTHRIN	0.2
Butte	Agriculture	LIME-SULFUR	207476.4
Glenn	Agriculture	LIME-SULFUR	12713.6
Sacramento	Agriculture	LIME-SULFUR	246.7
Tehama	Agriculture	LIME-SULFUR	16565.1
Yuba	Agriculture	LIME-SULFUR	37440.0
Butte	Structural Pest Control	LIMONENE	0.1
Glenn	Structural Pest Control	LIMONENE	0.1

County	Type of Application	Chemical	Total lbs Applied
Sacramento	Structural Pest Control	LIMONENE	<0.0
Sacramento	Landscape Maintenance	LINALOOL	<0.0
Yuba	Structural Pest Control	LINALOOL	0.1
Colusa	Agriculture	LINURON	8.8
Butte	Agriculture	MAGNESIUM PHOSPHIDE	53.9
Colusa	Agriculture	MAGNESIUM PHOSPHIDE	25.4
Glenn	Agriculture	MAGNESIUM PHOSPHIDE	112.1
Sacramento	Agriculture	MAGNESIUM PHOSPHIDE	25.7
Tehama	Agriculture	MAGNESIUM PHOSPHIDE	51.9
Yuba	Agriculture	MAGNESIUM PHOSPHIDE	39.1
Yuba	Structural Pest Control	MAGNESIUM PHOSPHIDE	<0.0
Butte	Structural Pest Control	MALATHION	8.6
Sacramento	Structural Pest Control	MALATHION	201.8
Shasta	Structural Pest Control	MALATHION	0.5
Butte	Landscape Maintenance	MANCOZEB	9.6
Sacramento	Agriculture	MANCOZEB	3.1
Sacramento	Landscape Maintenance	MANCOZEB	159.3
Sacramento	Rights of Way	MANCOZEB	0.4
Shasta	Landscape Maintenance	MANCOZEB	14.9
Colusa	Agriculture	MANEB	1097.8
Glenn	Agriculture	MCPA, DIMETHYLAMINE SALT	116.3
Glenn	Rights of Way	MCPA, DIMETHYLAMINE SALT	1.8
Sacramento	Landscape Maintenance	MCPA, DIMETHYLAMINE SALT	5.2
Tehama	Agriculture	MCPA, DIMETHYLAMINE SALT	24.9
Sacramento	Landscape Maintenance	MCPA, ISOOCTYL ESTER	55.9
Yuba	Structural Pest Control	MCPA, ISOOCTYL ESTER	0.9
Sacramento	Landscape Maintenance	MCPP, DIMETHYLAMINE SALT	3.5
Sacramento	Structural Pest Control	MCPP, DIMETHYLAMINE SALT	0.3
Shasta	Landscape Maintenance	MCPP, DIMETHYLAMINE SALT	<0.0
Sacramento	Landscape Maintenance	MCPP, POTASSIUM SALT	4.1
Shasta	Landscape Maintenance	MCPP, POTASSIUM SALT	4.1
Glenn	Agriculture	MCPP-P, DIMETHYLAMINE SALT	13.0
Sacramento	Landscape Maintenance	MCPP-P, DIMETHYLAMINE SALT	1.2
Sacramento	Structural Pest Control	MCPP-P, DIMETHYLAMINE SALT	<0.0
Shasta	Landscape Maintenance	MCPP-P, DIMETHYLAMINE SALT	0.2
Tehama	Landscape Maintenance	MCPP-P, DIMETHYLAMINE SALT	<0.0
Butte	Landscape Maintenance	MECOPROP-P	0.3
Colusa	Landscape Maintenance	MECOPROP-P	<0.0
Glenn	Structural Pest Control	MECOPROP-P	0.1
Sacramento	Landscape Maintenance	MECOPROP-P	7.1
Sacramento	Structural Pest Control	MECOPROP-P	0.7

County	Type of Application	Chemical	Total lbs Applied
Shasta	Structural Pest Control	MECOPROP-P	0.5
Tehama	Landscape Maintenance	MECOPROP-P	0.1
Yuba	Structural Pest Control	MECOPROP-P	<0.0
Butte	Agriculture	MEFENOXAM	<0.0
Glenn	Agriculture	MEFENOXAM	1148.2
Sacramento	Agriculture	MEFENOXAM	3.1
Sacramento	Landscape Maintenance	MEFENOXAM	0.7
Butte	Agriculture	MESOSULFURON-METHYL	0.4
Glenn	Agriculture	MESOSULFURON-METHYL	1.6
Butte	Landscape Maintenance	METALAXYL	0.1
