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November 30, 2009

Ms. Stephanie Fong
Central Valley Regional Water Quality Control Board
11020 Sun Center Drive, Suite 200
Rancho Cordova, CA 95670

Board of Directors

Representing:

County of Sacramento

County of Yolo

City of Citrus Heights

City of Elk Grove

City of Folsom

City of Rancho Cordova

City of Sacramento

City of West Sacramento

Re: Comments on Acute Toxicity of Ammonia/um and Wastewater Treatment Effluent - Associated Contaminants on Delta Smelt – 2009, Draft Report (10/30/09).

Dear Ms. Fong,

The Sacramento Regional County Sanitation District (District) is providing the attached comments on Acute Toxicity of Ammonia/um and Wastewater Treatment Effluent - Associated Contaminants on Delta Smelt – 2009, Draft Report (10/30/09), by Werner, I., L.A. Deanovic, M. Stillway, and D. Markiewicz.

SRCS D continues to be a partner with the Central Valley Regional Water Quality Control Board (CVRWQCB) and UC Davis Aquatic Toxicity Lab (ATL) in this study since it began in the early 2008. We are pleased to continue providing our technical input and logistical support that have helped make these studies successful and have added valuable perspective to this project.

This draft report gives a clear presentation of the study findings, but the report would benefit from a more balanced interpretation of these data and environmental relevance in several important discussions. It is the District's understanding that environmental relevance was an intended focus of these studies as defined in the original sampling and analysis plan which tries to link the laboratory tests with real world conditions (The Effects of Wastewater Treatment Effluent Associated Contaminants on Delta Smelt Ammonia Toxicity Sampling and Analysis Plan. Final. Werner, Irvine, and Foe 7/28/08).

"Hypothesis 1: Delta smelt survival is negatively impacted (i.e., increased mortality) by ambient ammonia concentrations in the Sacramento River with increasing concentrations causing increased mortality under the study conditions."

However, when ambient conditions are discussed in the report they sometimes paint an unnecessarily alarming picture by presenting only extreme environmental conditions for comparison with effect levels from this study (e.g., see specific comment 5).

Mary K. Snyder
District Engineer

Stan R. Dean
Director of Policy and Planning

Prabhakar Somavarapu
Director of Operations

Marcia Maurer
Chief Financial Officer

Claudia Goss
Director of Communications

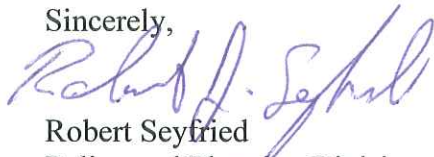
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SRCSO suggests presenting environmentally relevant or average conditions in the Delta, which would provide a more realistic assessment of these data. SRCSO would also suggest that the report describe the environmental relevance related to the effect levels from SRWTP effluent, namely that ten times the average percent effluent discharged to the river was needed to affect Delta smelt.

In addition, this report holds a much different interpretation of 2009 test data than that provided for the 2008 Delta smelt effluent-ammonia bioassays (Werner et al. 2009) in terms of reference toxicity data and variability in ammonia concentrations in paired treatments. Results that were considered extreme enough to invalidate test results in 2008 are apparently now acceptable for the 2009 test results (e.g., see specific comments 7, 14, and 29). Since the 2009 test is a repeat of the July 2008 test it would be appropriate to evaluate both data sets based on the same acceptability criteria, namely those criteria agreed upon at a meeting of the POD-CWT ammonia subcommittee (April 8, 2009). If the 2008 data are not re-evaluated for a comparison with the results in this report, then we strongly recommend a comprehensive report summarizing all ammonia-effluent Delta smelt toxicity data when these tests are concluded.

