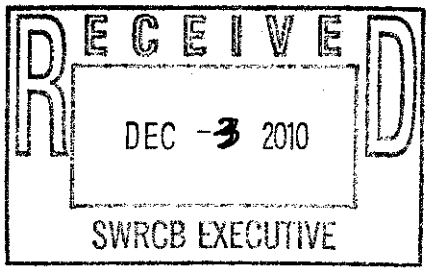
Public Hearing (12/15/10)
CEC – Recycled Water
Deadline: 1/10/11 by 12 noon

From: John Ackerman <jma439@gmail.com>
To: <commentletters@waterboards.ca.gov>
CC: Edo McGowan <edo_mcgowan@hotmail.com>
Date: Friday, December 03, 2010 1:25 PM
Subject: Fwd: Comment Letter - CEC Monitoring for Recycled Water
Attachments: Blue Ribbon Panel.pdf; Final Capps letter and Addendum-2.pdf

--------- Forwarded message ---------
From: John Ackerman <jma439@gmail.com>
Date: Fri, Dec 3, 2010 at 1:22 PM
Subject: Comment Letter - CEC Monitoring for Recycled Water
To: John Ackerman <jma439@gmail.com>



Jeanine Townsend, Clerk to the Board
State Water Sources Control Board
1001 I Street, 24th Floor
Sacramento, CA 95814

Re: Public comment session with Blue Ribbon Panel on Dec. 15, 2010

From: John M. Ackerman, M.D. and Edo McGowan, Ph.D.

Dear Panel Chairman and other Panel members:

We hope that you will have the time to read and digest the following material prior to the Dec. 15 session.

Please first open the attachment entitled Blue Ribbon Panel.

There are 3 corrections:
-In the 8th paragraph of the text beginning in the first line with: "Please read the citations---", the last sentence of the paragraph should read: MRSA now kills more Americans than AIDS according to the CDC. (http://www.naturalnews.com/022806.html)
-In the 2nd to the last paragraph of the text beginning in the first line of that paragraph with: "The Panel mentions the work of Harwood---", please ignore the link in the middle of the paragraph.
-In Reference #48, please go to the 2nd to last sentence regarding McGowan's comments. The word biots should be biota.

Following the Blue Ribbon Panel attachment, please open the second attachment. It emphasizes what we consider to be essential recommendations to be considered at this time for the production of truly safe water.

ANTIBIOTIC RESISTANT BACTERIA AND THEIR GENES IN RECYCLED WATER

The State of California Water Resources Control Board's Blue Ribbon Panel on Contaminants of Emerging Concern (CEC) acknowledges that they and their advisors (including the California Department of Public Health) are not knowledgeable enough regarding the issue of the safety or lack of safety of the presence of multi-antibiotic resistant organisms in recycled water. The recycled water is, among other things, planned to be indirectly used for: a,) potable water and b.) directly used for irrigation of crops eaten raw as well as pasture lands for livestock eventually marketed for human consumption. The Panel recommends further research by the CDC.

We suggest that this logical conclusion be followed by logical recommendations. Namely, that a temporary moratorium be imposed on recycled water for the following uses: indirect use for potable water systems and direct use for both a.) irrigation of crops eaten raw and b.) pasture lands for livestock eventually marketed for human consumption. The recent presence of resistant pathogens in communities (and not just in hospitals) which are causing life threatening illnesses (initiated by Staph aureus, very dangerous species of E. coli and Klebsiella) are extremely worrisome from a Public Health perspective. If such accelerated presence of antibiotic resistant organisms and their illnesses continue, the safety of many individuals of all ages and the consequent security of our nation will be at much greater risk.

The Panel acknowledges that some uncertainties exist regarding the safety of the presence of multi-antibiotic resistant microbial pathogens. Its conclusion is to encourage additional research by the CDC. This stance by the Panel is confusing for the public as well as decision makers. There is already proof that the multiple barrier concept and the level of disinfection presently utilized by wastewater treatment plants for recycled water does not eliminate the presence of the multi-antibiotic resistant pathogens from the final recycled water product. However, we do have plenty of documentation that all over the U.S. agricultural and hamburger recalls continue because of the acute emergence of: a,) serious illness due to the presence of antibiotic resistant E. coli , b.) life threatening pneumonias initiated by antibiotic resistant Klebsiella and c.) disfiguring and lethal Staph aureus infections.

