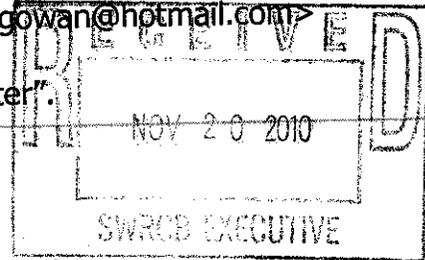


**commentletters - Comment Letter – CEC Monitoring for Recycled Water”.**

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**Date:** Saturday, November 20, 2010 10:00 PM  
**Subject:** Comment Letter – CEC Monitoring for Recycled Water”



**ANTIBIOTIC RESISTANT BACTERIA IN RECYCLED WATER DESTINED FOR AQUIFER RECHARGE**

To: The State Water Resources Control Board, via Ms. Jeanine Townsend, SWRCB  
 Fm: Dr Edo McGowan  
 Re: Comments on CEC Panel Final Report, preparatory to the State Water Resources Control Board hearing on monitoring constituents of emerging concern in recycled water during its December 15, 2010 board meeting.

Please provide these comments sufficiently ahead of the hearing to give the Board an adequate opportunity to digest this material.

In its final report, the CEC Panel fudges with its words about disqualifying itself when discussing antibiotic resistance. It is critical to understand that the Panel had no expertise in the subject but nonetheless, chose to give opinions. This stance by the Panel may tend to confuse decision-makers and the public and that, from a public health perspective, is a reckless disregard for the truth and the citizens of this state.

Let's then carefully go through the CEC Panel's Final Report and provide examples of the above and why clarification is wanting **before** the State Board takes action.

On page 3 of the Final Report, we find the following: **"The Panel also chose not to consider the occurrence of waterborne microbial pathogens or their acquisition of antibiotic resistance."** The Panel by this statement tells the reader that **there are** waterborne microbes; it does not say the "potential" occurrence. It then goes on to indicate : **"Given the multiple barrier concept and water treatment process redundancy requirements in place, the Panel believes that the potential public health risk associated with exposure to pathogens in recycled water used for landscape irrigation or groundwater recharge is very small. However, the Panel acknowledges that some uncertainties exist regarding the occurrence of emerging waterborne microbial pathogens and encourages additional research into their fate in water reuse systems."**

But this is nonsense, the Panel admits it has no expertise but then opines that exposure is small and then backtracks on itself that there are uncertainties and that more research is needed. What is the Panel really saying here to aid the decision-maker in a policy judgment when the decision-maker is also not expert in the subject?

The Panel then equivocates that-----**"There is no doubt that treatment through wastewater plants reduces the number of pathogenic bacteria (Harwood, Levine et al. 2005; Rijal, Zmuda et al. 2009; Zhang, Marrs et al. 2009); however, there is controversy in the literature as to whether the reduction is sufficient (Harwood, Levine et al. 2005; Chang, Toghrol et al. 2007)) and whether the coliform assays used as surrogates are sufficient (Zhang, Marrs et al. 2009)."**

This statement by the Panel on reduction of numbers of pathogenic bacteria (no mention is made about virus, viruses in the lysogenic state, and antibiotic resistant genes) should be placed in context along with the material from the US/EPA study on wastewater plants as conducted by the Wastewater Research Division, Municipal

Environmental Research Laboratory, U.S. Environmental Protection Agency, Cincinnati, Ohio, See: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC241834/pdf/aem00183-0119.pdf>. This US/EPA study was conducted 3 decades ago and comes to conclusions far different from the Panel. Thus, it is not that the information is not there, especially if one looks at the citations within the US/EPA study and the scientific literature since then, it is just that this Panel was unfamiliar with the research because of its lack of expertise. Thus it really can not guide the decision-maker, and thus the decision-maker may be badly misled.

From the US/EPA study:

"Several researchers have pointed out that wastewater, treated or untreated, is a primary contributor of bacteria to the aquatic ecosystem (12, 16, 17, 20, 27, 29). Studies have been conducted which demonstrate that significant numbers of multiple drug-resistant coliforms occur in rivers (17), bays (9), bathing beaches (28), and coastal canals (13). Waters contaminated by bacteria capable of transferring drug resistance are of great concern since there is the potential for transfer of antibiotic resistance to a pathogenic species."

The critical aspect here and something that seems to have gone over the head of the Panel is that we are discussing the transfer of genetic information from bacteria and that includes transfer to humans. Infections with antibiotic resistant organisms now kill more Americans than AIDS.

The US/EPA report noted above, thus continues as follows:

"When bacteria which carry transmissible R-factors (R+ bacteria) are ingested by a human host, the R-factors may transfer into commonly occurring bacteria of the gastrointestinal tract (32). These organisms may subsequently transfer this resistance to pathogenic organisms, resulting in reduced efficacy of antimicrobial chemotherapy in the event of an infection. In vivo studies have shown that when individuals carrying R+ bacteria are subjected to antibiotic therapy, these organisms flourish and transfer their resistance to other bacteria (25).

