

From: Brenda Adelman
To: commentletters
Cc: Marcus.Felicia@Waterboards; Moore.Steven@Waterboards
Subject: RRWPC Comments for Dec. 1st meeting on Proposed Amendment to Policy for Recycled Water
Date: Wednesday, November 29, 2017 11:23:17 PM
Attachments: [RRWPC Comments Propos. Amend. Recycle Water Policy.doc](#)
[Vandenberg - water board comments & MSF11.pdf](#)
[RRWPC Comments re DPR11.doc](#)
[Endocrine-Disruption-Reference-List1131.doc](#)
[Comments SWRCB IPR 9-12131.doc](#)



Dear Ms. Townsend:

I cannot attend the Dec. 1st meeting unfortunately on the Recycled Water Policy. I attach some comments about the policy that I hope you will pass on to the Board (1st item attached above) I have taken the liberty to send this email to Board Chair Marcus and to Board Member Moore also. I have also attached a few other documents as well as some links below to other important works.

Please send me a brief response saying you received these okay. Thank you.

Brenda Adelman

<http://www.ourstolenfuture.org/newscience/lowdose/2007/2007-0525nmdrc.html> "Does the Dose Make the Poison" Peter Myers and Wendy Hessler 2007

www.endocrinedisruption.org Endocrine Disruption Exchange Website founded and managed by Theo Colborn until her death in December, 1915: She is the Rachel Carson of endocrine disruption science. This site includes a list of potential endocrine disruptor chemicals

<http://www.environmentalhealthnews.org/ehs/news/2012/low-doses-big-effects> by Marla Cone: Editor in Chief of Environmental Health News "Low doses, big effects: Scientists seek 'fundamental changes' in testing, regulation of hormone-like chemicals"

Vandenberg, L.N., et al., *Hormones and endocrine disrupting chemicals: low dose effects and non-monotonic dose responses*. Endocrine Reviews, 2012. **33**(3): p. 378- 455, <http://www.ncbi.nlm.nih.gov/pubmed/22419778> (This is an important study out in March, 2015 that involved the work of 12 research scientists in the endocrine disruption field. The study reviews the many studies on the topic as of the date of publication.)

Pharmaceuticals in the Environment: A growing threat to our tap water and wildlife, <http://www.chemtrust.org.uk/wp-content/uploads/CHEM-Trust-Pharma-Dec14.pdf>

Nikita Naik, Wastewater Irrigation on Farms Contaminates Food, Pesticides and You, Vol. 34, #3, Fall 2014 p.19- p.23, <http://www.beyondpesticides.org/infoservices/pesticidesandyou/documents/WastewaterFall2014.pdf>

[CHEMTrust overview of Key Scientific Statements on Endocrine Disrupting Chemicals \(EDCs\) 1991-2013, as of January 2014.](#)

(This document contains about 35 major scientific reports and statements over 22 years that each contain many references and resources on endocrine disruption

TEDX One Page Fact Sheet:

[http://endocrinedisruption.us2.list-manage.com/track/click?
u=10e84a56c4886d1bc606f4725&id=423c498353&e=8bd25c3d7e](http://endocrinedisruption.us2.list-manage.com/track/click?u=10e84a56c4886d1bc606f4725&id=423c498353&e=8bd25c3d7e)

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State Water Resources Control Board
Sent via Email to: commentletters@waterboards.ca.gov
Attn: Ms. Jeanine Townsend: Clerk to the Board

November 28, 2017

Re: Early Public Consultation Meeting:
PROPOSED AMENDMENT TO THE POLICY FOR RECYCLED WATER

Dear State Water Board Members:

Thank you for the opportunity to comment on the proposed amendment to the Recycled Water Policy. Unfortunately, I cannot attend the Dec. 1st meeting in Sacramento, and while I would very much like to be there in person, I hope this letter with a few attachments will carry the same weight as a public appearance. RRWPC has submitted numerous comments to your Board on this issue over the last ten years. And while our basic concerns are unchanged, our understanding of the situation and the volume of the information available over the years has substantially increased and evolved over time. We hope you will read these new comments.

RRWPC Concerns Regarding Recycled Water Policy Proposed Amendment....

RRWPC understands that there is enormous public pressure to seek out new water resources, and wastewater reuse is being seen by many as an important, and perhaps cheaper source than other potential options, such as tunnels, desalination, and new dams. While none of these have been taken off the table as yet, and all are still being considered, the wastewater reuse appears to be a favored option.

We do advocate that limited reuse should be allowed for some applications, when the greatest caution is used, but we believe that direct potable reuse be avoided entirely. While technological advances have furthered the ability to get many toxins out of liquid waste, nevertheless, we have not heard anyone claim that ALL toxins are removed. Furthermore, many medium and smaller wastewater districts cannot afford the expensive technology needed to assure removal of even most of the toxins of concern even though at times they may have extreme water shortages. Until concerns expressed below are fully address, we would hate to see 'regulatory adjustments' made to requirements to allow for such use.

Furthermore, when systems get old and begin to degrade, repairs may alter the complex process used to protect water quality, without public notice of potent dangers that may be present. Adequate requirements are needed in such circumstances. Our deep concern is based on the knowledge that few toxic substances are adequately monitored, identified, and controlled, and that designating any water as high quality may be misleading. Where actual wastewater is being considered, this use becomes even more problematic, especially since a very limited number of surrogates have been accepted to represent a huge number of toxic substances. Finally, it is unclear whether stringent limits will be put in place to protect ALL species. It is actually easier to protect human health than most aquatic species, since fish and small aquatic life are far more susceptible to toxins and we don't track that at all.

(We first learned about endocrine disruption in a small two paragraph article in Science News around 1993 where they described a UK study on the Seine River, just downstream of a wastewater treatment plant and noted the feminization of fish. Since then more has been revealed about the impacts of various chemical constituents on the life course of many aquatic species. This also involves study of the complexities of the water environment itself.

According to the USGS website:

Chemical Transformations in Water Reclamation and Reuse

Many hydrological, geochemical and biological processes associated with water reclamation and reuse are poorly understood. In particular, the occurrence, fate, and effects of trace organic and inorganic contaminants present in reclaimed water needs further investigation. Research on the chemistry of reclaimed water and the relationship to hydrological processes is especially critical to individuals responsible for management, protection, and restoration of these resources. The project objective is to understand the basic principles controlling the sources, occurrence, and transformations of wastewater derived trace chemicals and the interaction of reclaimed water chemistry with receiving streams, lakes, wetlands, and ground water ecosystems. The project will (should?) integrate chemical measurements, theoretical predictions, laboratory studies and experimental field studies in ground-water and surface-water environments.

To what extent have studies of estrogenic effects within natural water bodies under all flow and temperature conditions and for all species and their life processes been studied? And if that has occurred, to what extent has the theory been assumed, that low dose exposures are safe? We have read that some treatment processes minimize the amount of fish feminization by exposure to conventionally treated wastewater (tertiary or secondary?) but does the highest form of treatment protect all life forms living in wastewater containing streams, since it is so difficult to assure that reuse applications never get to the water.

Have the following issues been addressed regarding wastewater reuse?

The concept of low dose impacts of endocrine disrupting effects has not been adequately addressed and/or accounted for in the assumptions about the adequacy of highest wastewater treatment methods to protect the health and safety of all species that will be exposed.