Sacramento	Landscape Maintenance	METALDEHYDE	11.6
Sacramento	Structural Pest Control	METALDEHYDE	2.2
Sacramento	Rights of Way	METAM-SODIUM	1016.8
Shasta	Rights of Way	METAM-SODIUM	11.1
Yuba	Rights of Way	METAM-SODIUM	64.3
Sacramento	Agriculture	METHIOCARB	4.5
Sacramento	Structural Pest Control	METHOMYL	<0.0
Butte	Puclic Health Pest Control	METHOPRENE	0.1
Butte	Structural Pest Control	METHOPRENE	<0.0
Colusa	Structural Pest Control	METHOPRENE	<0.0
Sacramento	Structural Pest Control	METHOPRENE	<0.0
Butte	Agriculture	METHYL BROMIDE	3087.6
Colusa	Agriculture	METHYL BROMIDE	58.0
Colusa	Structural Pest Control	METHYL BROMIDE	15.0
Glenn	Agriculture	METHYL BROMIDE	1090.7
Glenn	Rights of Way	METHYL BROMIDE	156.8
Sacramento	Agriculture	METHYL BROMIDE	0.6
Shasta	Agriculture	METHYL BROMIDE	2.7
Tehama	Agriculture	METHYL BROMIDE	63837.8
Yuba	Agriculture	METHYL BROMIDE	757.5
Shasta	Rights of Way	METHYL ISOTHIOCYANATE	2.0
Sacramento	Rights of Way	METRIBUZIN	0.5
Shasta	Agriculture	METRIBUZIN	99.8
Butte	Agriculture	MINERAL OIL	8688.9
Glenn	Agriculture	MINERAL OIL	1516.1
Sacramento	Agriculture	MINERAL OIL	3336.2
Sacramento	Landscape Maintenance	MINERAL OIL	37.0
Shasta	Landscape Maintenance	MINERAL OIL	17.6
Yuba	Agriculture	MINERAL OIL	15658.0
Sacramento	Agriculture	MOLINATE	0.9
Butte	Landscape Maintenance	MSMA	1.1

County	Type of Application	Chemical	Total lbs Applied
Colusa	Landscape Maintenance	MSMA	0.3
Sacramento	Landscape Maintenance	MSMA	13.6
Sacramento	Structural Pest Control	MSMA	1.0
Shasta	Landscape Maintenance	MSMA	3.9
Tehama	Landscape Maintenance	MSMA	0.1
Yuba	Structural Pest Control	MSMA	1.1
Sacramento	Landscape Maintenance	MUSCALURE	<0.0
Sacramento	Structural Pest Control	MUSCALURE	<0.0
Sacramento	Agriculture	MYCLOBUTANIL	0.5
Sacramento	Landscape Maintenance	MYCLOBUTANIL	2.7
Tehama	Agriculture	MYCLOBUTANIL	<0.0
Colusa	Landscape Maintenance	NALED	130.2
Butte	Agriculture	NAPROPAMIDE	14.4
Butte	Landscape Maintenance	NAPROPAMIDE	3.0
Butte	Rights of Way	NAPROPAMIDE	3.0
Colusa	Agriculture	NAPROPAMIDE	12.5
Tehama	Agriculture	NAPROPAMIDE	432.0
Butte	Agriculture	N-OCTYL BICYCLOHEPTENE DICARBOXIMIDE	<0.0
Butte	Structural Pest Control	N-OCTYL BICYCLOHEPTENE DICARBOXIMIDE	0.9
Colusa	Structural Pest Control	N-OCTYL BICYCLOHEPTENE DICARBOXIMIDE	<0.0
Glenn	Structural Pest Control	N-OCTYL BICYCLOHEPTENE DICARBOXIMIDE	<0.0
Sacramento	Structural Pest Control	N-OCTYL BICYCLOHEPTENE DICARBOXIMIDE	8.7
Shasta	Structural Pest Control	N-OCTYL BICYCLOHEPTENE DICARBOXIMIDE	0.8
Tehama	Structural Pest Control	N-OCTYL BICYCLOHEPTENE DICARBOXIMIDE	0.1
Yuba	Structural Pest Control	N-OCTYL BICYCLOHEPTENE DICARBOXIMIDE	0.3
Butte	Agriculture	NORFLURAZON	619.9
Glenn	Agriculture	NORFLURAZON	2313.2
Tehama	Agriculture	NORFLURAZON	260.0
Butte	Structural Pest Control	NOVIFLUMURON	<0.0