The Panel then notes: "**The Panel was not charged with this important question and suggests that further research into this problem is necessary and may require resources at the Federal level.**" Is the Panel then suggesting that absent this critical information that the decision-makers merely punt and hope that the Feds will at some future point actually do some research? In discussing the generation of antibiotic resistance via wastewater treatment with US/EPA, the CDC, and the inter Agency Task force on Antibiotic resistance, I am told by each that nothing in this area is going on. US/EPA additionally tells me that have no scientists working on this topic. Thus we go back to the work done on antibiotic resistance by US/EPA three decades ago, which is cited above, stating:-----"**wastewater, treated or untreated, is a primary contributor of bacteria to the aquatic ecosystem**"

The Panel notes that there are-----"**Concerns that California drinking water augmentation projects may add to the problem of antibiotic-resistant bacteria containing antibiotics and antimicrobials in trace amounts are not likely to be a problem in California water recycling programs....**" This is a curious sentence. It may demonstrate more clearly that the Panel did not really understand the issue since it is not expert. Let us dissect the sentence and I think that will be instructive. First, as constructed it appears, that in

the mind of the Panel, there is a problem with antibiotic resistant bacteria because they are containing antibiotics and antimicrobials. It is in fact the genetic information that is the worry but that seems to be missed on the Panel which concerns itself with the trace amounts of the antibiotics and antimicrobials. Trace amounts of antibiotics and antimicrobials, while important to the maintenance of resistance is not the key issue. It is the ability of genes to transfer to humans and the antibiotic resistant genes are so small that they pass through typical filters used in water quality control and are immune to chlorine used at typical levels in water treatment; thus they survive. We, in the scientific community, are now picking up antibiotic resistant genes (ARGs) in the nation's drinking water supply. How did those genes get into the drinking water supply? If we go back to the US/EPA study and reread the insert from the US/EPA study above, we note that "bacteria carrying transmissible R-factors, when ingested by a human transfer that genetic information to bacteria of the gastrointestinal tract and subsequently to pathogenic organisms, resulting in reduced efficacy of antimicrobial chemotherapy." This is critical because we not only now have resistant pathogens that can kill within 24 hours but the human gut will generate vast numbers of resistant microbes in 24 hours. These then go back through the wastewater treatment plants and back out into the environment. We have a revolving door and each cycle shows increased virulence and resistance.

The panel, with the above noted thought, skipped-over or not understood, assures the reader that:-----**"The concentrations of these antibiotics and antimicrobials, and others, in finished water that is used for recharge projects are below levels that cause resistance to occur de novo (Watkinson, Murby et al. 2007) and thus are not likely to be the source of antibiotic resistance."** Again, the principal point is the genetic information, thus the above assurance by the Panel has little real meaning and is in fact dangerous because it may tend to assure the decision-maker that all is well.

The Panel continues----- **"There is keen interest in the potential health effects of drug resistant microbes, which are already present in the environment, potentially becoming resistant because of exposure to low concentrations of antibiotics. At sub-inhibitory doses, antibiotics may lead to increased resistance in bacteria – but the concentrations found in recycled water are at least three orders of magnitude lower than the concentrations needed for resistance (Watkinson, Murby et al. 2007)."**

Here we have more of the same, ignoring or not understanding that the issue is genes and again leading the decision-maker down a primrose path by either dismissing this or through ignorance, just missing this critical point.

The Panel notes-----**Treatment processes at reclamation facilities effectively reduced the amount of both MRSA and the meca gene, however, did not eliminate them (Börjesson, Melin et al. 2009).** By the apparent lack of understanding within the Panel that these bacteria can and do reproduce at high rates and that genetic information may be passed to and maintained by non-pathogens and the human gut, the Panel again misses the point, hence misguiding the decision-maker.

The Panel notes that more investigation is warranted. We would agree that this is true and thus the decision-maker must await such investigation before lunging ahead blindly and consequently putting the public at risk. The Panel mentions the work of Harwood which was predicated on the WERF study by Rose that came out in detail in 2004. Let's look at Harwood's work, a study conducted over a year's time which reviewed finished reclaimed (recycled) water in Florida, Arizona and also in California under Title 22:

"Microorganisms were detected in disinfected effluent samples at the following frequencies: total coliforms, 63%; fecal coliforms, 27%; enterococci, 27%; C. perfringens, 61%; F-specific coliphages, ~40%; and enteric viruses, 31%. Cryptosporidium oocysts and Giardia cysts were detected in 70% and 80%, respectively, of reclaimed water samples. Viable Cryptosporidium, based on cell culture infectivity assays, was detected in 20% of the reclaimed water samples. No strong correlation was found for any indicator-pathogen combination. When data for all indicators were tested using discriminant analysis, the presence/absence patterns for Giardia cysts, Cryptosporidium oocysts, infectious Cryptosporidium, and infectious enteric viruses were predicted for over 71% of disinfected effluents. The failure of measurements of single indicator organism to correlate with pathogens suggests that public health is not adequately protected by simple monitoring schemes based on detection of a

single indicator, particularly at the detection limits routinely employed."

It is quite clear from the work of Harwood that the finished reclaimed (recycled) water is not by any stretch of the imagination, free of human health risk.

Thus until the state has a full grasp of the potential impacts to human health from the use of recycled water, it should place a moratorium on its use for artificial recharge and its use in food crop production.