While the Science Advisory Panel advises the Board on the risks associated with Constituents of Emerging Concern (CEC's), there is no endocrinologist on the panel, and a whole body of science from the last 25 years, appears to have been given very short shrift. In addition, the moniker, 'CEC's', fails to convey the seriousness and level of threat regarding the whole field of endocrine disruption. (We attach the new one page explanation of endocrine disruption put out by The Endocrine Disruption Exchange, the group founded by Theo Colborn, mother of this field.)

The sheet states: *"Laboratory and epidemiological studies have confirmed that EDCs have a wide array of effects on humans and wildlife. Examples include reduced reproductive ability,*

changes to secondary sex characteristics, certain cancers (such as breast, ovarian, prostate, and testicular), delayed cognitive development, altered response to stress, increased accumulation of fat and changes in sensitivity to insulin.” One specific example involves studies that indicate that sperm quality and quantity have diminished by 50% since the 1970’s. This finding is seldom mentioned when birth rate data shows significant decline; other reasons are often given.

A CNN Report found on the web states:

“Researchers led by Dr. Hagai Levine of Hebrew University of Jerusalem examined thousands of studies and then conducted a meta-analysis of 185 studies. These included 42,935 male participants who provided semen samples between 1973 and 2011. The chosen studies were well distributed over the nearly 40 years of the study period and among 50 different countries. The analysis included information on fertility status, age, ejaculation abstinence time, semen collection method, sperm count method and geographic location at the level of continent.

Based on their analysis, the international team of researchers from Brazil, Denmark, Israel, Spain and the United States reported a decline in sperm concentration of 1.4% per year with an overall drop of 52.4% during the entire study period for men living in industrialized, Western countries. Meanwhile, total sperm count among the same group plunged 1.6% per year and 59.3% overall. By comparison, the researchers found no significant declines in the sperm counts and sperm concentrations of men living in South America, Asia and Africa.

The extent of the decline is a heartache," said Levine. "It's hard to believe -- it's hard to believe for me."

By contrast, the Legislature defined recycled water as “*water which, as a result of treatment of waste, is suitable for a direct beneficial use or a controlled use that would not otherwise occur and is therefore considered a valuable resource.*” To my knowledge, there have been no long-term studies that demonstrate that this is truly possible, and in light of the vast amount of information that has become available over the last 25 years on endocrine disruption, it could be a highly risky practice for which human health results may bear the burden for many years to come.

This document admits (“*Informational Document*” page 2, bottom: prepared for Dec. 1st meeting) that dangerous chemicals are frequently unregulated and not well-monitored and are found in personal care products, pharmaceuticals including antibiotics and antimicrobials, industrial, agricultural, and household chemicals, hormones, food additives, and much more. The TEDX Sheet states that, “*We breathe, eat, drink, and touch EDCs every day. They are components of plastics, pesticides, flame retardants, fragrances and more.*” And they remain in our bodies....

Concerns about safety and reliability of wastewater technology....

Can new wastewater treatment technology reliably clean and treat wastewater to a degree of perfection that would make it perfectly safe at all times? In this age of extensive amounts of unregulated toxins, is it even possible to reliably and consistently treat chemical hazardous waste in wastewater adequately, especially when systems age and become decrepit with extensive use? The main goals of this amendment include:

- *Support increased reuse of wastewater in a way to protect the environment and public health while mitigating water shortages.* RRWPC believes this is much easier said than done and that a great deal of scientific evidence is being ignored as noted below. We are concerned about the constant spread and proliferation of toxins in our environment, even at small doses will impact public and environmental health in subtle ways that may not be noticeable at first, but turn out to be quite profound ultimately.

- *Changing regulatory aspects of recycled water production including changes to Title 22, etc.* We have found Title 22 provides few protections from toxic exposures and the human health problems that can result. The main focus is on pathogens. Furthermore, we don't believe that other water laws have addressed the issues of endocrine disruption and specifically 'low dose' impacts.
- *Amend Recycled Water Policy to reflect recommendations of the reconvened Science Advisory Panel on CECs in recycled water.* While the participants in the Panel are all notable scientists, it does not appear that they represent the whole range of fields that are critical to these issues.

Do experts relied on represent all fields of concern?

The Informational Document states (page 5) that since the last amendment, a large amount of recycled water research has become available. One goal of this amendment is to update recommendations to incorporate updated information. Much of that information has been generated by the National Research Institute (NWRI) who, at the request of the State Water Board, established an expert panel to convene pursuant to CA Water Code, Sections 13562(a)(2) and 13565(a). Their report of 10-31-16 is entitled "*Expert Panel Finding on California State Water Resources Control Board's Proposed Uniform Water Recycling Criteria for Surface Water Augmentation*". The following statement was included in my comments on proposed augmentation of drinking water supplies with wastewater. We believe these comments would probably also apply to other reuse options as well. (attached)

It appears that the National Water Research Institute (NWRI) also weighed in with information on the safety of augmentation of drinking water sources with treated wastewater through their consultant role with San Diego Indirect Potable Reuse/Reservoir Augmentation Demonstration Project. Their general conclusion was that reservoir augmentation was safe if all treatment processes are adequately maintained.

But we wonder about the intellectual independence of NWRI, as they were called out by Wikipedia about possible conflict of interest. I googled NWRI on the web and came up with a Wikipedia entry which said this about NWRI: "***A major contributor to this article appears to have a close connection with its subject. It may require cleanup to comply with Wikipedia's content policies, particularly neutral point of view.***"

If NWRI was used to certify prior findings of the State, and support previous regulations, then their intellectual independence may be compromised. Our concerns are based on the fact that the member agencies of nonprofit NWRI pay \$50,000 a year for membership and who all seek to utilize (or already utilize) the augmentation of reservoirs with treated wastewater (and other reuse options). Below are proponents and NWRI members who would benefit by influencing regulations to enable this system:

Inland Empire Utilities Agency, Irvine Ranch Water District, Los Angeles Department of Water and Power, Orange County Sanitation District, [Orange County Water District](#), West Basin Municipal Water District

The other organization providing a great deal of information for the state on reuse, *California WateReuse* has this description in one of their web entries: "*WateReuse is the only trade association that focuses solely on advancing laws, policy and funding to increase water reuse.*" Because they state their focus is only on promoting reuse, they have an inherent bias. RRWPC believes that because of their advocacy, they don't have a balanced view of the studies and information available on endocrine disruption.

Why no endocrinology experts?

We have expressed concerns about many of the panel's findings and have inquired before, why there has been no endocrinologist as part of any of the Scientific Panels? We wonder if any of the hundreds of scientific studies by endocrinologists working in the field have not been cited? We believe that the implications of estrogenic effects may be a barrier to providing safe and healthy water supplies that also allow expansion and growth. In today's environment, perhaps both are not possible.

Laura Vandenberg, PhD provides an excellent expression of the issue...