The District's detailed comments and recommendations are attached. We hope that these and other comments can be discussed at the next POD-CWT, if necessary. The District is ready to continue participating in these studies in search of solutions to the POD. Please feel free to contact Cameron Irvine at (916) 875-9179 or at Irvinec@sacsewer.com if you have any questions

Sincerely,



Robert Seyfried
Policy and Planning Division
Sacramento Regional County Sanitation District

Attachments

cc: Pamela Creedon, Central Valley Regional Water Quality Control Board
Mary Snyder, District Engineer, SRCSD
Stanley Dean, District Manager, SRCSD
Prabhakar Somavarapu, Plant Manager, SRCSD
Mitch Maidrand, Principal Civil Engineer, SRCSD
Robert Seyfried, Senior Civil Engineer, SRCSD
Terrie Mitchell, Legislative and Regulatory Affairs Manager, SRCSD
Cameron Irvine, CH2MHill
Debbie Webster, Executive Officer, Central Valley Clean Water Agencies
Dr. Inge Werner, Aquatic Toxicology Laboratory, UCD

ATTACHMENT 1

SRCS D Comments on “Acute Toxicity of Ammonia/um and Wastewater Treatment Effluent-Associated Contaminants on Delta Smelt – 2009” Draft Report (10/30/09), by Werner, I., L.A. Deanovic, M. Stillway, and D. Markiewicz.

GENERAL COMMENTS

General Comment 1. Please confirm that you are presenting the correct number of significant figures. Fewer significant figures are probably appropriate.

General Comment 2. This report holds a very different interpretation of reference toxicity data and toxicity data in relation to ammonia concentrations in paired treatments than was provided for the 2008 delta smelt effluent-ammonia bioassays (Werner *et al.* 2009). Results that were considered extreme enough to invalidate test results in 2008 are apparently acceptable for the 2009 test results (e.g., also see specific comments 7, 14, and 29). While we seem unable to agree on whether or not the 2008 data met the test acceptability criteria defined in the formal sampling and analysis plan (Werner *et al.* 2008), we contend that it would be appropriate to re-evaluate these data based on the acceptability criteria applied to the 2009 test reported here, which were agreed upon at a meeting of the POD-CWT ammonia subcommittee (April 8th, 2009). This is especially relevant since the 2009 test is a repeat of the July 2008 test. There is a great deal of value in all of the smelt toxicity testing completed by the ATL and it is a shame to see an entire tests invalidated when at least some of the test hypotheses evaluated can be interpreted. If July 2008 test data are not re-evaluated for a comparison between the results from two years of this study, then we strongly recommend a comprehensive report summarizing all ammonia-effluent delta smelt toxicity data at the completion of these evaluations.

SPECIFIC COMMENTS

SECTION 1 – EXECUTIVE SUMMARY

Comment 1: page 4, third paragraph. It is a bit confusing to mention three control samples in the preceding paragraph, but only results provided for two of them in the following paragraph. Reporting survival in the Garcia Bend Field Control – as written on page 13, paragraph 3, second sentence would alleviate this confusion.

Comment 2: page 4, third paragraph. Please consider describing the environmental relevance of these concentrations in the executive summary. The concentration of effluent in river water that caused significant mortality (18%) was approximate 10 times the effluent concentration in the Sacramento River during sampling.

SECTION 2 – BACKGROUND

Comment 3: page 5, fourth paragraph. This would be an appropriate section to describe the percent of SRWTP effluent that is typically present in the Sacramento River (~2%), which is important for determining the environmental relevance of this study and the effect concentrations determined.

Comment 4: page 5, fourth paragraph. Please include the EPA acute ammonia criteria range. This number is even more relevant than the chronic benchmarks provided, since this is an acute toxicity study.

Comment 5: page 5, fourth paragraph. In addition to describing water quality criteria for ammonia associated with the maximum pH and temperature conditions in the Delta, please also describe the average concentrations in the Sacramento River and their associated water quality criteria benchmarks. It would also be very helpful to describe how frequently, when, and where you expect these maximum temperature and pH conditions to occur. RMP data show that a pH over 8.3 has been reported in less than 10% of ambient delta samples. These are important considerations for determining environmental relevance of the study data.