A critical warning in 1982 by an EPA scientist, Meckes, (http://www.ncbi.nlm.nih.gov/pmc/articles/PMC241834/pdf/aem00183-0119.pdf) was published in a peer reviewed scientific journal regarding the serious potential dangers of antibiotic resistant organisms in byproducts of wastewater treatment plants. That paper does not appear in any of the EPA or CDC websites.

Finally and recently, political pressure has been directed toward veterinarians, physicians and the agricultural/livestock industries to stop the excessive use of

antibiotics (which stimulate the mutation of the pathogen's genes to become resistant to the antibiotics). That pressure is an excellent and appropriate preventative start. However, the already existing presence of the resistant pathogens at the end of the wastewater treatment process does not say much for the effectiveness of the multiple barrier concept.

In the Final Report, the Panel notes: "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)."

The logical conclusion by the Panel should also be preventative and rather conclude on the need for the above moratorium. This would give sufficient time for the CDC to also address the safety of the presence of the additional source of the pathogenic organisms. This would be logical for the public municipality decision makers and the professionals of the medical, veterinarian, agricultural and livestock communities as opposed to the plan to first use recycled water to indirectly create more potable water and continue to use recycled water to irrigate vegetable/fruit crops and pasture lands for livestock to be marketed for human consumption. Since illness prevention should be our joint objective, we should first wait for the CDC to do the requested research during a moratorium. Let's not put the cart before the horse.

Please read the citations within the US/EPA study and the scientific literature since 1982. 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 resistant bacteria, once swallowed, are capable of transferring antibiotic resistance within our bodies to (normally occurring) pathogenic species that exist in our bodies. Infections with antibiotic resistant organisms now kill more Americans than AIDS according to CDC. (Edo, you need to reference this)

In Dr. McGowan's discussions with US/EPA, the CDC, and the Inter Agency Task Force on Antibiotic Resistance, he was told by each that no research is planned to evaluate the consequences of our wastewater treatment plants supplying multi-antibiotic resistant organisms to our environments. US/EPA additionally told McGowan that it has 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, within the Final Report, that there are"--------concerns that California drinking water augmentation projects may add to the problem of antibiotic-resistant bacteria

(that are) in trace amounts (and) are not likely to be a problem in California water recycling programs." It is, in fact, that the genetic information is the worrisome issue. That seems to be missed on the Panel. The focus of the panel on only 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 the antibiotic resistance. They 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. In the Final Report, the Panel notes: "The concentrations of these antibiotics and antimicrobials, and others, in finished water that are 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 transfer in the human intestine of genetic information from swallowed (already existing) resistant pathogens put into the environment by the wastewater treatment plants. Thus, the above assurance by the Panel may tend to persuade the Board's decision-makers that all is well.

The Panel continues: "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)". Again, the Panel does not understand that the issue is the very small amount of transferred resistant genes to the pathogenic and normally occurring bacteria in our intestines. The latter then act as a lending library for later transfer to pathogens. The above statement by the Panel may lead decision-makers down a primrose path. When the usual scientific knowledge about contagion is discussed, the thinking includes the concentration of the infectious organisms (classically called dose response). However, when thinking about contagion with resistant genes, only a single gene is necessary.

Within the Final Report, the Panel notes: Treatment processes at reclamation facilities effectively reduced the amount of both MRSA and the mecA gene. However, (it) did not eliminate them (Börjesson, Melin et al. 2009). Again, after swallowing a minute number of resistant genes, the transfer of these resistant genes to our normal and pathogenic intestinal bacteria occurs and the subsequent multiplication of the now contaminated intestinal bacteria is extremely rapid People with compromised immune systems are extremely vulnerable to becoming seriously ill and those with well functioning immune systems may become carriers.