Laura Vandenberg, PhD, has written extensively on endocrine disruption and her words connote the complexity of the science. (Laura submitted a letter on this topic to your Board in 2012 for the Recycled Water Policy Amendment process.) She was one of twelve scientists who had reviewed recent studies on this topic and produced a study released in March, 2012. ([Endocr Rev.](#) 2012 Jun;33(3):378-455. Hormones and endocrine-disrupting chemicals: low-dose effects and nonmonotonic dose responses. [Vandenberg LN](#)¹, [Colborn T](#), [Hayes TB](#), [Heindel JJ](#), [Jacobs DR Jr](#), [Lee DH](#), [Shioda T](#), [Soto AM](#), [vom Saal FS](#), [Welshons WV](#), [Zoeller RT](#), [Myers JP](#))

She explains her research focus as follows:

“My research explores how early life exposures to chemicals and chemical mixtures can predispose individuals to diseases that manifest later in life. Classical toxicology often focuses on how fetal chemical exposures can produce birth defects, an important part of chemical safety. My work instead addresses how low doses of chemicals during critical windows of development can alter gene expression, cell differentiation, and tissue organization in subtle ways that can lead to adult diseases such as cancer, obesity, and infertility. I am specifically interested in the class of chemicals termed ‘endocrine disruptors’ and have worked extensively with chemicals used as plasticizers and flame retardants. My work also focuses on how traditional toxicology assays have failed to identify a number of ubiquitous endocrine disruptors, and how current risk assessment practices can be improved in the study and regulation of this class of chemicals.” (emphasis added)

RRWPC has seen little mention of these concerns by the State's Scientific Panel, especially in regard to direct potable reuse. What is notable here is the length of time between exposure of a toxin and the appearance of disease can be lengthy. Sometimes it covers generations. We have not seen this addressed in any depth by the State when taking regulatory action. Over and over we hear that much study needs to be done on endocrine disruption. The endocrinologists admit this is true in some areas; but they have also congregated vast amounts of information that we have not seen described in studies cited by those who justify reuse.

Conventional Risk Assessments still prevail...

Conventional risk assumptions are often used to justify broad applications of wastewater into the environment (i.e., the dose makes the poison and low doses are often considered inconsequential). It appears that few, if any, endocrinologists have been consulted (or their studies cited) to inform the Board of issues around low dose and non-monotonicity effects.

We noted that the Recommendations of the Advisory Group on Feasibility of Developing Criteria for DPR stated on page 14: *“Identify the levels of chemicals, including constituents of concern (COCs) and constituents of emerging concern (CECs) that are present in advanced treated water and compare them to levels in other drinking water sources. Investigate potential health effects from low dose exposures from these chemicals and COCs/CECs, especially if they are detected to occur more often in advanced treated water...”* They then go on to request investigation of the risk for greater exposure and possible need for additional treatment to reduce cumulative exposure relative to other water sources. I interpret this to mean that all water sources should have an equal amount of toxic chemicals, and NOT that it should be unacceptable for wastewater reuse to expand the amount of exposure and therefore risk. In our view, any study providing less information about potential triggers for serious disease than what Dr. Vandenberg cites above, is inadequate.

In regard to the ability of wastewater infrastructure to consistently and reliably treat wastewater for varied use, we note that engineered solutions are subject to natural hazards such as earthquakes, human error, and antiquated technology which would take great expenditures to upgrade. One example is the Flint, Michigan situation with dangerous levels of lead in the drinking water. There simply has not been the money to properly fix the infrastructure, nor the will among local politicians to find a way. (*Community affected is low income.*) Since the problem became known, we have learned of many water districts in the nation having lead levels far higher, and in some cases, twice as high as Flint's. How would the public know if similar situations occur with reuse?

In relation to the wastewater reuse issue, we believe that many citizens are uninformed about the many unknown toxins with which we all come in contact, and the potential health risks they pose and the limited amount of direct study and monitoring that occurs. We are concerned that consultants have been hired to persuade people that adding wastewater to their drinking water is perfectly safe, without fully examining the actual risk.

In addition, there are many non-toxic substances that have been found to be extremely toxic when combined with other benign substances, a complex issue for the wastewater treatment process. Since there are about 80,000 chemicals on the market, and most are unregulated, a large number of them end up in the wastewater stream. Has this been fully addressed? How do they identify what toxins to look for? Have all possibilities been considered?

Has any attempt been made to directly study the low dose affect?

RRWPC is concerned that exposure to small amounts of toxins, perhaps considered to be minimally risky for the general population, appears to be accepted by conventional risk assessments. The public, when surveyed by public relation firms at the behest of State Agencies, was told that small doses are safe and that it's done in Southern California and nothing bad has happened. (I have the documents in my files that couldn't be immediately located.) Or they are being told that it meets public health requirements, not realizing that Public Health Agencies have not adequately formulated policy around the potential harm of so-called Contaminants of Emerging Concern (CECs have been emerging now for over 25 years and about which thousands of studies have been done over that time, most of which do not seem to have been acknowledged by the State Board).

We can never know how many and what kind of toxic exposures each individual has personally come in contact with, nor what their body burden is at any given time. It must be considered, when determining safety of either irrigation water or the products irrigated, that toxins already in the water or food supply can exacerbate levels already found in one's body. (*For instance, some studies have found new infants to have toxins in their blood at birth.*)

There are chemicals everywhere we turn, and simultaneously, California cities burgeon with huge hospital complexes geared to treat diseases often caused by these constituents. Furthermore, infants and children, pregnant women, people with cancer and diseases that cause compromised immune systems, old people, and more have been found to be more susceptible to chemical exposures, with the range of possible effects more fully (but still partially) noted below. Has this been considered in setting regulatory requirements?

Also, wastewater irrigation is allowed on organic vegetables, yet studies have shown that wastewater irrigation applications become bio-available through ingestion. Do irrigators realize that they are potentially contaminating the people ingesting their organic product? Most people don't realize that we are all walking toxicological experiments.

How was safety of irrigating urban landscapes with tertiary wastewater determined?

We have another concern about the original Scientific Panel's conclusions. They determined that it was safe to irrigate urban landscapes with tertiary wastewater without any monitoring. Supposedly, best management practices were assumed to prevent runoff, but that simply did not happen in Rohnert Park and Santa Rosa. *(After a year or two of complaints, Santa Rosa did improve wastewater applications in their parks, schools, and other locations, but it appeared as though Rohnert Park continued excessive applications.)*

In 2011 and 2012, RRWPC photographed over a hundred runoff incidences into streets and drainages. These runoff events (Numerous pictures show irrigation water running into the street drain.) may have ended up in one of the most impaired Russian River tributary waterways during summer low flow conditions and for a very long time, it appeared that very little was done about it. *(Recently we were informed by RBI staff that requirements will be tightened during the next permit review process.)*

In our comments on Santa Rosa's Reclamation Permit review in 2013, (submitted to the State with our most recent comments) we documented extensive water use by irrigation sites (especially in Rohnert Park), compared to site acreage. We calculated gallons per acre, which was found in some cases to be twice as high as crop irrigation on agricultural parcels. Our review of irrigation reports also seemed to indicate little oversight and follow-up on problems, especially in regards to plant nutrient loads. *(We believe that incidental runoff was greatly abused.)*

Also, while Santa Rosa had done studies on the salt and nutrient management plan, and had hired consultants and made preliminary findings, to the best of our knowledge, it was never finalized publically by the Regional Board. (RRWPC submitted comments on the draft plan and never got a response.)