Sacramento	Structural Pest Control	NOVIFLUMURON	<0.0
Yuba	Structural Pest Control	NOVIFLUMURON	<0.0
Butte	Agriculture	ORYZALIN	16488.3
Butte	Landscape Maintenance	ORYZALIN	149.8
Butte	Rights of Way	ORYZALIN	334.8
Colusa	Agriculture	ORYZALIN	15766.3
Glenn	Agriculture	ORYZALIN	18422.5
Glenn	Rights of Way	ORYZALIN	27.0
Sacramento	Agriculture	ORYZALIN	5339.8
Sacramento	Landscape Maintenance	ORYZALIN	472.3
Sacramento	Rights of Way	ORYZALIN	1311.8
Shasta	Landscape Maintenance	ORYZALIN	5.0

County	Type of Application	Chemical	Total lbs Applied
Shasta	Rights of Way	ORYZALIN	4.0
Tehama	Agriculture	ORYZALIN	1808.0
Tehama	Landscape Maintenance	ORYZALIN	1.6
Tehama	Rights of Way	ORYZALIN	25.0
Yuba	Agriculture	ORYZALIN	3072.8
Yuba	Landscape Maintenance	ORYZALIN	1.4
Sacramento	Agriculture	OXADIAZON	0.3
Sacramento	Landscape Maintenance	OXADIAZON	12.0
Sacramento	Rights of Way	OXADIAZON	13.0
Shasta	Landscape Maintenance	OXADIAZON	0.6
Yuba	Landscape Maintenance	OXADIAZON	<0.0
Butte	Landscape Maintenance	OXYDEMETON-METHYL	1.7
Butte	Agriculture	OXYFLUORFEN	6639.7
Butte	Landscape Maintenance	OXYFLUORFEN	11.4
Butte	Rights of Way	OXYFLUORFEN	1.7
Colusa	Agriculture	OXYFLUORFEN	3302.0
Colusa	Landscape Maintenance	OXYFLUORFEN	1.9
Colusa	Rights of Way	OXYFLUORFEN	115.7
Glenn	Agriculture	OXYFLUORFEN	7041.4
Glenn	Rights of Way	OXYFLUORFEN	23.5
Sacramento	Agriculture	OXYFLUORFEN	3001.3
Sacramento	Landscape Maintenance	OXYFLUORFEN	2.1
Sacramento	Rights of Way	OXYFLUORFEN	58.2
Shasta	Agriculture	OXYFLUORFEN	4.8
Shasta	Landscape Maintenance	OXYFLUORFEN	3.1
Shasta	Structural Pest Control	OXYFLUORFEN	8.2
Tehama	Agriculture	OXYFLUORFEN	790.3
Tehama	Landscape Maintenance	OXYFLUORFEN	0.7
Tehama	Rights of Way	OXYFLUORFEN	5.5
Yuba	Agriculture	OXYFLUORFEN	2347.5
Yuba	Rights of Way	OXYFLUORFEN	14.4
Butte	Agriculture	PACLOBUTRAZOL	<0.0
Sacramento	Agriculture	PACLOBUTRAZOL	<0.0
Sacramento	Landscape Maintenance	PACLOBUTRAZOL	0.3
Sacramento	Rights of Way	PACLOBUTRAZOL	69.9
Shasta	Landscape Maintenance	PACLOBUTRAZOL	1.5
Shasta	Rights of Way	PACLOBUTRAZOL	4.6
Butte	Agriculture	PARAQUAT DICHLORIDE	3031.3
Colusa	Agriculture	PARAQUAT DICHLORIDE	2033.6
Colusa	Rights of Way	PARAQUAT DICHLORIDE	2.8
Glenn	Agriculture	PARAQUAT DICHLORIDE	6460.9

County	Type of Application	Chemical	Total lbs Applied
Glenn	Rights of Way	PARAQUAT DICHLORIDE	113.9
Sacramento	Agriculture	PARAQUAT DICHLORIDE	970.5
Shasta	Agriculture	PARAQUAT DICHLORIDE	503.1
Tehama	Agriculture	PARAQUAT DICHLORIDE	323.4
Yuba	Agriculture	PARAQUAT DICHLORIDE	110.2
Butte	Agriculture	PCNB	<0.0
Butte	Landscape Maintenance	PCNB	143.6
Sacramento	Landscape Maintenance	PCNB	56.9
Sacramento	Rights of Way	PCNB	60.0
Tehama	Landscape Maintenance	PCNB	6.0
Yuba	Landscape Maintenance	PCNB	41.7
Butte	Agriculture	PENDIMETHALIN	4665.2
Butte	Landscape Maintenance	PENDIMETHALIN	60.2