Comment 6: page 5, second paragraph. It is encouraging to see the 2008 study referenced to provide context to the current study. However, the District believes 7/17/08 effluent-ammonia study did yield some conclusive data. Please consider reporting that these tests showed that high concentrations of effluent (up to 32%) did not cause significantly lower survival than controls. This finding is worthy of mention, even if we cannot agree if it is appropriate to compare the data in terms of ammonia concentrations.

Comment 7: page 5, second fifth paragraph. While we are unable to agree on whether or not the ammonia-effluent-smelt toxicity data in 2008 met the test acceptability criteria defined in the formal sampling and analysis plan (Werner *et al.* 2008), we contend that it would be appropriate to evaluate these 2008 data based on the acceptability criteria presented in the 2009 test reported here. This is especially relevant since the 2009 test is a repeat of the July 2008 test and the present draft report does provide a comparison with many past results. None of the reasons previously given for invalidating these 2008 data stand up to review.

- 1) The statement that “*Test protocol specified that delta smelt survival in both culture facility and low-EC control water be at least 60 percent for the test results to be considered acceptable.*” is inconsistent with the sampling and analysis plan (SAP). The SAP states only that “*Hatchery controls <60% would invalidate the test*”, but does not specifically state anything about the low-EC control. Reconsideration of test acceptability criteria and data analysis for these tests by the POD-CWT ammonia subcommittee that were adopted for interpreting 2009 bioassays (April 8th, 2009) supported the conclusion that low EC controls are of secondary importance to Garcia Bend Field Controls (water used for ammonia and effluent treatments) and poor performance of the low-EC controls are insufficient to invalidate test results.

- 2) Concerns that “*SRWTP effluent reduced the pH at the highest exposure concentration thus reducing the concentration of pH-dependent ammonia, while the ammonium chloride treatment did not show this effect*” are unfounded. The maximum difference in pH was 0.24 pH units, only 3 percent less in effluent-ammonia treatments than in Garcia Bend-ammonia treatments. Further, differences in unionized ammonia were equally different between treatments in 2009 as they were in 2008. 2008 test results were considered invalid because of 9-16% lower ammonia concentration (maximum measured) in effluent-ammonia treatments. However, in 2009 there is no discussion of a 16-36% greater ammonia concentration (maximum measured) in effluent-ammonia treatments than in paired Garcia Bend-ammonia treatments in 2009. Similarly, mean ammonia concentrations in 2008 were 20-29% lower in effluent-ammonia than in Garcia Bend-ammonia, but mean ammonia concentrations up to

20% greater in effluent-ammonia than in Garcia Bend-ammonia received no discussion in 2009. Please provide a discussion addressing these issues.

- 3) The rationale that sensitive smelt, as indicated by reference toxicity testing in 2008, compromised the test results is unsubstantiated. Reference toxicity data show that Delta smelt tested in July 2008 were indeed the most sensitive tested, but this means they would be most likely to show adverse effects, and they did not. These smelt sensitivities were also well within 2 standard deviations of the running-mean reference toxicity result and meet EPA test acceptability criteria for reference toxicity tests. Likewise, some of the 2009 reference toxicity data presented in this report lie just outside the first standard deviation of the mean, just like the 2008 test in question, but the sensitivity of those fish are called “similar” to the larvae sensitivities in 2008. This would be apparent if reference toxicity data were plotted, as are typically done in toxicity reports. Please provide plots of the reference toxicity data.
- 4) Any suggestion that low EC affected larval delta smelt should be considered in light of the high survival shown in Garcia Bend (Field Control) water with only 115-119 uS/cm.

SECTION 3 MATERIALS AND METHODS

SECTION 3.2 AMMONIA/UM – SRWTP EFFLUENT TEST

Comment 8: page 7, first paragraph. Please include the LOEC in addition to the NOEC determined in 2008 in this description of the basis for test concentrations. The relevance of the NOEC is diminished when presented as an unbounded no-effect concentration.