The Panel notes that more investigation is warranted. We would agree that this is true and thus the decision-makers (the State Board) must await such investigation before blindly lunging ahead and consequently putting the public at risk. To move ahead absent this critical information would be reckless.

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, <http://aem.asm.org/math/sim.gif40%; 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." (http://aem.asm.org/cgi/content/short/71/6/3163)

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 of California has a full grasp of the potential impacts to human health from the use of recycled water and decides how to rectify the potential negative impacts, The Blue Ribbon Panel should place a moratorium on its use for artificial recharge and its use in all types of food production.

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Abstract
The incidence and the patterns of the antibiotic and metal resistance in 106 strains of Escherichia coli isolated from ground waters, used also as drinking water supply (sample A), was studied in comparison with the resistance behaviour in the 104 strains of the same microorganism isolated from non hospitalized patients (sample P). Significant differences between the percentage of resistant strains in the two examined samples were found for some of the antibiotics and the metals tested (ampicillin, streptomycin, kanamycin, mercury and zinc) while non statistically significant differences were found for gentamicin, tetracyclin, nalidixic acid and cadmium. From the high percentages of the resistant strains in the environmental sample (up to 44.3% for tetracyclin) we may deduce that also the ground waters, especially if used as drinking water, contribute to the spread of the resistant bacteria. The patterns of the antibiotic multiresistances in the strains isolated from patients and from ground waters do not differ greatly and this strengthens the hypothesis that resistance to antibiotics has been acquired by Escherichia coli strains before reaching the ground waters.
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Fecal coliforms were isolated from the inlet, the primary sedimentation tank, the activated sludge digestion tank, the final settling tank, the outlet and the return activated sludge drain at the municipal wastewater plant in Ube City, and examined for drug resistance and presence of R plasmids. Drug concentrations employed to distinguish resistant isolates from sensitive isolates were 25 micrograms/ml for tetracycline, kanamycin, chloramphenicol and streptomycin, 50 micrograms/ml for ampicillin, nalidixic acid and rifampicin, and 200 micrograms/ml for sulfisoxazole, respectively. Of a total of 900 isolates, 45.7% were drug resistant and 51.1% of them carried R plasmids. **The further along that wastewater had progressed through the treatment process the greater the tendency was for appearance of the multiresistant isolates.** These isolates also were shown to simultaneously carry transferable R plasmids. Observed resistant patterns of R plasmids were mainly multiple and encoded to resistance to tetracycline, chloramphenicol, streptomycin and sulfisoxazole. It became clear that multiplication of R plasmids took place in the activated sludge digestion tank. This study show that drug resistance transfer mediated by these R plasmids may occur in actual wastewater treatment plants.
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The complete 64 508 bp nucleotide sequence of the IncP-1 antibiotic-resistance plasmid pB10, which was isolated from a waste-water treatment plant in Germany and mediates resistance against the antimicrobial agents amoxicillin, streptomycin, sulfonamides and tetracycline and against mercury ions, was determined and analysed. It thus appears that plasmid pB10 acquired as many as five resistance genes via three transposons and one integron, which it may rapidly spread among bacterial populations given its high promiscuity...".

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We are currently facing a growing number of infections, and a growing number of patients who are dying from infectious diseases. At the same time, the number of reports on drug-resistant strains of bacteria is rising, while industrial efforts in antibiotic discovery and development have been declining.
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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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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.

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Once gene transfer has taken place, the resistant information may be long standing. A 1-week course of clarithromycin selects for macrolide-resistant S.
epidermidis that may persist up to 4 years after treatment. Highly resistant isolates could be detected 1 year after treatment in 4 patients and 4 years after treatment in 3 patients. Analysis showed that highly resistant strains persisted or 4 years, in the absence of further selection pressure, and that both resistant and susceptible strains were present 4 years after treatment. stably resistant populations increase the risk for treatment failure. Second, resistance in the normal microbiota might contribute to increased resistance in higher-grade pathogens by interspecies genetic transfer. Since the population size of the normal microbiota is large, multiple and different resistant variants can develop, which increases the risk for spread to populations of pathogens. Persisting populations of resistant microbiota further enhance transfer risk, especially if the selecting agent is used for treatment. Third, antimicrobial drugs may affect the stability of residential populations. (McGowan's note: As noted in the paper by Meckes, (US/EPA study, circa 1980) transfer of resistance to the human gut occurs where the internal biots becomes bothy resistant and shifted. Sjolund says very much the same thing and adds that multiple and different resistant variants can develop, which increases the risk for spread to populations of pathogens.