Butte	Rights of Way	PENDIMETHALIN	7.6
Colusa	Agriculture	PENDIMETHALIN	3158.2
Colusa	Landscape Maintenance	PENDIMETHALIN	10.2
Colusa	Rights of Way	PENDIMETHALIN	369.1
Glenn	Agriculture	PENDIMETHALIN	6692.4
Glenn	Landscape Maintenance	PENDIMETHALIN	90.9
Glenn	Rights of Way	PENDIMETHALIN	340.3
Glenn	Structural Pest Control	PENDIMETHALIN	1.9
Sacramento	Agriculture	PENDIMETHALIN	104.7
Sacramento	Landscape Maintenance	PENDIMETHALIN	500.1
Sacramento	Rights of Way	PENDIMETHALIN	12.0
Sacramento	Structural Pest Control	PENDIMETHALIN	30.3
Shasta	Agriculture	PENDIMETHALIN	26.3
Shasta	Landscape Maintenance	PENDIMETHALIN	39.0
Shasta	Landscape Maintenance	PENDIMETHALIN	3.9
Shasta	Rights of Way	PENDIMETHALIN	0.6
Shasta	Structural Pest Control	PENDIMETHALIN	24.0
Tehama	Agriculture	PENDIMETHALIN	204.5
Tehama	Landscape Maintenance	PENDIMETHALIN	10.6
Yuba	Agriculture	PENDIMETHALIN	1037.8
Yuba	Landscape Maintenance	PENDIMETHALIN	21.7
Butte	Structural Pest Control	PERMETHRIN	140.5
Colusa	Structural Pest Control	PERMETHRIN	5.7
Glenn	Structural Pest Control	PERMETHRIN	3.4
Sacramento	Landscape Maintenance	PERMETHRIN	2.5
Sacramento	Structural Pest Control	PERMETHRIN	392.4
Shasta	Structural Pest Control	PERMETHRIN	133.2
Tehama	Structural Pest Control	PERMETHRIN	11.5

County	Type of Application	Chemical	Total lbs Applied
Yuba	Structural Pest Control	PERMETHRIN	8.2
Butte	Puclic Health Pest Control	PETROLEUM DISTILLATES	137.4
Glenn	Structural Pest Control	PETROLEUM DISTILLATES	0.1
Sacramento	Landscape Maintenance	PETROLEUM DISTILLATES	519.1
Tehama	Structural Pest Control	PETROLEUM DISTILLATES	0.1
Yuba	Structural Pest Control	PETROLEUM DISTILLATES	0.6
Sacramento	Structural Pest Control	PETROLEUM DISTILLATES, AROMATIC	15.4
Sacramento	Agriculture	PETROLEUM DISTILLATES, REFINED	1518.3
Butte	Agriculture	PETROLEUM OIL, UNCLASSIFIED	7987.9
Butte	Landscape Maintenance	PETROLEUM OIL, UNCLASSIFIED	11.5
Butte	Structural Pest Control	PETROLEUM OIL, UNCLASSIFIED	3.1
Sacramento	Structural Pest Control	PETROLEUM OIL, UNCLASSIFIED	7.6
Shasta	Landscape Maintenance	PETROLEUM OIL, UNCLASSIFIED	11.3
Tehama	Agriculture	PETROLEUM OIL, UNCLASSIFIED	2039.6
Yuba	Agriculture	PETROLEUM OIL, UNCLASSIFIED	35183.7
Butte	Puclic Health Pest Control	PHENOTHRIN	0.3
Butte	Structural Pest Control	PHENOTHRIN	<0.0
Colusa	Structural Pest Control	PHENOTHRIN	0.0
Sacramento	Structural Pest Control	PHENOTHRIN	<0.0
Shasta	Structural Pest Control	PHENOTHRIN	<0.0
Butte	Structural Pest Control	PHENYLETHYL PROPIONATE	1.0
Glenn	Structural Pest Control	PHENYLETHYL PROPIONATE	<0.0
Sacramento	Structural Pest Control	PHENYLETHYL PROPIONATE	0.6
Shasta	Structural Pest Control	PHENYLETHYL PROPIONATE	<0.0
Tehama	Structural Pest Control	PHENYLETHYL PROPIONATE	<0.0
Yuba	Structural Pest Control	PHENYLETHYL PROPIONATE	<0.0
Butte	Agriculture	PHOSMET	123.2
