12/4/07 Bd. Mtg.
Water Recycling Policy
Deadline: 10/26/07 by Noon

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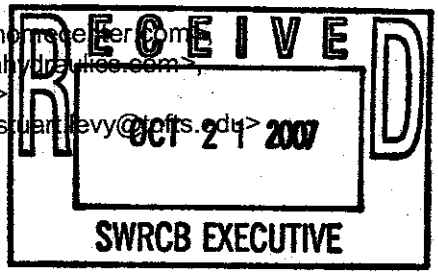

To: Ms Townsend, SWRCB
Re: Addendum to Edward McGowan's comments on proposed water recycling policy
Fm: Dr Edo McGowan

In addressing your Board recently in Los Angeles (proposed Water Recycling Policy as part of its October 2, 2007 board meeting in Los Angeles), I was allowed 3 minutes to deliver my comments and was abruptly cut off. The Board thanked me and noted that they had PREVIOUSLY received my comments. That statement by the Board was incorrect; what I was attempting to say that day (Oct 2, 2007) was that the Board's staff environmental analyses were deficient, this was not included in previous comments as I had not seen the staff report before the day of the hearing, including its environmental analyses.

I indicated within my testimony that I stood as an expert and noted that the following portions of the staf environmental analyses, noted below, were deficient. As expert commenting on CEQA issues, I have moved the leverage that should drive an EIR. Credible expert testimony that a project may have a significant impact, even if contradicted, is generally dispositive: under such circumstances an EIR must be prepared (see City of Livermore v LAFCO [1st Dist 1986] 184 Cal App 3d 531, 541-42 [230 Cal Rptr 867]. Indeed, an EIR is required precisely in order to resolve the dispute among experts---see Guide to CEQA p. 226, 10th Ed 1999.

Further, this may also be able to drive an EIS as the feds must make some decision that there is consistency between PL 92-500 and state law, which allows the state to continue to operate as its servant in this arena. State systems will be changed by this policy which impacts consideration of incidental runoff, hence PL 92-500, et seq.

The areas I noted as being deficient in the state's analyses of environmental impacts are as follows:

AG RESOURCES---Bioaccumulation of pathogens and pollutants in soils and crops will thus impact agriculture and its products. Changes in soil biota and runoff (incidental runoff carrying genetic material conferring both resistance and virulence), hence impacting biodiversity intra and extra agriculture. Both of these are potentially significantly adverse. The paper by R.E. Andrews and T.E. Loynachan, of the Iowa State University of Science and Technology (9706089 Tn 916 Mediated Genetic Exchange from Genetically Engineered Microbes to Soil Microbes) along with the lay press discussion of community acquired methicillin resistant Staph aureus heightens this issue to that of a nationsl crisis on antibiotic resistant pathogens. The World health Organization notes that antibiotic resistance is a Global Crisis. Since recycled water carries both pathogens and their genetic materjal, this is an adverse impact and one that is cumulative. Sorry people, there is no way around this from either a medical or scientific perspective. The only way out is political and your Board should be outside of politics.

The WERF paper by Rose, et al demonstrated that Title 22 water carried significant numbers of pathogens. My own work has demonstrated that this water carries multi-drug resistant bacteria (MDRB). The work by Pruden, et al demonstrates that sewer plants and then later drinking water treatment plants fail to effectively eliminate antibiotic resistant genes (ARGs). These ARGs are not susceptible to levels of chlorine used by industry. There are little data on the impacts of UV on these genetic fragments, thus this gives no assurance. Again, ozone data are scarce, thus we are on the cutting edge here and thus we need the analyses of an EIR. Because of the robustness of this genetic material, these genes are found in

the potable water supply. I had mentioned that we found two pharmacies that were using potable water supplies as raw stock to make sterile water for mixing medications. We found MDRB in this water and it was being used to make up medications.

As noted in the Andrews paper, broad-spectrum conjugative elements are able to mobilize themselves and other genetic information of both chromosomal and plasmid origin. These are transferable to soil organisms and thus, may play in important role in the development of the antibiotic resistant microbial population in both animals and humans. As wastes are introduced into the soil, the evidence shows that these organisms remain for at least six months. During this time, there is opportunity for genetic exchange between these members of the mammalian gut flora and soil microbes that contain other antibiotic resistance genes. Andrews noted that the presence of even small quantities of the antibiotic would substantially enhance this process. During this genetic exchange, antibiotic resistance may be passed to the microflora and the enterococcal population may pick up new resistances.