Recommended actions proposed:

- Any new regulations allowing reuse for direct and indirect potable reuse, should carefully limit reuse to only treatment processes that utilize the highest level of treatment and that also undergoes frequent and rigorous monitoring of toxins. (Wastewater treatment plants generally monitor for priority pollutants once a year; we believe it should be much more frequent.)
- We suggest that detection limits be set at points where low dose effects can occur. (parts per billion or trillion in some cases)
- We suggest best management practices for urban irrigation include the following:
 - Drip irrigation if possible or very mild spray focused directly on vegetation
 - Set back from sidewalks and streets at least 20'
 - No irrigation in dividers or areas between street and sidewalks
 - Strict application according to vegetation demand
 - No ponding allowed
 - No runoff allowed, but for occasional broken sprinkler head (NOT misdirected head)
 - Monitoring of site for runoff at least 3 times a week
 - No watering on slopes facing street or sidewalk, etc.
- Annual reporting about operation at a minimum
- All spills reported within a day to Regional Board
- Visible signs about wastewater irrigation with 8.5" x 11" signs

Thank you for consideration of my comments.

Brenda Adelman for RRWPC

RRWPC

Russian River Watershed Protection Committee

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State Water Resources Control Board

Sent via Email to: commentletters@waterboards.ca.gov

Attn: Ms. Jeanine Townsend: Clerk to the Board

September 11, 2017

Re: Surface Water Augmentation Regulations

Dear State Water Board Members:

Thank you for the opportunity to comment on the proposed regulations. While I realize that a lot of work has gone into this, we have the same reservations that we had during the process for the Recycled Water Policy and subsequent documents released for comment on this and related topics since 2008.

We are concerned about the Board's proposed rulemaking regarding the use of treated wastewater to augment reservoir supplies used for drinking water. RRWPC, as you may recall, has submitted numerous comments on the Recycled Water Policy and its Amendment, the Report to Legislature on DPR, and General Order WDRs for Recycled Water Use. We have also appeared in person before the Board at least four different times to discuss our concerns (many more times before the Regional Board). We have provided the Board with numerous documents containing peer reviewed studies concerning impacts of very low doses of minute amounts of estrogenic chemicals, some of which we attach to this letter (studies, not chemicals). In those comments, there are links to many biological, peer reviewed, scientific studies and articles.

The outcome? No one at the State has either addressed our concerns in a meaningful way or disputed them (that we recall). No one at the State has commented on the many peer reviewed scientific studies that assure us there is no safe level of an endocrine disrupting chemical in our bodies. No one has commented on the many examples in nature indicating that wildlife are suffering, and perhaps dying because of these exposures. Frogs in particular have been shown to grow multiple sets of male and female reproductive organs, mostly due to exposure to atrazine at a level as minute as parts per billion range. There are many examples of hermaphrodite changes taking place in gulls as well, as a result of extremely low exposures. In humans, these chemicals have causal links to cancer, heart disease, obesity, Alzheimer's, birth defects (especially reproductive), Parkinson's, diabetes, autism, and transgender issues, etc. Meeting drinking water MCL's says nothing about avoiding these problems, and unfortunately, Health Departments have avoided this issue.

Further, to my knowledge, no study has been examined of all the many combined

exposures experienced by any individual, and perhaps it would be an impossible study to design and still have scientific credibility. For example, people are exposed to toxic endocrine disrupting chemicals when they touch most store receipts and then use a disinfectant wipe (or perhaps it's the other way around). In combination, these two chemicals are much more toxic than each is separately. Also, two completely benign chemicals (those weren't) can combine into one toxic one. There are at least 1000 chemicals that have been identified as having endocrine disruption properties and more are being discovered every day. Yet the Scientific Panel just examined epidemiological studies and not the actual biological studies conducted by endocrinologists themselves. (Do you know that male sperm counts have decreased on average by 50%?)

Based on studies I have seen, I'm not sure there are (yet) reliable technologies that can regularly remove all endocrine disrupting chemicals from the waste stream. As of a few years ago, even Dr. Crook asserted that in a document he wrote. (See my article and links to Environmental Perspectives). Furthermore, there is no endocrinologist on the Scientific Panel. There doesn't seem to be much discussion about endocrinology and yet the Scientific Panel authorized the proposed project as being safe for human health. We are sorry that the focus is on accomplishing advanced treatment and getting the toxins out, and not on a range of biological results.

There are many uncertainties about the reliability of wastewater treatment effectiveness in regard to the multitude of chemicals in our environment. What happens when there is a major earthquake or a huge hurricane and the treatment system goes down for lengthy periods? As systems come to rely on merging the waste with the real water, what happens if things fall apart for lengthy periods? What happens when a serious human error occurs (even the most highly qualified workers have slip-ups)? Where will fresh, healthy water come from under those circumstances? The management of these systems seems so complex, there must be times when things fall apart, and what then?

This analysis should at least acknowledge the existence of all the potential exposures to chemicals that one comes across in daily life. We constantly hear about chemicals in children's toys, cloths, mother's milk, wine, food, etc. Furthermore, while the water delivered to the tap may be touted as perfectly clean, we don't know if the pipes they flow through are free of noxious toxins. Perhaps some of the worst industrial toxins are occasionally monitored, but the vast accumulation of a huge multitude of toxins in our daily lives, and which come together in the waste stream, is seldom mentioned. Perhaps the small amount ending up in the drinking water will be all that's needed to cause developmental problems in young children (USGS has found numerous toxins in drinking water nationwide).

It may be that endocrine impacts are the worst-case outcome, and yet it's one that has been ignored as the State moves forward in the practice of adding treated wastewater to the drinking water supply. (One article I attach by Peter Myers very clearly explains the endocrine, low dose response.) Finally, the adage that the dose makes the poison, is out of date and only confounds the issue in light of all the new science coming forth in the last 25 years. There is a huge divide among scientists in this regard, on the scale of those who believe in global warming and those who don't. How many Irma's do we need before all people are convinced? It doesn't appear as though the 'new' thinkers have been part of this process.

RRWPC is in the midst of developing comments for the Russian River Pathogen TMDL and can only give these current documents a brief scrutiny. But they really don't seem much different than prior documents that we have studied. (We attach two of our most recent comment letters, and their still timely attachments and links.) We would think that CEQA or its equivalent, would demand that you seriously address the issues raised by the documents we keep submitting. By authorizing the regulations, you are forwarding the development of new expensive infrastructure. The further you go along this track, the harder it will be to stop the train, since government gets invested in staying on track.

We are also concerned about the statement on page 2 of the *"Initial Statement of Reasons"*: *"Although the absence of SWA regulations wouldn't preclude the permitting of SWA projects, the adoption of uniform criteria in the form of SWA regulations is expected to streamline the permitting process."* We are concerned about allowing permits and streamlined projects moving forward until the concerns expressed in our letter regarding potential impacts from endocrine disrupting chemicals, are fully addressed.