49. Aiello AE, Marshall B, Levy SB, Della-Latta P, Lin SX, Larson E. Antibacterial cleaning products and drug resistance. Emerg Infect Dis. 2005 Oct;11(10):1565-70). http://www.ncbi.nlm.nih.gov/pubmed/16318697

50. Matt Wook Chang. Toxicogenomic Response of ***Staphylococcus aureus* to Peracetic Acid. *Environ. Sci. Technol.*, 2006, 40 (16), pp 5124–5131.** http://pubs.acs.org/doi/abs/10.1021/es060354b
51. Sara Firl. The Importance of Municipal Sewage Treatment in the Spread of Antibiotic Resistance. 106th General Meeting of the American Society for Microbiology. May 21-25, 2006, Orlando, Florida. http://www.cura.umn.edu/reporter/06-Fall/LaPara_et_al.pdf
Our study determined that substantial numbers of antibiotic-resistant bacteria were present in municipal wastewater, and that the existing treatment infrastructure did not adequately prevent release of antibiotic-resistant bacteria into the environment. Many of the bacteria found in the wastewater treatment plant and in the plant effluent were tentatively identified as potential pathogens and were also resistant to multiple antibiotics, raising public health concerns.
52. MJ Higgins, S Murthy. Examination of Reactivation and Regrowth of Fecal Coliforms in Anaerobically Digested Sludge WERF Report: Biosolids and Residuals (03-CTS-13T), 2006 (June).
http://www.werf.org/AM/Template.cfm?Section=Biosolids&CONTENTID=12522&TEMPLATE=/CM/ContentDisplay.cfm
53. Matt Wook Chang. Toxicogenomic response to chlorination includes induction of major virulence genes in Staphylococcus aureus. Env Sci & Tech 2007, vol. 41,no. 21, pp. 7570-7575
Microbial control in aqueous environments entails widespread use of chlorination. Hypochlorous acid induced transcription of genes encoding major virulence factors of S. aureus, such as exotoxins, hemolysins, leukocidins, coagulases, and surface adhesion proteins, which all play essential roles in staphylococcal virulence. This work implies that chlorination may stimulate production of virulence factors, which provides new insight into host-pathogen interactions and effects of chlorine application for microbial control.
54. HJ Jang. *Toxicogenomic* Response of Staphylococcus aureus to Triclosan. The *FASEB Journal.* 2008;22:1023.1.
http://www.fasebj.org/cgi/content/meeting_abstract/22/1_MeetingAbstracts/1023.1
55. Heather Storteboom. et.al Tracking Antibiotic Resistance Genes in the South Platte River Basin Using Molecular Signatures of Urban, Agricultural, And Pristine Sources. Oct 21, 2010.
http://pubs.acs.org/doi/abs/10.1021/es101657s
Antibiotic resistance genes (ARGs) have been recognized by the scientific community as emerging contaminants, independent of their host bacterial cells (1, 2). ARGs are broadly distributed across various environmental matrices (e.g., soils, groundwater, surface water, and sediments) with strong evidence of human activity driving amplification above background occurrence (1-6). Nonnative bacteria possessing ARGs are transported to surface waters via point-sources, such as wastewater treatment plant (WWTP) effluents or runoff from animal feeding operations (AFOs), or

nonpoint sources, such as runoff from agricultural fields where manure or sewage sludge have been applied.

John M. Ackerman, M.D.
5971 Scott Ct.
Goleta, CA 93117

November 16, 2010

Representative Lois Capps
Santa Barbara Office
301 E. Carrillo Street, Suite A
Santa Barbara, CA 93101

Dear Representative Capps:

Please consider this letter as an addendum to the correspondence we sent to you via your in-house e-mail on November 3, 2010.