Build up of antibiotics within soils from reclaimed water is discussed by Chad Kinney, et al.

Andrews notes----------"My group has established the former, namely, that, in laboratory microcosms, Nitrococcus spp receive Tn916 from the enterococci. After receiving new antibiotic resistance the enterococci may be reestablished in the animal or human guts by passage through the environment."

He goes on to note--------"Antibiotic resistance among bacteria is becoming an increasing problem in both human and animal medicine. Strains resistant to virtually all commonly used antibiotics have been isolated from nosocomial infections. Many believe that the misuse and overuse of antibiotics contribute to this problem. Although development of resistant populations is serious, a far more serious situation may be created if these resistant phenotypes become linked to, or mobilized by, naturally occurring conjugal elements in the ecosystem. Conjugal elements may be, in part, responsible for the recent increase in pathogenic bacteria showing multiple resistance to antibiotics."

The paper by Andrews is correct---there is a problem and it has not been recognized by your Board. Here is the problem--- If the organism (big or small) is irritated, it will shift toward a more comfortable attitude and that may thus include survival modes. In the microbes, this may take on development of resistance and entering a viable but non-culturable state, or it may become a persister. Additionally, one needs to consider development of biofilms, especially with the nutrient rich water that is recycled water. This is not confined to antibiotics that are found in recycled water. As shown by Ian Pepper and others for soil organisms, this development of resistance can be against 2-4D, a phenoxy herbicide. We also know that recycled water does not remove many materials that can induce resistance. Disinfectants (triclosan) can see shifts that confer resistance. This along with human pathogens go through with the recycled water onto already primed lands.

In agricultural lands, heavy metals (mixed with fertilizer to get rid of toxic waste) and pesticides can confer resistance within the soil microbes. Not everything within a pesticide formulation is the active ingredient, there are carriers and other materials and these also may irritate soil organisms. If these things, as added to soils, irritate the soil microbes, they will shift toward resistance----same metabolic machinery that works for antibiotics. Thus already within agricultural soils there is a population of resistant organisms. Now dump onto this already primed resistant system, a new set of genetic information----genetic information related to human pathogens that allows the adoption of virulence and antibiotic resistance through the application of Title 22 water. You have exacerbated the system that does then allow for potentially significant human health problems.

Thus these microbes can be brought back into the house----and now tie Pat Rusin/Chuck Gerba's paper on pathogens from household items, from finger to mouth, then add on Stu Levy's work on transfer along various gut bacteria of different animals, tack on Maria Sjolund's work showing extended in residence time for maintaining resistance in the gut flora, then look at Schentag's work--------and you have a problem---a potentially significant adverse problem.

Schentag, et al. (2003), in Walsh, followed surgical patients with the subsequent results. Pre-op nasal

cultures found Staphylococcus aureus 100% antibiotic susceptible. Pre-op prophylactic antibiotics were administered. Following surgery, cephalosporin was administered. Ninety percent of the patients went home at post-op day 2 without infectious complications. Nasal bacteria counts on these patients had dropped from 10/5th to 10/3rd, but were now a mix of sensitive, borderline, and resistant Staphylococcus sp. By comparison, prior to surgery, all of the patients' Staphylococcus samples had been susceptible to antibiotics. For the patients remaining in the hospital and who were switched on post-op day 5 to a second generation cephalosporin (ceftazidine), showed bacterial counts up 1000-fold when assayed on post-op day 7 and most of these were methicillin resistant Staphylococcus aureus (MRSA). These patients were switched to a 2-week course of vancomycin. Cultures from those remaining in the hospital on day 21, revealed vancomycin resistant enterococcus (VRE) and candida. Vancomycin resistant enterococci infections can produce mortality rates of between 42 and 81%.

Note in the above, that these patients harbored NO resistant bacteria in their nasal cavities upon entry to the hospital.

But what would be the result if there had been inadvertent acquisition of resistance from environmental contamination such as through recycled water? Gerba and Rusin [9] conducted research about the passage from finger to mouth of pathogens found on typical household objects. Others have documented dust as a mechanical vector for pathogens. Thus what of the dwelling down wind from land application of sewer sludge or from a sewage sludge composting facility? Gerba and others have written extensively about the survival of pathogens and their viable infectivity once they are absorbed onto sediments [10]. Anyone who lives in an agricultural area knows that tillage and wind cause large movements of soil and dust. The USGS has written extensively on the movement of dust from Africa, across the Atlantic and carrying with it viable pathogens thus causing respiratory disease in the Caribbean [11].

