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August 15, 2013

Ms. Betty Yee
Senior Water Resources Control Engineer
Central Valley Regional Water Quality Control Board
11020 Sun Center Drive #200
Rancho Cordova, CA 9670

Dear Ms. Yee:

This letter will serve as my peer review of the Proposed Basin Plan Amendments to Add Policies for Variances and Exceptions. Please note that I am sending you this on university stationary but the opinions and statements are my personal conclusions and do not represent the opinion of the University of California or any other individuals or departments at the University.

I have reviewed the July 2013 Draft Staff Report on policies for variances from surface water quality standards for "Point Source Discharges, Variance Program for Salinity, and Exception from Application of Water Quality Objectives for Salinity" and the supporting/referenced documents in the two CDs you sent to me. I will use the term "Total Dissolved Solids" or TDS to refer to salinity.

It is my understanding that the eventual salinity target concentrations for the Central Valley and the Tulare Lake Basin are not yet available and will not become available until after permits need to be issued for wastewater treatment plants in these basins. Therefore the treatment plants may be faced with an unknown discharge permit and may need to build treatment process that may not be able to comply with the eventual target TDS, or may produce effluent that has lower TDS than necessary. In either case, there will be an economic loss associated with the incorrect process sizing or selection.

Reducing the TDS of a wastewater is difficult and there are few processes that can remove TDS or salts from wastewater. The draft report notes that the primary candidate processes are electro dialysis, reverse osmosis (RO) and nano filtration. I am quite familiar with both nano filtration and RO since I have used both in my pilot research projects. Electro dialysis is less commonly used in wastewater reclamation because it only removes the salts and does not reduce the organics. I agree that RO is the best alternative for reducing the TDS. Nano filtration is not as good a choice since it does not usually remove monovalent ions; hence the TDS is partially reduced but the resulting water quality may not have an optimum blend of ions for reclamation use (too high a percentage of sodium and chloride). The cost of RO tertiary treatment is still high, even though great progress has been made in the last 20 years with membranes that operate at lower pressure. I agree with the staff findings that RO is be the best process and that it will be expensive.

Checking the cost estimates developed by the three consultants is beyond the scope of this review, but I know that the cost of adding RO can equal the total cost of secondary treatment, at some sites. Also the cost of adding RO and operating the RO plant will vary among treatment plants as a function of their existing treatment processes. Those plants using lagoons or trickling filters for secondary treatment will require more pretreatment and expense that those plants using an activated sludge process, especially for an activated process operating in biological nutrient removal mode.

I found the discussion on page 26 of the draft report especially important. This page discusses the potential reductions of TDS in the Delta based upon reducing the effluent TDS from the treatment plants. They are marginal and make me wonder what benefits might be provided by increasing the cost of treatment with RO addition.

I read the consultant reports on the CD in detail since I am very familiar with treatment plants. I agree with their analysis and conclusions. The reductions in influent TDS to the treatment plants by source control is impressive. I think the analyses are generally well done and accurate. The general conclusion of the Staff and consultants is that secondary treatment plants do not remove TDS, and indeed this is so.

A point that the consultants do not make is that certain processes in secondary treatment plants may increase the TDS of the wastewater. As these plants endeavor to reduce the TDS as low as possible, they should consider the use of two technologies: the first is advanced primary treatment, and the second is disinfection by chlorine or chloramines. The three example plants do not use advanced primary treatment, as far as I can tell, but some of the plants impacting the Delta salinity may use advanced primary treatment.

Advanced primary treatment is a useful technique to reduce the influent chemical oxygen demand (COD) and total suspended solids (TSS) concentration to the following secondary treatment processes. In this way the load is reduced on the secondary processes, which may delay the need to expand the plant or reduce overall energy consumption. Advanced primary has been practiced by most of the southern California coastal plants and Point Loma in San Diego is the best example. With advanced primary treatment, coagulants are added to the primary influent which increase the primary clarifier efficiency. Usually a metal salt, such as ferric chloride, and an organic polymer are used. The ferric chloride has additional benefits if anaerobic digestion is used. The disadvantage of this technique is that the TDS of the wastewater is increased. It may be 20 mg/L or so depending on the coagulant dose. The organic polymer does not increase the TDS.

A second place where the treatment plants may increase the TDS is through chlorination. Both chlorination with free chlorine or chloramination will increases the effluent TDS. The sulfur dioxide used for dechlorination produces sulfate as a byproduct. Disinfection by UV is a popular alternative for disinfection and adds no TDS to the water. It also minimizes the transport of hazardous chemicals.

As progress is made towards meeting the TDS goals, the treatment plants should reconsider the use of metal salts as coagulants, as well as upgrading chlorine disinfection processes to UV processes.

Another issue that concerns me about using RO to remove TDS from the treatment plant effluent is future competition for this high quality water. It is possible that the RO product water, especially if an advanced disinfection process is used, will be of higher quality that the drinking water available in these communities. It seems there could be a debate about why this water is being discharged as opposed to being reused. Indeed this thought brings up a host of possibilities if the eventual TDS objectives require RO treatment to reduce treatment plant effluent TDS. One possibility is to use RO on the drinking water supply to improve drinking water quality - the reduced TDS will carry though to the treatment plant and have the same benefit as treating its effluent. Importantly, the cost of treating the drinking water will be lower than the cost of treating the same volume of wastewater.

I believe there are several issues that should be addressed before large investments are made in building and operating RO plants to reduce treatment plant effluent TDS. I do not believe all possible options have been explored and some of these options cannot be evaluated until the target TDS is known. Also, RO technology is relatively mature but advances are still being made; therefore waiting to build the RO plants will allow the improved technologies to be used.

I have also read the various conditions and instructions in the draft proposal. I am not an expert in this area and have no recommendations to make on the wording of the document.

In summary, I can find no flaws in the staff recommendation on page 22 to adopt alternative 4 and their recommendation on page 29 to adopt alternative 2.

Very truly yours,

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