INITIAL STATEMENT OF REASONS: Some Specific Concerns

- The Initial Statement of Reasons mentions the need to meet appropriate levels of toxins in monitoring. We can't comment on the selected MCL's, other than to say, if they are not based on biologic studies that determine health impacts to specific human populations, such as pregnant women, infants, children, lactating mothers, people with compromised immune systems, and include addressing the concept of low dose impacts, then the studies you DO look at may not provide the full range of risk possibilities.
- On page 16 it mentions that a report will be required if more than 10% of samples for quarter don't meet surrogate or operational standard. That means that 10% can exceed current legal standards, not to mention exceed the true level at which harm can occur with ED (Endocrine Disrupting) chemicals. (What repercussions will occur if it happens more than once?) Furthermore, it indicates surrogates will be relied upon, which means the vast number of chemicals and chemical combinations will not be tested.
- While drinking water treatment methods will be used rather than wastewater treatment methods (less stringent), we still don't feel secure that the levels allowed will prevent harm. The concept of 'the dose makes the poison' doesn't apply with most ED chemicals. Furthermore, it seems as though the mechanisms to protect drinking water quality where wastewater is being used, should be far more stringent than what is being proposed here and may not consider the multitude of interactions with other sources. For instance, I wonder about aging infrastructure and leaking toxins from pipes. Are any lead pipes still used? Does the plastic pipe leach endocrine disrupting chemicals in its life history? Furthermore, there are many pipes involved after the final test and before reaching the mouth of a human. What are the potential effects, especially in poor neighborhoods where upkeep is minimal, to the water actually being used? Is that considered at all, especially since many of these toxins bioaccumulate?
- Since the State does not consider endocrine disruption controls as yet, how will having certified labs and workers help in regards to such exposures? It doesn't seem

as though quarterly monitoring will be adequate to control toxins that harm in the parts per billion range. Also, you will be dealing with surrogates, so most chemical toxins won't even be directly monitored. This is a problem in relation to ED's.

- It is likely that the treatment processes will not be able to keep out all the pharmaceuticals, let alone their synthesized combinations either. This is an issue of great concern, along with the current crisis with antibiotic resistance. Antibiotics are found in meats and many food products. The more they are used, the more resistance is uncovered. In the meantime, pharmaceutical companies are doing almost nothing to develop new antibiotics, since they are not a big money maker and new ones are expensive to develop. Are pathogens in the water tested for antibiotic resistance? How can quality of drinking water be assured if not?
- In regards to unregulated chemicals, we don't understand how the public can be assured that the analytical methods chosen will be adequate to protect their health. It seems as though the cart is before the horse here. Similar comment for log/10 removals. It seems like possible treatment barriers should be well established before implementation begins. What makes me nervous here (page 22) is the statement, *"Failures of a shorter duration (i.e., 24 hours) are to be reported to the Regional Board no later than ten days after month in which incident(s) occurred."* And, *"The criteria are designed to assure a safe, treatable source of water for a SWTP, not the uniformly high quality required of finished drinking water."* Some failures may be more serious than others and all should be reported immediately, if possible.
- How does Table 1 on page 20 relate to the new bacteria standard that is about to be considered by the State Water Board? Will the standards in this document match the new one you are about to adopt? Since health professionals seem to take more care with pathogens than with toxins, hopefully we can trust the numerical limits established for pathogens. (Surface water conditions are considered before addition of treated wastewater.) Communication glitches occur from time to time, and with people's health more at stake in this process, what will happen if there is a breakdown and treatment levels are not obtained because of missed communication? What are the enforcement actions that might be taken to assure all treatment steps are completed appropriately?
- Why is quarterly monitoring of wastewater to be added to reservoir, considered adequate, especially since that appears to be the most risky of the drinking water/wastewater combination? We also wonder how frequently pathogens will be monitored?
- Overall, the level of monitoring is very detailed although relatively infrequent. As more toxins may be added in the future, this is likely to increase. (Will this compromise public health be at any time?) As I write this, Irma is moving through Florida, and everyone is anxious about the level of damage that might occur to an entire state. Here in California we have earthquakes, floods and fires to contend with. Since this technology relies on extremely careful monitoring, what happens when things break down? How will all of this work during emergencies and how much toxicity might customers be exposed to? It is my understanding that tests are available for EDs that are effective and relatively inexpensive (I could be wrong about that.) and focus on surrogates that have proven to cover the big picture. Could the State look into this? (Treatment plants can be down for weeks after this

disaster. What plans are in place for a situation where treated wastewater is added to reservoirs that might be impacted. What happens in an emergency?)

- On page 26 it is mentioned that additional monitoring may occur for chemical toxins **that are expected to exist in the municipal wastewater**. What would it take to get the State to require testing for EDs on a regular basis? If the State won't even acknowledge the existence of low dose effects of endocrine disrupting chemicals, what good would it do to measure all the others? If we were to evaluate the basis for the burgeoning explosion of massive health care facilities in major population centers, would EDs be a big part of the picture?
- Page 32 requires that an Expert Panel or an independent scientific advisory panel, make a finding that SWA criteria adequately protect public health. In our view, unless these groups also include analysis by an endocrinologist with outstanding bona fides, their views and endorsements are incomplete. The scientific discoveries over the last 25 years regarding endocrine disruption, an aspect that affects almost all levels of health for humans, pets, wildlife and aquatic life, cannot be ignored without serious ramifications. Some people believe that this issue is every bit as important as global warming. As mentioned earlier, Eds cause a large range of reproductive problems, developmental problems, illnesses and life-threatening diseases. How can you not do more with this regulation before you head into programs that continue to inject disease causing chemicals directly into our bodies, our children and our planet?

Two Schools of Scientific Thought...

RRWPC has been aware that many scientists are of the old-school approach that believes in testing chemicals for toxicity separately (not looking at the effects of large combinations of toxins) and developing legal standards based on these singular effects. They also believe, we are told, that conventional pollutants are the main concern (I may not be expressing this appropriately, but I think you know what I mean.) and that EDs also appear in nature substances that we ingest, and as such, are not dangerous. Also, many believe that 'the dose makes the poison' and that no harm can occur with very small doses.

Then there is the new school (last 25 years or so) that feels they have demonstrated, that with the endocrine system, which governs most of our organ functions, that assumption is turned on its head. (Please see attachments.)

Although your expert panelists have impressive vitae's, it appears they have not advised about low dose impacts (as far as I can tell). Furthermore, I have learned some things about the National Research Institute (NWRI) who, at the request of the State Water Board, established an expert panel to convene pursuant to CA Water Code, Sections 13562(a)(2) and 13565(a). Their report of 10-31-16 Entitled "Expert Panel Finding on California State Water Resources Control Board's Proposed Uniform Water Recycling Criteria for Surface Water Augmentation"

It appears that the National Water Research Institute (NWRI) also weighed in with information on the safety of augmentation of drinking water sources with treated wastewater through their consultant role with San Diego Indirect Potable Reuse/Reservoir Augmentation Demonstration Project. Their general conclusion was

that reservoir augmentation was safe if all treatment processes are adequately maintained.

But we can't help but wonder about the intellectual independence of this group, as they were called out by Wikipedia about possible conflict of interest. If they were used to certify the prior findings of the State, and support previous regulations, then their intellectual independence may be compromised.

The State must be aware of the member agencies of nonprofit NWRI who pay \$50,000 a year for membership and who seek to utilize (or already utilize) the augmentation of reservoirs with treated wastewater. These are the proponents and NWRI members who take advantage of regulations to enable this system:

Inland Empire Utilities Agency

Irvine Ranch Water District

Los Angeles Department of Water and Power

Orange County Sanitation District

[Orange County Water District](#)

West Basin Municipal Water District

All of these entities are advocates for this use.