In that letter we referred to research documenting the presence of multi-antibiotic resistant organisms in the 3 byproducts of wastewater treatment plants. Although we believe there is sufficient research regarding this potential danger to our citizens, this addendum outlines recommendations for other necessary research as well as recommendations to upgrade Regulations plus Standards.

We would like to know your thinking about the above. Also, please contact us if you have questions.

Please confirm receipt of the November 3, 2010 e-mail letter and this e-mail letter.

Respectfully,

John M. Ackerman, M.D.

Edo McGowan, Ph.D.

P.S. My wife and I were driving recently in the State of Wisconsin and stopped to have lunch. The person sitting next to us was a recently retired gentleman who for years ran one of the independent private laboratories contracting with wastewater treatment plants. He was very concerned about the quality of byproducts released from the wastewater treatment plant. He said staff at the wastewater treatment plants deny any problem.

Today I had lunch with a friend who rafted down the Colorado River this summer. A hydrology Ph.D. major discussed with him the fact that he and his class colleagues had the exact same concerns.

Best,
John

Suggestions to Improve Quality of All Types of Waters

A. Upgrading Standards and Regulations:

1. Feds - Define contamination to include chemical and biological materials in: a.) effluent, recycled water and biosolids at the end of the wastewater treatment plant sanitization process; b.) the delivery pipes at the point of use for recycled water; c.) effluent at the point of transfer to surface waters; d.) recycled water immediately prior to its release at points of use; e.) biosolids immediately prior to its spread onto commercial agricultural and commercial pasture lands, domestic lawns and domestic vegetable/fruit gardens; and f.) potable water.
   - Oversight by the Feds of the State and Regional Water Quality Boards to follow suit.
2. Feds: Determine who is responsible for the delivery and testing of the water after it leaves the wastewater treatment plant.
3. Testing needs to be upgraded to the level of culturing for antibiotic resistant organisms and detecting genetic fragments instead of the single indicator utilized during present day practice.
   a. Feds need to upgrade the disinfection Regulations of the three wastewater treatment plant byproducts (effluent, biosolids, and reclaimed/recycled water).

b. Feds need to require such testing not only in the final three byproducts of the wastewater treatment plants, but also after the delivery through the pipes at points of use, at the points of transfer of effluent to surface water, and for biosolids just prior to points of use onto commercial agricultural and pasture lands.
c. In addition, Feds need to upgrade these same Regulations for potable water.
d. Feds need to do strict, transparent oversight regarding the above on the follow-through behavior of State and Regional Water Quality Control Boards. Penalties would accrue to the states if Regulations are not vigorously followed.

4. Feds need to upgrade the design of wastewater treatment plants:
   a. An upgrading of the Standards and Regulations regarding the release of wastewater treatment plant effluent, recycled water and biosolids plus potable water as determined by the above resistance culturing and genetic fragment testing plus appropriate filtering until antibiotic resistant organ+isms and their genetic fragments are completely absent.
   b. Edo McGowan, Ph.D. emphasizes that the typical approach to evaluating the contagiousness of organisms is by the classic and antiquated "dose response". However, the danger posed by antibiotic resistant organisms is their ease of multiplication within the intestinal tract. This multiplication is extremely rapid and the change remains for years. Only a single organism is required to force such a shift. People with compromised immune systems are, then, very vulnerable to becoming seriously ill. This can occur even if only one dead organism or only its genetic fragments enter the intestine. Those with adequate immune systems might not become ill, but they may become carriers. This applies to the contamination from wastewater by all three of its byproducts onto:
      - Commercial crops
      - Commercial pastures
      - Municipal and private lawns
      - Municipal golf courses
      - Domestic vegetable and fruit gardens
   c. Oversight of the State by the Feds to follow through with strict penalties if not accomplished properly.

5. Feds: Much more strict oversight for all types of food production including agricultural, meats of all types, fish, etc. (regarding hygienic protocols and the need to decrease the use of antibiotics).
6. Feds: Replace or repair underground infrastructure of piping both for wastewater and for potable water all over the country.