Glenn	Agriculture	PHOSMET	136.5
Butte	Agriculture	PHOSPHINE	116.2
Colusa	Agriculture	Phosphine	5.4
Glenn	Agriculture	PHOSPHINE	18.8
Sacramento	Agriculture	PHOSPHINE	2.6
Tehama	Agriculture	PHOSPHINE	32.0
Butte	Agriculture	PIPERONYL BUTOXIDE	<0.0
Butte	Puclic Health Pest Control	PIPERONYL BUTOXIDE	1.5
Butte	Structural Pest Control	PIPERONYL BUTOXIDE	3.8
Colusa	Structural Pest Control	PIPERONYL BUTOXIDE	<0.0
Glenn	Structural Pest Control	PIPERONYL BUTOXIDE	1.3
Sacramento	Landscape Maintenance	PIPERONYL BUTOXIDE	<0.0
Sacramento	Structural Pest Control	PIPERONYL BUTOXIDE	22.8

County	Type of Application	Chemical	Total lbs Applied
Shasta	Structural Pest Control	PIPERONYL BUTOXIDE	1.8
Tehama	Structural Pest Control	PIPERONYL BUTOXIDE	0.5
Yuba	Structural Pest Control	PIPERONYL BUTOXIDE	2.9
Sacramento	Landscape Maintenance	POLYOXIN D	5.2
Sacramento	Agriculture	POTASSIUM N-METHYLDITHIOCARBAMATE	12704.2
Butte	Agriculture	PRODIAMINE	29.9
Butte	Landscape Maintenance	PRODIAMINE	3.6
Butte	Rights of Way	PRODIAMINE	46.9
Colusa	Rights of Way	PRODIAMINE	122.2
Glenn	Agriculture	PRODIAMINE	122.9
Glenn	Rights of Way	PRODIAMINE	234.9
Sacramento	Landscape Maintenance	PRODIAMINE	86.5
Sacramento	Rights of Way	PRODIAMINE	578.7
Sacramento	Structural Pest Control	PRODIAMINE	21.0
Shasta	Landscape Maintenance	PRODIAMINE	2.6
Shasta	Rights of Way	PRODIAMINE	20.4
Tehama	Landscape Maintenance	PRODIAMINE	0.7
Tehama	Rights of Way	PRODIAMINE	11.9
Yuba	Landscape Maintenance	PRODIAMINE	14.9
Yuba	Rights of Way	PRODIAMINE	10.6
Yuba	Structural Pest Control	PRODIAMINE	0.2
Butte	Structural Pest Control	PROPETAMPHOS	0.2
Sacramento	Structural Pest Control	PROPETAMPHOS	<0.0
Tehama	Structural Pest Control	PROPETAMPHOS	<0.0
Colusa	Landscape Maintenance	PROPICONAZOLE	1.3
Sacramento	Agriculture	PROPICONAZOLE	5.4
Sacramento	Landscape Maintenance	PROPICONAZOLE	23.7
Shasta	Landscape Maintenance	PROPICONAZOLE	20.4
Butte	Structural Pest Control	PROPOXUR	<0.0
Sacramento	Structural Pest Control	PROPOXUR	0.2
Shasta	Structural Pest Control	PROPOXUR	<0.0
Tehama	Structural Pest Control	PROPOXUR	<0.0
Tehama	Agriculture	PROPYLENE OXIDE	902.8
Sacramento	Agriculture	PROPYZAMIDE	83.0
Sacramento	Landscape Maintenance	PROPYZAMIDE	3.1
Tehama	Landscape Maintenance	PROPYZAMIDE	2.0
Yuba	Agriculture	PROPYZAMIDE	1.5
Colusa	Agriculture	PYRACLOSTROBIN	15.5
Glenn	Rights of Way	PYRAFLUFEN-ETHYL	0.8
Butte	Agriculture	PYRETHRINS	3.9
Butte	Puclic Health Pest Control	PYRETHRINS	0.3

County	Type of Application	Chemical	Total lbs Applied
Butte	Structural Pest Control	PYRETHRINS	1495.5
Colusa	Structural Pest Control	PYRETHRINS	<0.0
Glenn	Structural Pest Control	PYRETHRINS	0.1
Sacramento	Landscape Maintenance	PYRETHRINS	<0.0
Sacramento	Structural Pest Control	PYRETHRINS	4.1
Shasta	Structural Pest Control	PYRETHRINS	0.4
Tehama	Structural Pest Control	PYRETHRINS	0.1