I googled NWRI on the web and came up with a Wikipedia entry which said this about NWRI:

"A major contributor to this article appears to have a [close connection](#) with its subject. It may require [cleanup](#) to comply with Wikipedia's content policies, particularly [neutral point of view](#)"

Then Wikipedia explains their conflict of interest statement as follows:

Wikipedia's conflict of interest statement:

Conflict of interest (COI) editing involves contributing to Wikipedia about yourself, family, friends, clients, employers, or your financial and other relationships. Any [external relationship](#) can trigger a [conflict of interest](#).^[a] That someone has a conflict of interest is a description of a situation, not a judgment about that person's opinions or integrity.^[b]

COI editing is strongly discouraged on Wikipedia. It undermines public confidence, and it risks causing [public embarrassment](#) to the individuals and companies being promoted. Editors with a COI cannot know [whether or how much it has influenced their editing](#). If COI editing causes disruption, an administrator may opt to place blocks on the involved accounts.

Editors with a COI, including [paid editors](#), are expected to [disclose it](#) whenever they seek to influence an affected article's content. Anyone editing for pay [must disclose who is paying them](#), who the client is, and any other relevant affiliation; this is a requirement of the [Wikimedia Foundation](#).^[6] In addition, COI editors are generally advised not to edit affected articles directly, and to propose changes on talk pages

instead.

When investigating COI editing, do not reveal the identity of editors against their wishes. Wikipedia's policy against harassment, in particular the prohibition against disclosing personal information, takes precedence over this guideline. Editors discussing changes to this guideline should disclose whether they have been paid to edit Wikipedia.

RRWPC's concerns about situation....

The reason RRWPC includes this conflict of interest material is to point out that use of any research by NWRI should fully disclose to the public that the person writing the article did not respect Wikipedia's conflict of interest requirements. RRWPC's view is that if the State relied on this agency's work in any way without full disclosure of the membership of the group, (individual scientists are listed, but not the agencies mentioned above who support the organization. We believe that it is inappropriate to not list that information since the Districts financially supporting the group are also the District's aiming to be authorized through proposed regulations to implement the technology.

Also, we have another concern closely related to one above. We know that a major effort involving this organization and State Water Board staff included public relations campaigns to convince people that drinking wastewater is a safe thing to do. People were told it was very highly treated; that others used this wastewater to no harmful health effect, and that the State would assure it's safety by regulating it carefully. (While the State may consider this truthful information, we don't recall any downside to this practice being mentioned to the public.) At least two professional public relation firms were hired to conduct the public opinion research. In the survey questions I viewed, probably because endocrine disruption was not discussed from what I recall, the safety of this practice may have been misrepresented. I believe that only an endocrinologist who is fully informed about current science in the field, could verify whether I am correct or not.



RRWPC

Russian River Watershed Protection Committee

P.O. Box 501
Guerneville, CA 95446
<http://www.rrwpc.org>

Jeanine Townsend, Clerk to the Board
State Water Resources Control Board

Sent via Email to: commentletters@waterboards.ca.gov
October 23, 2016

COMMENT LETTER-REPORT TO LEGISLATURE ON DPR

Dear Ms. Townsend:

The purpose of this letter is to provide comments on the Report to the Legislature on the *Feasibility of Developing Uniform Water Recycling Criteria for Direct Potable Reuse* and recommendations from expert and advisory panels on that topic. We appreciate the opportunity to comment on this report.

RRWPC Background...

Russian River Watershed Protection Committee (RRWPC) is a nonprofit, public benefit corporation founded in 1980. For about the last eight years, we have been tracking and commenting on the issue of wastewater reuse (specifically regarding tertiary wastewater irrigation) to both your Board and the Regional Water Quality Control Board. During that time, RRWPC has submitted comments and attachments on the *Recycled Water Policy* and the *Policy Amendment*, the *General Waste Discharge Requirements for Landscape Irrigation Users of Municipal Recycled Water (General Permit)*, the *General Order for Recycled Water Use (2014 and 2016)*, *The North Coast Basin Plan Amendment for Recycled Water Use*, etc. We include via link RRWPC Comments and Attachments on the *General Order for Recycled Water Use (2016)* for this record: http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/comments/general_order/)

RRWPC represents hundreds of lower Russian River residents, property and business owners, recreationists, etc. who are concerned about water quality and flows, along with clean drinking water, in the lower Russian River, one of the most popular summer vacation destinations of the Bay Area. For years, our area was the recipient of Santa

Rosa's treated wastewater discharges into our river. For fifteen years we battled this problem and they ultimately built a 40-mile pipeline to take their wastewater to the Geysers steam fields. This has sensitized our community to the problems of allowing toxic materials into our waterways and we are deeply concerned about DPR.

We are concerned that little is known about the toxic substances in our river and we have always wondered what unregulated remnant toxins enter the river through other wastewater discharges, agricultural and irrigation runoff. While the SWAMP program has been conducting some tests on river toxicity, we have not seen any results as yet. The specter of DPR may be enough to drive people to the bottle, the water bottle that is, as some urban water districts promote, "Take it from the tap".

We are aware that the purpose of these comments is to address the feasibility of developing water recycling criteria for DPR to inform the Legislature, and that it is highly unlikely that DPR would become a reality for Northern California anytime soon. We are nonetheless very concerned about the prospect of having statewide regulations developed at this time for direct potable reuse. While we do not claim to be experts in the field of wastewater technology, especially at its highest level of constituent removal, we do know enough about some of the vulnerabilities and issues connected with this possibility that we wish to have our concerns about public health and background information about endocrine disruption entered into the record.

DPR may be infeasible.....

What we do know is that, if done with full consideration of all potential health risks, making the adaptations needed for DPR will be very expensive, may involve higher energy use and potentially increased carbon releases (contrary to current goals to reduce carbon emissions). As with all infrastructure projects, it will ultimately be subject to human failure (with associated higher risk to the public), natural disaster, deterioration with age, not to mention unknown environmental side effects of the technology that may be difficult and expensive to address. These documents provided far more detail on the technical toxin removal aspects of DPR, but left the critical and complex health risk analyses to some vague future studies.

Our growing concerns about endocrine disruption impacts, sometimes caused by the chemical soup of unregulated chemicals bought together by wastewater treatment processes, motivate us to keep commenting on this issue. A woman acquaintance from Santa Cruz, Jude Todd PhD, has authorized me to submit her 27-page analysis of the issue, written to address reuse in the Santa Cruz area and attached to this submission. We share many of the same concerns and I am grateful for her input.

Dr. Todd has comprehensively detailed the issues with wastewater reuse and CECs with specific focus on endocrine disruption. (Attachment #1) She also addresses indirect potable reuse on page 13 of her document, expressing significant concerns about the very limited monitoring of only six constituents out of the many thousand toxins of concern. On page 14 she makes the astute observation that,

Generally speaking, regulatory toxicologists are not on the same page with endocrinologists, developmental biologists, molecular biologists, geneticists, epidemiologists, and other independent scientists who understand how endocrine disruptors and other CECs impact living organisms. As Andrea Gore, editor of Endocrinology, puts it, "There are fundamental differences between

regulatory toxicologists and what I refer to as 'people who understand the endocrine science.'" (qtd. in Brown and Grossman 2015)".

Although her focus is mostly on wastewater irrigation, the issues Dr. Todd delineates in her paper are every bit as important and relevant to DPR, and perhaps even more so. She also provides an extensive list of scientific resources that should be of value to your staff and the Legislature. I urge you to read this important paper. Can you even consider taking steps to put wastewater into the drinking water supply while ignoring the scientific work of so many experts working in the field of endocrine disruption?