SECTION 3.3 TESTS WITH DELTA SMELT

Comment 9: Page 9, first paragraph. The heading numbers seem to be out of place. Section 3.3.4 should not precede Section 3.3.2.

Comment 10: page 11, first paragraph. “Four to seven-day flow-through tests...” Please clarify which tests were 4 days and which were 7 days. I first thought this might mean that seven-day tests were conducted with survival counts made on the fourth and seventh day. Later it became clear that only one LC50 test was continued to 7 days.

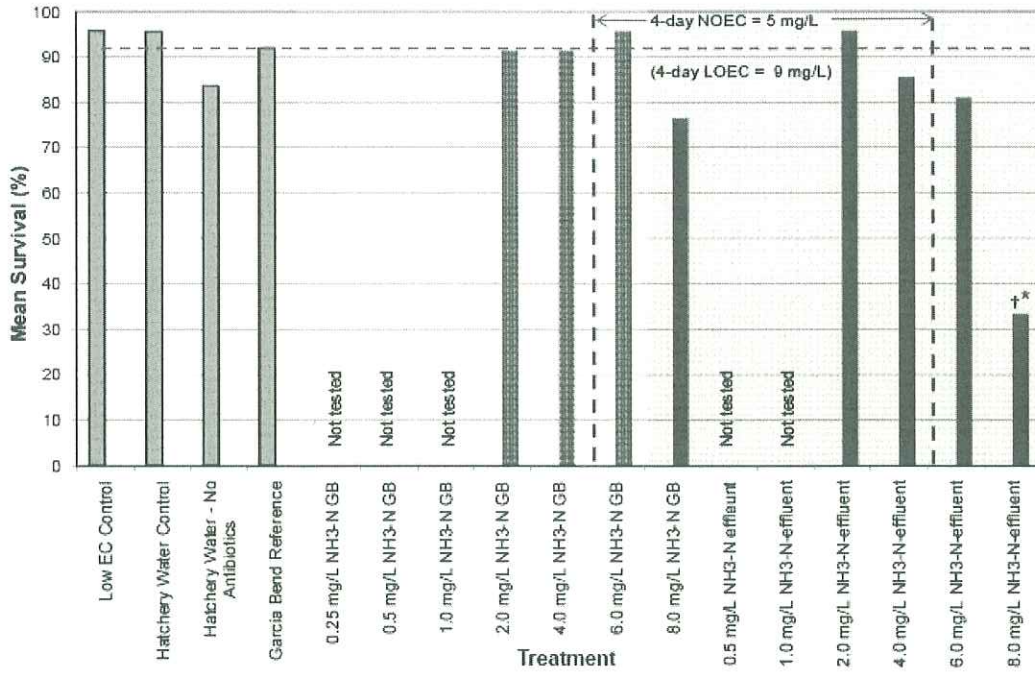
SECTION 4 – RESULTS

SECTION 4.1 TESTS WITH DELTA SMELT

SECTION 4.1.1 AMMONIA/UM AND SRWTP EFFLUENT EXPOSURES

Comment 11: page 13, fourth paragraph. It may be helpful to present these data in a figure, rather than just in a table. An example is provided below.