[10] Rusin P, et al. Comparative surface-to-hand and fingertip-to-mouth transfer efficiency of gram-positive bacteria, gram-negative bacteria, and phage. J Appl Microbiol. 2002;93(4):585-92; See also: Shivi Selvaratnam and J. David Kunberger.
Increased frequency of drug-resistant bacteria and fecal coliforms in an Indiana Creek adjacent to farmland amended with treated sludge. Can. J. Microbiol./Rev. can. microbiol. 50(8): 653-656 (2004).

[11] Gerba CP et al. Effect of sediments on the survival of Ericherichia coli in marine waters. AEM July 1976 114-20. LaBelle RL, et al. Influence of pH, salinity and organic matter on the absorption of enterovirus to estuarine sediments. AEM July 1979 93-101---sediment can act as a reservoir for enterovirus.

[12] Griffin DW. African desert dust in the Caribbean atmosphere: Microbiology and public health. Aerobiologia. 2001 Sept : Volume 17, Number 3, pp. 203 - 213

[13] Sjolund et al. (2005) Emerging Infectious Diseases (Vol. 11, # 9, Sept 2005 @ p. 1389 et seq),

[14] Giacometti A, Cirioni O, Kamysz W, Silvestri C, Licci A, D'Amato G, Nadolski P, Riva A, Lukasiak J, Scalise G. In vitro activity and killing effect of uperin 3.6 against gram- positive cocci isolated from immunocompromised patients. Antimicrob Agents Chemother. 2005 Sep;49(9):3933-6. Robertson GT, Zhao J, Desai BV, Coleman WH, Nicas TI, Gilmour R, Grinius L, Morrison DA, Winkler ME. Vancomycin tolerance induced by erythromycin but not by loss of vncRS, vex3, or pep27 function in Streptococcus pneumoniae. J Bacteriol. 2002 Dec;184(24):6987-7000.].

[15] Walsch, C. Antibiotics---, Actions, Origins, Resistance, (March 2003) New York: ASM Press.

AIR QUALITY---Increased removal of solids to attain the clarity of water needed for Title 22 will see increased biosolids. Each ton of land applied or composted biosolids will produce 3,000 cu ft of methane. Thus there will be an accumulative added adverse impact to greenhouse gas emission, a potentially significant adverse impact. This may be prohibited by the recent Calif Supreme Court decision. Additionally, spray irrigation of recycled water will see down wind drift of pathogens and other irritants. In a true aerosol, the drift distances are impressive, thus potentially impacting large areas.

BIO RESOURCES---Accumulation of pollutants and adverse impacts on biodiversity and riparian systems may produce a series of adverse and cumulative impacts. The paper discussing movement of pathogens and the build up of pollutants such as pharmaceuticals from reclaimed water is discussed by Kinney, et al. Additionally, the incidental off-site movement discussed in the policy would allow for the movement of genetic material conferring both resistance and virulence.

Increased frequency of drug-resistant bacteria and fecal coliforms in an Indiana Creek adjacent to farmland amended with treated sludge

Shivi Selvaratnam and J. David Kunberger
Can. J. Microbiol./Rev. can. microbiol. 50(8): 653-656 (2004)

Abstract: Many studies indicate the presence of human pathogens and drug-resistant bacteria in treated sewage sludge. Since one of the main methods of treated sewage disposal is by application to agricultural land, the presence of these organisms is of concern to human health. The goal of this study was to determine whether the frequency of drug-resistant and indicator bacteria in Sugar Creek, which is used for recreational purposes, was influenced by proximity to a farmland routinely amended with treated sludge (site E). Surface water from 3 sites along Sugar Creek (site E, 1 upstream site (site C) and 1 downstream site (site K)) were tested for the presence of ampicillin-resistant (AmpR) bacteria, fecal and total coliforms over a period of 40 d. Site E consistently had higher frequencies of AmpR bacteria and fecal coliforms compared with the other 2 sites. All of the tested AmpR isolates were resistant to at least 1 other antibiotic. However, no isolate was resistant to more than 4 classes of antimicrobials. These results suggest that surface runoff from the farmland is strongly correlated with higher incidence of AmpR and fecal coliforms at site E.
Key words: drug-resistant bacteria, indicator bacteria, treated sludge, surface runoff.