Need for full disclosure on extent of effort and potential impacts....

I'm concerned that Water Board staff and their panels have not defined the extent of the problem of endocrine disruption in the report to the Legislature. Perhaps the quote immediately above explains why. In your staff responses to RRWPC comments on the *General Order for Recycled Water Use*, it states on page 30, "*The Science Advisory Panel acknowledged that the science regarding endocrine disrupting chemicals is incomplete, especially regarding mixtures of CECs.*"

Rather than acknowledging all the scientific work that has already been done, the Panel mostly ignores the vast amount of research conducted by the many professionals noted above, along with environmental health organizations and publications such as *Environmental Health Perspectives*, *San Francisco Medical Society Journal*, *Environmental Health News*, *The Endocrine Society*, *Environmental Working Group*, *USGS*, and many more noted in our *Endocrine Resource List (Attachment #2)* in Canada, Europe, and other advanced countries. While the knowledge in this field continues to evolve, and many more scientific breakthroughs will no doubt occur, it is a travesty to pretend that nothing worthy of note has been accomplished as of this time. (Our lists could be much longer; resources provided in this letter are the tip of the iceberg.)

Why is there no mention of Dr. John Peterson Myers (Pete Myers), who for 25 years, along with Theo Colborn, Lou Guillette and numerous others, lead the field of endocrine disruption and its effects on human health and wildlife? Unfortunately, Dr. Colborn died almost two years ago and is greatly missed; but we wonder why has her name or Dr. Myer's never appeared in any of your documents? (We attach an obituary of Theo telling of her accomplishments over 25 years (Attachment #3) and a prestigious National Institute of Environmental Health Sciences, (part of NIH) recent award to Dr. Myers (Attachment #4).)

The work of Pete Myers and Theo Colborn resulted in the book, *Stolen Future* that was published in the mid-90's. Subsequently it triggered the release of hundreds of millions of dollars for endocrine research (especially from NIH) which in turn brought forth much of the progress in this field over the years since. And their names and their work and the studies they generated don't seem to even be worthy of a mention in any of your documents. Why is that? (I again attach my list of references containing these and other quality scientific references. (Attachment #4)

Laura Vandenberg, PhD, who was a lead writer among 12 scientists, including Dr. Colborn and Dr. Myers, had submitted a comment letter on the *Recycled Water Policy Amendment* stating that there is no safe dose of endocrine disrupting chemicals. She

also emphasized that this is not controversial and that The Endocrine Society, with hundreds of member endocrinologists from around the globe, supports this view completely. (Attachment #5) The link to the study, published in March, 2012, and documents about 800 studies on endocrine disruption, is:

- Vandenberg, L.N., et al., *Hormones and endocrine disrupting chemicals: low dose effects and non-monotonic dose responses*. Endocrine Reviews, 2012. 33(3): p. 378-455, <http://www.ncbi.nlm.nih.gov/pubmed/22419778>

The Endocrine Disruption Exchange (TEDX) is Dr. Colborn's website and contained a concise one-page fact sheet with the important basics on this topic. I am placing it in the body of this letter because it is so very important to this topic. (Her website also contains a wealth of information that can be easily understood by most.)

Endocrine Disruption Fact Sheet

The Endocrine Disruption Exchange (TEDX): www.endocrinedisruption.org

Nov. 7, 2011

What are endocrine disrupting chemicals?

The endocrine system is involved in every stage of life, including conception, development in the womb and from birth throughout early life, puberty, adulthood and senescence. It does this through control of the other vital systems that orchestrate metabolism, immune function, reproduction, intelligence and behavior, etc.

The endocrine system acts through signaling molecules, including hormones such as estrogens, androgens, thyroid hormones, and insulin, as well as brain neurotransmitters and immune cytokines (which are also hormones) and other signaling molecules in the body.

How are humans exposed to endocrine disrupting chemicals?

We breathe, eat, drink, and touch EDCs every day. Some can be persistent and remain in the environment for centuries and can build up in the body. Other non-persistent EDCs can be so ubiquitous they are found in nearly every human tested. EDCs include components of plastics, pesticides, flame retardants, fragrances and more. They are found in our homes, schools and work places, toys, clothing, cosmetics, sunscreens, electronics, furniture, cleaning products, lawn care products, automobiles, building materials, food, and food packaging.

How do endocrine disrupting chemicals affect our health?

A vast body of scientific literature exists on the health impacts of some EDCs, while for others there is very little research. Laboratory studies and human epidemiological studies confirm that EDCs have a wide array of effects on the body. Effects of EDCs have been found in animals at tissue concentrations below those measured in humans. In the US, the cost of treating health conditions for which EDC exposure is implicated is over \$1 trillion a year.

What distinguishes EDCs from other chemicals of concern?

Dose: *a central feature of endocrine disruption is that effects are found using very low chemical concentrations. Effects of EDCs at very low concentrations can be different from effects of the same chemical at higher concentrations.*

Timing: *there are many periods of vulnerability during which exposure to EDCs can be particularly harmful. The most well studied critical periods are prenatal and early postnatal development. Effects of early life exposure may not manifest until much later in life. Effects in one generation may be transmitted to future generations through mechanisms involved in programming gene activity, referred to as epigenetic changes.*

*Endocrine disrupting chemicals (EDCs) interfere with hormone signaling in a variety of ways depending on the chemical and the hormone system. Biomonitoring of chemicals in human blood and urine has shown that 100% of the people tested have EDCs in their bodies. EDCs have been implicated in neurological diseases, reproductive disorders, thyroid dysfunction, immune and metabolic disorders and more. **Traditional approaches to determining safe exposure levels (for example, chemical risk assessments) do not work with EDCs.** (emphasis added)*

The low dose problem.....

Chemical risk assessment has always assumed that “...*the dose makes the poison.*” Over-simplified, high doses are considered bad and low doses generally good and toxic risk levels are expected to correspond. But all of that is turned on its head with endocrine disruption. Dr. Pete Myers, along with Wendy Hessler define it well in their article, “*Does the dose make the poison?*” <http://www.ourstolenfuture.org/newscience/lowdose/2007/2007-0525nmdrc.html>

They explain that sometimes they see effects at low doses that they don't see with large and that is counter intuitive to most scientists conducting risk assessments. The authors express concern that this anomaly sometimes leads to health standards that are too weak.

Dr. Myers explains, “*In standard toxicology, as the dose increases, so does the effect. Conversely as dose decreases, so does its impact. This relationship is called a monotonic dose-response curve because effects are either increasing or decreasing.... Non-monotonic curves, in contrast, change direction. Over part of the curve, response increases with dose, while over another portion it decreases as dose increases.... While toxicologists have traditionally assumed that the dose makes the poison, endocrinologists --scientists who study the action of hormones-- have long known that hormones can have different effects at different doses.*”

Marla Cone, Editor in Chief of Environmental Health News explains the low dose effect this way: <http://www.environmentalhealthnews.org/ehs/news/2012/low-doses-big-effects> (see article)

With chronic diseases, risk is difficult to define....