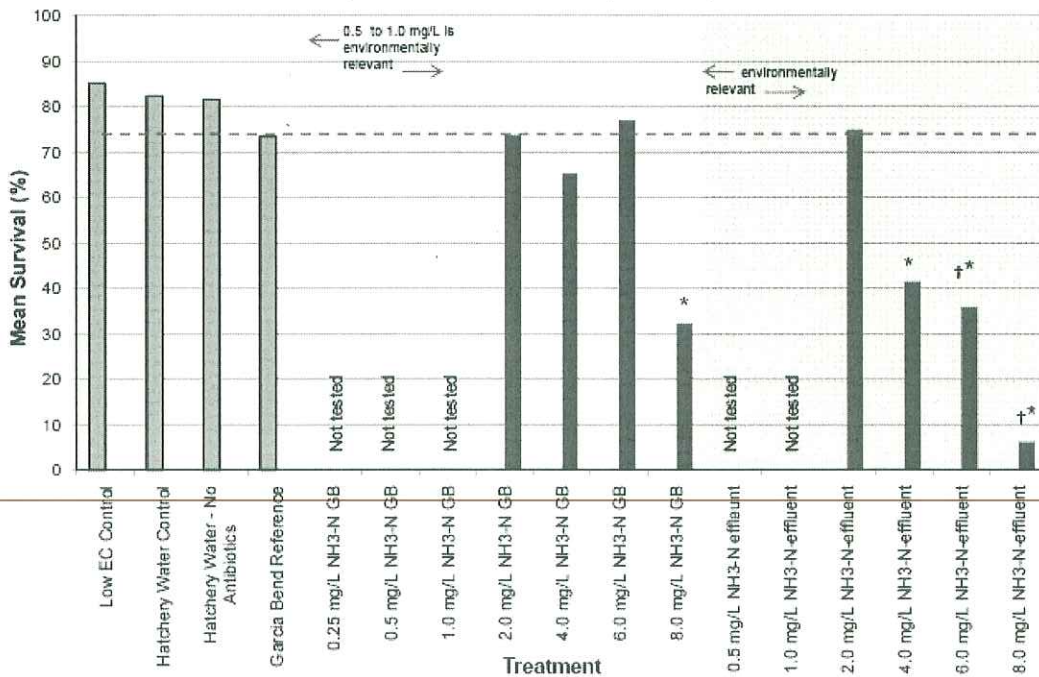
4 day Acute Delta Smelt Toxicity Bioassays June 10 17, 2009



* Indicates a significant difference from the Garcia Bend Control

† Indicates a significant difference between ammonia-effluent and the corresponding ammonia-GB treatments

7-day Acute Delta Smelt Toxicity Bioassays - June 10-17, 2009

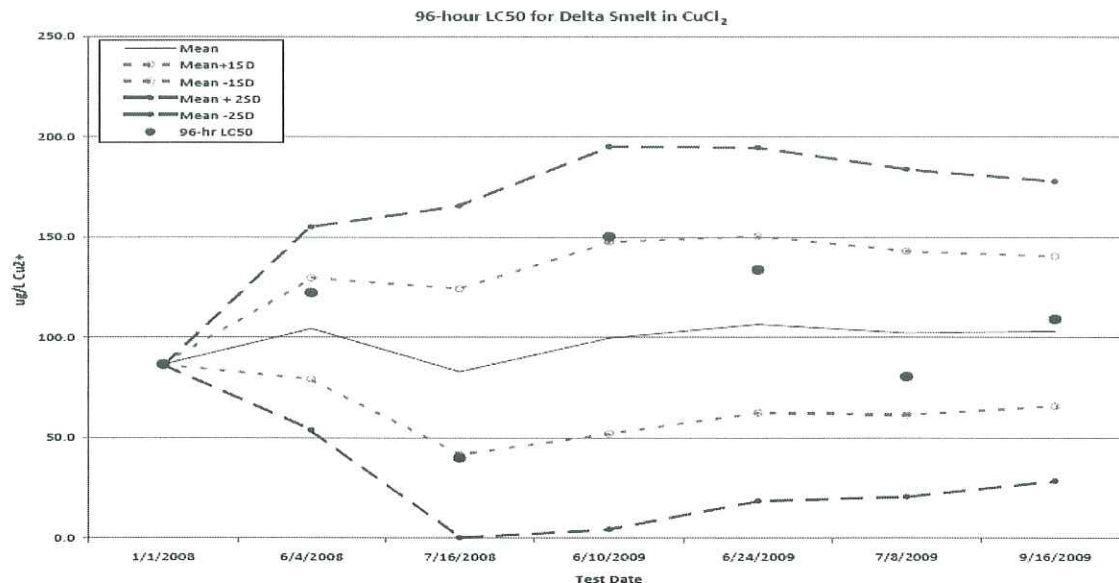


† Indicates a significant difference from the Garcia Bend Control

* Indicates a significant difference between ammonia-effluent and the corresponding ammonia-GB treatments