B. Research to be considered:

1. The Feds should choose to repeat testing for resistance instead of single indicator as described above. However, that might not be necessary. In addition to research by several reputable researchers (see reference list prior to September 12, 2010 conference call), Edo McGowan, Ph.D. repeatedly documented the excessive presence of multi-antibiotic resistant organisms at the end of the recycled wastewater treatment process in addition to points of use at sprinklers, drinking taps, and even in pharmacy water used to mix medications.
2. Retreatment, recirculation, retesting and appropriate filtering of effluent and recycled water plus potable water (as many times as it is necessary) before these waters are released either to surface waters or to delivery pipes to points of use in order to document with resistance culturing and genetic fragment testing that the resistant bacteria and their genetic fragments have been completely eliminated (see upgrading of Regulations A.4).
3. Presently, wastewater includes "emerging contaminants of concern" plus multi-antibiotic resistant organisms and their genetic fragments. The present Standards and Regulations require, at some point within the treatment process, the removal of the suspended solids so that the discharged effluent, recycled water and remaining biosolids meet water quality and other Standards. The Feds should consider new technology that destroys the suspended solids in wastewater prior to those solids entering the wastewater treatment plant. New technology can convert those solids to biofuels. This process is superior not only because additional biofuels provide financial advantages but also creates a much improved quality of water at the end of the treatment process. The removal of the suspended solids before the treatment system prevents the treatment plant's conversion of suspended

solids into solution. This lack of solids in solution is a cleaner product because the emerging contaminants of concern are no longer present. Wastewater treatment plants (under present Regulations) are not capable of removing the emerging contaminants of concern if they are primarily in solution. The conversion of the suspended solids prior to entering the treatment plant also destroys most of the antibiotic resistant organisms.

4. Research and design regarding manufacture of filter systems to filter out the remaining genetic fragments from wastewater effluent and recycled water including potable water (see upgrading Regulations A.4).

5. In parallel with the Clean Air Act regarding automobile exhaust, creatively research more effective ways to destroy any remaining multi-antibiotic resistant organisms after the biofuel conversion process. This includes effluent, recycled water plus potable water before they are released into our environments. More research is needed regarding the use of chlorine or ultraviolet because they increase resistance and virulence. Keep in mind that these two disinfection processes increase temporary states of viable but not culturable (VBNC) conditions of these organisms. Delivery pipes of wastewater treatment effluent, recycled water and potable water may include biofilms that harbor viable but not culturable as well as culturable resistant organisms. Such pipes need to either be cleaned or replaced and require recirculation mechanisms and concentrated ozone under constant pressure which is, to date, the most effective disinfection agent.

6. Presently, Klebsiella pneumonia is rapidly becoming resistant to antibiotics in addition to the already existing status of Staph aureus and certain strains of dangerous E.coli. Therefore, the present day environmental approach to antibiotic resistance is only part of the solution. More and more recent studies are emphasizing the transfer of animal illness to humans (e.g., swine flu pandemic and its relationship to those animals and even the possibility of migrating birds which have spent time in swine environs).

Therefore, it would be important for the Feds to, on a preventative basis, do more creative research regarding animal to human disease transfer. After all, the increasing human presence of animal diseases (in addition to the increasing presence of antibiotic resistance) now arising in our communities (instead of just in hospitals) is a threat to our citizens as well as a large, insidious potential threat to the security of our nation.

C. What do we know that works now:

1. Concentration and separation of wastewater solids in suspension prior to entering wastewater treatment plants. Conversion of the separated and consolidated solids to methane-type gas which is captured to power other technologies or sell as an energy commodity. Financial profits follow. However, any remaining presence of biosolids at the end of the wastewater treatment process should not be transferred to our environments unless properly ozonated and filtered because of the possible presence of remaining multi-antibiotic resistant organisms and their genetic fragments.

2. Culturing for multi-antibiotic resistant organisms and testing for the presence of genetic fragments vs the ineffectiveness of using single indicator identifier testing.