Yuba	Structural Pest Control	PYRETHRINS	0.4
Butte	Agriculture	PYRIPROXYFEN	15.8
Butte	Structural Pest Control	PYRIPROXYFEN	0.1
Glenn	Agriculture	PYRIPROXYFEN	13.6
Glenn	Structural Pest Control	PYRIPROXYFEN	<0.0
Sacramento	Structural Pest Control	PYRIPROXYFEN	0.4
Shasta	Structural Pest Control	PYRIPROXYFEN	<0.0
Tehama	Structural Pest Control	PYRIPROXYFEN	<0.0
Yuba	Structural Pest Control	PYRIPROXYFEN	<0.0
Butte	Agriculture	SETHOXYDIM	15.3
Butte	Rights of Way	SETHOXYDIM	0.6
Glenn	Agriculture	SETHOXYDIM	58.5
Glenn	Rights of Way	SETHOXYDIM	0.2
Tehama	Rights of Way	SETHOXYDIM	0.6
Butte	Structural Pest Control	SILICA AEROGEL	4.3
Colusa	Structural Pest Control	SILICA AEROGEL	0.1
Glenn	Structural Pest Control	SILICA AEROGEL	1.0
Sacramento	Landscape Maintenance	SILICA AEROGEL	<0.0
Sacramento	Structural Pest Control	SILICA AEROGEL	23.8
Shasta	Structural Pest Control	SILICA AEROGEL	4.1
Tehama	Structural Pest Control	SILICA AEROGEL	1.5
Yuba	Structural Pest Control	SILICA AEROGEL	8.2
Butte	Agriculture	SIMAZINE	6563.8
Butte	Landscape Maintenance	SIMAZINE	248.5
Butte	Rights of Way	SIMAZINE	60.1
Colusa	Agriculture	SIMAZINE	415.8
Colusa	Rights of Way	SIMAZINE	21.6
Glenn	Agriculture	SIMAZINE	2380.0
Glenn	Landscape Maintenance	SIMAZINE	5.4
Glenn	Rights of Way	SIMAZINE	889.1
Glenn	Structural Pest Control	SIMAZINE	6.0
Sacramento	Agriculture	SIMAZINE	5512.6
Sacramento	Structural Pest Control	SIMAZINE	9.0
Tehama	Agriculture	SIMAZINE	2206.3

County	Type of Application	Chemical	Total lbs Applied
Tehama	Rights of Way	SIMAZINE	24.0
Yuba	Agriculture	SIMAZINE	385.4
Butte	Structural Pest Control	S-METHOPRENE	<0.0
Colusa	Structural Pest Control	S-METHOPRENE	<0.0
Glenn	Structural Pest Control	S-METHOPRENE	<0.0
Sacramento	Landscape Maintenance	S-METHOPRENE	<0.0
Sacramento	Structural Pest Control	S-METHOPRENE	0.1
Shasta	Structural Pest Control	S-METHOPRENE	<0.0
Tehama	Structural Pest Control	S-METHOPRENE	<0.0
Yuba	Structural Pest Control	S-METHOPRENE	<0.0
Sacramento	Landscape Maintenance	S-METOLACHLOR	91.4
Sacramento	Agriculture	SODIUM BROMIDE	148.1
Shasta	Structural Pest Control	SODIUM BROMIDE	49.8
Shasta	Landscape Maintenance	SODIUM CARBONATE PEROXYHYDRATE	0.4
Glenn	Rights of Way	SODIUM CHLORATE	345.0
Yuba	Landscape Maintenance	SODIUM DICHLORO-S-TRIAZINETRIONE	1.2
Sacramento	Agriculture	SODIUM DICHLORO-S-TRIAZINETRIONE DIHYDRATE	6.7
Sacramento	Rights of Way	SODIUM FLUORIDE	1273.4
Shasta	Rights of Way	SODIUM FLUORIDE	6.5
Sacramento	Agriculture	SODIUM HYPOCHLORITE	95.5
Shasta	Structural Pest Control	SODIUM HYPOCHLORITE	34.3
Tehama	Structural Pest Control	SODIUM HYPOCHLORITE	347.8
Glenn	Rights of Way	SODIUM METABORATE TETRAHYDRATE	557.8
Sacramento	Rights of Way	SODIUM NITRATE	1.1
Sacramento	Agriculture	SPINOSAD	0.6
Tehama	Agriculture	SPINOSAD	2.0
Tehama	Agriculture	SPINOSAD	1.2