SECTION 4.1.3 COPPER REFERENCE TOXICANT TESTS

Comment 12: page 23, first paragraph. It is difficult to follow the history of reference toxicity test data for delta smelt as written, and some data are missing. Please present all historical delta smelt reference toxicity data for comparison with the current results. Reference toxicity testing is meant to allow a comparison of organism sensitivity among current and past bioassays. It would be very helpful to present these data visually as is typically done in toxicity reports (example shown below for delta smelt reference toxicity data).



Comment 13: page 23, first paragraph. Delta smelt age at testing has been repeatedly stated to be an important factor in delta smelt sensitivity. Please consider presenting the age of delta smelt used for reference toxicity tests when discussing test endpoints.

SECTION 5 – QUALITY ASSURANCE/QUALITY CONTROL

SECTION 5.1 POSTIVIVE CONTROL TESTS WITH DELTA SMELT

Comment 14: page 30, fifth paragraph. It would be appropriate and consistent with USEPA recommendations to interpret delta smelt reference toxicity data in the context of two standard deviations of the running mean, as is done for fathead minnow reference toxicity tests. Some of the 2009 reference toxicity data presented in this report lie just outside the first standard deviation of the mean of all reference toxicity test results (i.e., 150 mg/L), just like the 2008 test data (40 mg/L) that was invalidated for this very reason. However, in 2009 these fish sensitivities are called “similar” to the initial reference toxicity results in 2008 (87 mg/L). Please explain the rationale for these disparate interpretations of reference toxicity data and their validation of these bioassays.

SECTION 6 – DISCUSSION AND CONCLUSIONS

Comment 15: page 31, second paragraph. It is not clear if or how a “first tier” investigation differs from a screening study, or what significance this term implies. Please consider using language describing this test that is consistent with that used in the past to avoid confusion. This was called a “screening study” when performed in 2008 and when discussed in meetings.

Comment 16: page 31, third paragraph. This study began in 2008 with two objectives. The second of these hypotheses is presented in the report. Please consider mentioning the other hypothesis that is also addressed by this study, especially since it is mentioned as a conclusion on the following page

Comment 17: page 31, third paragraph. The District believes it is incorrect to state that the hypothesis listed “...delta smelt survival is negatively impacted by one of more contaminant(s) that are positively correlated with ammonia/um from SRWTP” could not be addressed to any degree by previous tests. Neither Test I n test II (2008) found significantly reduced delta smelt survival at environmentally relevant effluent concentrations bracketing those that occur in the Sacramento River. This is a significant finding of the 2008 tests (Tests I and II) that cannot be disputed. Please include these important findings and provide a comparison with the current results.

Comment 18: page 32, second paragraph. The text states a LOEC of 9% effluent. This is inconsistent with the results presented in Table 3-2 where the NOEC was 9% effluent and the LOEC was 18% effluent. Please correct this statement.

Comment 19: page 33, second paragraph. Please describe the environmental relevance of effluent concentrations at the NOEC and LOEC. For example, the concentration of effluent in river water that caused significant mortality (18%) was approximately 10 times the average effluent concentration in the Sacramento River (~2%). The NOEC for effluent (7-day) was determined to be 9% and effects did not occur until effluent comprised 18% of the test solution. This is relevant information that is ignored when considering the potential for adverse effects in the environment on page 33. “*These criteria may not be protective of larval delta smelt especially when considering the additional toxicity of unknown effluent-associated contaminants (Table 13).*” The potential for adverse acute effects from effluent is very low when considering the NOEC and LOEC effect levels from effluent.

Comment 20: page 33, Table 13. Please add the USEPA acute ammonia criteria to this table, since these are the relevant benchmarks for comparing acute toxicity test results from this study.