Hospital effluent: A source of multiple
drug-resistant bacteria
V. Chitnis, D. Chitnis*,†, S. Patil** and Ravi Kant*

The present work was carried out to study the spread of multiple drug-resistant (MDR) bacteria from hospital effluent to the municipal sewage system. The MDR bacteria population in hospital effluents ranged from 0.58 to 40% for ten hospitals studied while it was less than 0.00002 to 0.025% for 11 sewage samples from the residential areas. Further, the MDR bacteria carried simultaneous resistance for most of the commonly used antibiotics and obviously the spread of such MDR bacteria to the community is a matter of grave concern.
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Ribeiro [12] and others [13] have found that as these organisms progress further through sewer treatment, the level of resistance and number of transferred plasmids increases. Reinthaler et al [14] found that the highest resistance rates were found in E. coli strains of a sewage treatment plant which treats not only municipal sewage but also sewage from a hospital. Thus, these authors concluded that sewage treatment

processes contribute to the dissemination of resistant bacteria in the environment.

13] Nakamura S, Shirota H. Behavior of drug resistant fecal coliforms and R plasmids in a wastewater treatment plant] Nippon Koshu Eisei Zasshi 1990 Feb;37(2):83-90.

HAZARDS---Pathogens, their genetic material, pharmaceuticals, endocrine disrupters, etc impacting via incidental runoff and soil erosive forces to down-gradient systems will produce an adverse and cumulative impact, see also cites above.

HYDROLOGY---Pathogens and pharmaceuticals will have a cumulative adverse impact. This is in contradiction to anti degradation policies as well as state law. Water Code 13550(a)(3) notes that the use of recycled water will not have a detrimental impact on public health. H&SC 5410 (d) notes that contaminant means any impairment of water quality by waste to a degree that impacts public health. This then feeds into H&SC 5411 that notes that no person shall discharge sewage or other waste or effluent in any manner that will result in contamination, pollution, or nuisance. Nuisance is included in H&SC 5410 (f) to mean anything that is injurious to health. Certainly pathogens and the genetic information conferring antibiotic resistance that are transferable to the human gut bacteria are injurious to health.

With increased availability of potable water offset by recycled water, there will be growth, thus an inter locking train of potentially cumulative adverse impacts to the following: Land Use, Noise, Population & Housing, Public Services, Recreation Needs, Transportation/Circulation, Utilities/Services.

Further, Incidental runoff does not consider movement of pathogens and their genetic material and the establishment of environmental niches that act as lending libraries for resistance and virulence. Finding number 10 is not supported by science, and thus impacts #7b on p.4. Because of the ability of genetic material to be transferred and to establish niches and biofilms, very small original numbers can become very impressive numbers in short number. Because of communicable disease potentials, this can easily get out of control.

It is much more perverse and complicated than the above but this will give you some ideas of what they are playing with. The staff fails to appreciate this, hence the EIR/EIS are need.

LAND USE. The cumulative impacts from an added water source (recycled water) on land use will see a coupled train of impacts related to land use decisions, hence services. That water and land use are tied together is noted by a recent decision examining the intersection between land use planning and water supplies: see----Vineyard Area Citizens for Responsible Growth, Inc. v. City of Rancho Cordova (Vineyard Area Citizens). The train of coupled cumulative impacts would thus include growth inducement because of the substitution of recycled water for potable. In looking at a similar situation for the new POTW in Santa Paula. The 4.2 MAF could be expected to off set a like amount of potable supply, thus this would be growth inducing.

Opening a source of additional water that is substituted for potable sources would impact housing, hence the need for utilities and services---including roads (transport and circulation) hence noise and air quality in a cumulative way. This would then be considered potentially adverse impacts. The environmental document prepared by staff does not consider the above impacts.

Thus the findings within the staff report for item # 17, Mandatory Findings of Significance: a), b), and c) are incorrect and the level of significance of all three become potentially significant, not---as staff had indicated---less than significant with mitigation incorporated. Additionally, the reader is accorded no useful or credible discussion of the mitigation. Accordingly the way to look at these impacts is to do a valid EIR.