Sacramento	Agriculture	STREPTOMYCIN SULFATE	0.6
Butte	Agriculture	STRYCHNINE	1.1
Butte	Landscape Maintenance	STRYCHNINE	<0.0
Butte	Rights of Way	STRYCHNINE	0.4
Colusa	Agriculture	STRYCHNINE	<0.0
Glenn	Agriculture	STRYCHNINE	3.1
Sacramento	Landscape Maintenance	STRYCHNINE	<0.0
Sacramento	Structural Pest Control	STRYCHNINE	<0.0
Shasta	Agriculture	STRYCHNINE	0.2
Tehama	Agriculture	STRYCHNINE	0.6
Tehama	Agriculture	STRYCHNINE	65.4
Yuba	Agriculture	STRYCHNINE	0.8
Yuba	Rights of Way	STRYCHNINE	<0.0
Yuba	Structural Pest Control	STRYCHNINE	0.1

County	Type of Application	Chemical	Total lbs Applied
Butte	Structural Pest Control	SULFLURAMID	<0.0
Sacramento	Landscape Maintenance	SULFLURAMID	<0.0
Sacramento	Structural Pest Control	SULFLURAMID	<0.0
Shasta	Structural Pest Control	SULFLURAMID	<0.0
Yuba	Structural Pest Control	SULFLURAMID	<0.0
Butte	Landscape Maintenance	SULFOMETURON-METHYL	0.4
Butte	Rights of Way	SULFOMETURON-METHYL	22.6
Colusa	Rights of Way	SULFOMETURON-METHYL	4.1
Glenn	Rights of Way	SULFOMETURON-METHYL	52.4
Sacramento	Landscape Maintenance	SULFOMETURON-METHYL	30.4
Sacramento	Rights of Way	SULFOMETURON-METHYL	358.2
Sacramento	Structural Pest Control	SULFOMETURON-METHYL	7.5
Shasta	Landscape Maintenance	SULFOMETURON-METHYL	0.3
Shasta	Landscape Maintenance	SULFOMETURON-METHYL	68.9
Shasta	Rights of Way	SULFOMETURON-METHYL	10.7
Tehama	Landscape Maintenance	SULFOMETURON-METHYL	0.5
Tehama	Rights of Way	SULFOMETURON-METHYL	1.7
Yuba	Rights of Way	SULFOMETURON-METHYL	18.7
Butte	Agriculture	SULFUR	697.6
Sacramento	Agriculture	SULFUR	1116.0
Sacramento	Landscape Maintenance	SULFUR	8.6
Butte	Agriculture	SULFURYL FLUORIDE	644.7
Butte	Structural Pest Control	SULFURYL FLUORIDE	272.3
Glenn	Structural Pest Control	SULFURYL FLUORIDE	18.8
Sacramento	Structural Pest Control	SULFURYL FLUORIDE	3303.6
Tehama	Structural Pest Control	SULFURYL FLUORIDE	30.6
Yuba	Agriculture	SULFURYL FLUORIDE	1955.1
Yuba	Structural Pest Control	SULFURYL FLUORIDE	105.9
Butte	Agriculture	TAU-FLUVALINATE	<0.0
Sacramento	Landscape Maintenance	TAU-FLUVALINATE	1.6
Butte	Rights of Way	TEBUTHIURON	1.3
Glenn	Rights of Way	TEBUTHIURON	66.9
Sacramento	Landscape Maintenance	TEBUTHIURON	76.8
Sacramento	Rights of Way	TEBUTHIURON	142.0
Tehama	Rights of Way	TEBUTHIURON	10.4
Sacramento	Agriculture	TERRAZOLE	13.5
Sacramento	Agriculture	THIOPHANATE-METHYL	64.3
Sacramento	Landscape Maintenance	THIOPHANATE-METHYL	37.0
Shasta	Landscape Maintenance	THIOPHANATE-METHYL	<0.0
Tehama	Landscape Maintenance	THIOPHANATE-METHYL	0.1
Yuba	Landscape Maintenance	THIOPHANATE-METHYL	49.0

County	Type of Application	Chemical	Total lbs Applied
Butte	Agriculture	THIRAM	0.6
Butte	Structural Pest Control	THYME	1.6
Glenn	Structural Pest Control	THYME	<0.0
Sacramento	Structural Pest Control	THYME	0.6
Tehama	Structural Pest Control	THYME	<0.0