Comment 21: page 33, Table 13. Please explain why a range of 30-day Chronic Criteria are presented for single temperature and pH values, rather than a single chronic criterion.

Comment 22: page 33, Table 13. The District suggests changing the fifth column heading from “30-d Chronic Criterion Ammonia” to “30-d Chronic Criterion Ammonia *Equivalent*”. The USEPA ammonia/ium criteria are based on total ammonia and it is misleading to state these criteria are unionized ammonia concentrations.

Comment 23: page 33, third paragraph. The District disagrees with the assertions that chronic toxicity may be occurring in the Sacramento River. This was based on extrapolating worst case acute-to-chronic ratios (ACRs) to chronic values for Delta smelt and then comparing these hypothetical benchmarks with ambient data. Instead, an analysis of available paired pH, temperature and ammonia data should be performed to make the most credible assessment of chronic toxicity conditions in the river. At a minimum, please qualify this discussion as an extremely conservative (e.g., worst possible case) exercise and not as a likely situation.

Comment 24: page 33, third paragraph. Please consider increasing the credibility and utility of the ACR discussion by including recent results from pilot Delta smelt chronic testing (i.e., swimming impairment). These tests showed threshold chronic effects to delta smelt at concentrations similar to those that caused acute effects. This translates into a species specific ACR closer to 1.

Comment 25: page 33, third paragraph. Please comment on the fact that RBT LC50s are typically in the 10's to 20's mg/L NH₃-N and use of the ACRs cited (15-24) would drive these values below the EPA chronic criterion.

SECTION 7 – UNCERTAINTIES AND RECOMMENDATIONS FOR FUTURE STUDIES

Comment 26: page 34, third paragraph. Please consider qualifying this sentence. For example “*Significant uncertainties remain with respect to the [potential for] deleterious effects of ammonia/um and SRWTP effluent in the Sacramento-San Joaquin Delta:*”

Comment 27: page 34, fifth paragraph. Please consider qualifying the first statement by adding that these effects occurred at effluent concentrations well above than those that occur in the Sacramento River.

Comment 28: page 34, fifth paragraph. Please comment on the potential for adverse effects in the Sacramento-San Joaquin Delta from ammonia concentrations near background (0.001 mg/L), as referenced by Buhl (2002).

Comment 29: page 34, third paragraph. Please expand the uncertainty discussion to include how effects from differences in pH/unionized ammonia in test concentrations may have affected the test results. As an example, consider commenting on how there is no discussion of up to 20% greater ammonia concentrations (mean) in effluent-ammonia treatments than in paired Garcia Bend-ammonia treatments in 2009; whereas, differences of 20-30% lower ammonia concentrations were one of the reasons for invalidating test results in 2008. Likewise, maximum measured ammonia concentrations up to 36% greater in the effluent-ammonia treatments were not mentioned in 2009 tests. Mean ammonia differences less than 30% at the effect concentration invalidated test results in 2008.

Comment 30: Please consider adding to the uncertainty descriptions that the 2009 results represent only a single toxicity test (up to three if the results from 2008 are portrayed). Therefore, these results do not account for variability in smelt, effluent quality, or river water quality among other things.

Comment 31: page 35. Please consider adding the recommendation to repeat this study. It is very surprising to see the reproducibility of this study omitted from the listed recommendations, especially when there have already been discussions of when these repeated tests could occur.

Comment 32: page 35. Please consider adding the recommendation to conduct 7-day LC50 data for larvae delta smelt exposed to ammonia/ium. This is a critical data gap to allow comparison with the 7-day effluent-ammonia and Garcia Bend-ammonia bioassays. Especially since LC50s for the 4-day effluent-ammonia and Garcia Bend-ammonia bioassays (7.2 and >7.7 mg/L) were both very different from the LC50 test results of 11.6 mg/L in lab water. Only one 7-day LC50 study has been conducted, and this was with juvenile smelt (149 dph) which were shown to be less sensitive to ammonia than larvae used in effluent-ammonia bioassays.