Shasta	Agriculture	THYMOL	231.5
Sacramento	Structural Pest Control	TRALOMETHRIN	0.1
Sacramento	Landscape Maintenance	TRIADIMEFON	0.4
Sacramento	Rights of Way	TRIADIMEFON	<0.0
Yuba	Landscape Maintenance	TRICHLORO-S-TRIAZINETRIONE	8.9
Butte	Landscape Maintenance	TRICLOPYR, BUTOXYETHYL ESTER	42.3
Butte	Rights of Way	TRICLOPYR, BUTOXYETHYL ESTER	9.6
Butte	Structural Pest Control	TRICLOPYR, BUTOXYETHYL ESTER	33.3
Colusa	Landscape Maintenance	TRICLOPYR, BUTOXYETHYL ESTER	0.4
Colusa	Rights of Way	TRICLOPYR, BUTOXYETHYL ESTER	11.2
Glenn	Landscape Maintenance	TRICLOPYR, BUTOXYETHYL ESTER	27.3
Glenn	Rights of Way	TRICLOPYR, BUTOXYETHYL ESTER	16.3
Glenn	Structural Pest Control	TRICLOPYR, BUTOXYETHYL ESTER	0.3
Sacramento	Landscape Maintenance	TRICLOPYR, BUTOXYETHYL ESTER	55.0
Sacramento	Rights of Way	TRICLOPYR, BUTOXYETHYL ESTER	130.4
Sacramento	Structural Pest Control	TRICLOPYR, BUTOXYETHYL ESTER	1.4
Shasta	Agriculture	TRICLOPYR, BUTOXYETHYL ESTER	1.3
Shasta	Landscape Maintenance	TRICLOPYR, BUTOXYETHYL ESTER	7.1
Tehama	Landscape Maintenance	TRICLOPYR, BUTOXYETHYL ESTER	8.8
Tehama	Rights of Way	TRICLOPYR, BUTOXYETHYL ESTER	22.3
Yuba	Landscape Maintenance	TRICLOPYR, BUTOXYETHYL ESTER	1.7
Yuba	Structural Pest Control	TRICLOPYR, BUTOXYETHYL ESTER	0.3
Butte	Rights of Way	TRICLOPYR, TRIETHYLAMINE SALT	1.2
Colusa	Structural Pest Control	TRICLOPYR, TRIETHYLAMINE SALT	1.1
Sacramento	Landscape Maintenance	TRICLOPYR, TRIETHYLAMINE SALT	0.5
Sacramento	Rights of Way	TRICLOPYR, TRIETHYLAMINE SALT	8.4
Sacramento	Structural Pest Control	TRICLOPYR, TRIETHYLAMINE SALT	0.1
Shasta	Rights of Way	TRICLOPYR, TRIETHYLAMINE SALT	535.6
Yuba	Rights of Way	TRICLOPYR, TRIETHYLAMINE SALT	0.8
Sacramento	Agriculture	TRIFLOXYSTROBIN	0.2
Sacramento	Landscape Maintenance	TRIFLOXYSTROBIN	1.4
Sacramento	Agriculture	TRIFLUMIZOLE	1.2
Butte	Landscape Maintenance	TRIFLURALIN	2.4
Sacramento	Agriculture	TRIFLURALIN	269.9
Sacramento	Landscape Maintenance	TRIFLURALIN	30.4
Sacramento	Rights of Way	TRIFLURALIN	346.3

County	Type of Application	Chemical	Total lbs Applied
Sacramento	Structural Pest Control	TRIFLURALIN	11.7
Tehama	Landscape Maintenance	TRIFLURALIN	1.0
Yuba	Agriculture	TRIFLURALIN	0.2
Yuba	Landscape Maintenance	TRIFLURALIN	7.5
Yuba	Rights of Way	TRIFLURALIN	7.9
Sacramento	Structural Pest Control	WARFARIN	<0.0
Shasta	Landscape Maintenance	WARFARIN	1.1
Butte	Agriculture	XYLENE RANGE AROMATIC SOLVENT	4.0
Sacramento	Landscape Maintenance	ZINC CHLORIDE	12.4
Shasta	Structural Pest Control	ZINC NAPHTHENATE	0.3
Sacramento	Agriculture	ZINC PHOSPHIDE	1.0
Sacramento	Landscape Maintenance	ZINC PHOSPHIDE	0.6
Sacramento	Rights of Way	ZINC PHOSPHIDE	0.1
Sacramento	Structural Pest Control	ZINC PHOSPHIDE	0.6
Butte	Agriculture	ZIRAM	511.4
Sacramento	Agriculture	ZIRAM	19.0
Shasta	Agriculture	ZIRAM	0.6
Yuba	Agriculture	ZIRAM	3380.8