Can anyone identify specific cases where wastewater is known to have caused a specific cancer incidence or that of any other chronic disease? The truth is, when it comes to chronic conditions, generally people may suspect a cause, but can seldom definitely and specifically point to the precise time and place an illness was initiated. And perhaps that is why Public Health Departments focus on pathogenic illness and seldom, if ever, address more mysterious, but common problems.

Dr. Todd quotes Linda Birnbaum, toxicologist in charge of the National Toxicology Program and the National Institute of Environmental Health Services that, “...*an ED is anything that affects the synthesis of a hormone, the breakdown of a hormone or how the hormone functions.*” And then she continues...

“*We used to think it had to bind with a hormone receptor but endocrine disruptors can perturb hormone action at other stages in the process*” (qtd. in Borrell 2012, emphasis added). Such perturbations in hormone function can have wide-ranging impacts on our bodies. As the Environmental Working Group, an independent health research organization, explains: *There is no end to the tricks that endocrine disruptors can play on our bodies: increasing production of certain hormones; decreasing production of others; imitating hormones; turning one hormone*

into another; interfering with hormone signaling; telling cells to die prematurely; competing with essential nutrients; binding to essential hormones; accumulating in organs that produce hormones. (Environmental Working Group 2013)

Given this list of ways that EDs can stymie our normal bodily functions, we can begin to see how they can precipitate childhood leukemia and other cancers, allergies, asthma and other respiratory problems, genital malformations in baby boys, early puberty in girls, ADHD, diminished IQ, autism, obesity, diabetes, cardio-pulmonary diseases, immune-system dysfunction, and Parkinsonism; evidence is mounting that endocrine disruptors may also play a role in development of Alzheimer's disease and other mental illnesses."

Finally, April, 2016 issue of *Environmental Health Perspectives*, (#6) Linda S. Birnbaum et.al. state in the article, "Informing 21st Century Risk Assessments with 21st-Century Science," *"The majority of regulatory frameworks guide risk assessment from the perspective of a single chemical or single component of a project formulation and often do not account for multiple chemical exposures and mixtures. Furthermore, most chemical risk assessments of potential human health effects rely on testing in animal models using exposures that are typically higher than those experienced by humans. This testing model requires the assessor to extrapolate to lower doses and across species, and it provides limited consideration of variability within species. All of these factors undermine confidence that current risk assessments are protective of human health, particularly for the most vulnerable individuals, communities, and life stages."*

Conservation slipping as reuse grows extensively...

With all this, we wish to acknowledge the State's legitimate concerns about developing adequate water supplies under all scenarios for the entire state. First and foremost, the emphasis on conservation needs to be continually emphasized. Unfortunately, many California areas have significantly increased water use in the last year after winter rain eased the drought. In our area, water contractors are now up to about half way between 2013 use and 2015 conservation accomplishments. Local contractors are relieved that they can now get more income from water sales and they point to our full three-year reservoir as an adequate supply (Lake Sonoma).

For instance, Sonoma County Water Agency contractors' water sales in July, August, September of 2015 were 9371.1 acre feet, and in 2016, they were 11,204.6 AF. This was almost a 20% increase. In an article entitled '*Weaker water conservation numbers prompt fears that California is going back to its old bad habits*' author Matt Steven (The Times 10-15-16) (Attachment #7) states that, "*Californians' water conservation slipped for the third consecutive month in August, prompting new alarm from regulators about whether relaxed water restrictions may be causing residents to revert to old habits as the state enters its sixth year of severe drought.*" Isn't full time conservation a much cheaper and healthier route to increasing water supplies than encouraging big infrastructure projects that grow old, they fail, and massive pollution results, as is happening now with water pipes leaching lead?

Wouldn't it be cheaper and healthier in the long run to charge much more for water and build less infrastructure (including wastewater treatment plants)? Is it possible that users may come to appreciate it more and treat it with more respect? To constantly advocate for more growth is slow but steady suicide where drinking water is concerned.

While not wanting to explore another issue in greater detail, something must be done about the wanton use of water in many agricultural areas. It is said that 80% of California's water is used by agriculture, yet regulations of that use have been minimal or non-existent. The passage of the new SGMA groundwater law will help, and we hope serious management of our dwindling resource occurs, although we won't hold our breath. What good does it do if we have adequate almonds to eat and no clean or even less clean water to drink? (Calling attention to the crop that it is said uses one gallon per nut to grow.)

Public perception and DPR...

The City of Santa Rosa has changed the name of their Water and Wastewater Utilities Department to *Water Department*, to convey to the public that all water is the same, but the reverse of that famous quote, "*A rose by any other name would smell as sweet....*", if true, belies their intention.

Some of the State's Advisory Committee meeting notes on this issue expressed a big concern about public perception of DPR. The group spent time focusing on messaging and emphasizing that the wastewater would be *purified* and totally safe to drink. Public opinion consultants were hired and surveys were taken regarding public perception of augmenting water supplies with 'purified' wastewater. When those surveyed were told that it was done in other places and that no one got sick from it, they thought it must be okay. Of course, no one mentioned the difficulties of assessing causes of chronic illnesses and the inability to prove that no one got sick.

It's unclear how one would really determine the complete safety of drinking water that contains treated wastewater, even when highly treated. Of course no scientific studies have been conducted to test cause and effect ratios of toxic exposure in relation to human disease, nor will they be. Reliance on epidemiological studies are the norm where appropriate, but it is unlikely one can be found that replicates the conditions that will be utilized for DPR. Public health departments have great expertise assessing and controlling pathogens, and many precautions have been effectively imposed to prevent many acute diseases and illnesses.

But when it comes to chronic diseases such as cancer, developmental problems such as autism, neurological and reproductive birth defects, and many other health problems that are associated with exposures to endocrine disrupting chemicals, little is known about the exact pathway of disease in terms of lifestyle, toxic exposure, heredity, etc. that lead to initiation of the condition and/or illness, although more and more studies link toxic exposures to these and many other adverse health conditions.

Unregulated toxins are everywhere; they are in our food, our water, our clothing, our furniture and mattresses, our house cleaning and personal care products, our autos, and much more. And those that get washed into the waste stream to our treatment plants are a toxic stew of pharmaceuticals, industrial and combustion by-products, heavy metals, pesticides, and more. But even more than that, not only does a vast array exist in the wastewater collection process, and in our households, but much of it actually accumulates in our bodies, and may or may not trigger a disease process. You see, we all have different vulnerabilities and our stage in life, and our health history may compound the impacts of various exposures.

Environmental Working Group

Recently an article described how clothing particles Organophosphate pesticides and PBDE flame retardants, lead and mercury are all found to be prime examples of neuro-developmentally toxic chemicals according to July, 2016 issue of Environmental Health Perspectives Article, *“Project TENDR: Targeting Environmental Neuro-Developmental Risks. (Attachment #8) The TENDR Consensus Statement”*. The project was a call to address the role of common exposures to toxic substances. They state, *“The TENDR authors agree that widespread exposures to toxic chemicals in our air, water, food, soil, and consumer products can increase the risks for cognitive, behavioral, or social impairment, as well as specific neurodevelopmental disorders such as autism and attention deficit hyperactivity disorder (ADHD).”*

Further on it states, *“Many toxic chemicals can interfere with healthy brain development, some at extremely low levels of exposure.” Critical windows of development have been identified up through puberty whereby, “....toxic chemical exposures may cause lasting harm to the brain that interferes with a child’s ability to reach his or her full potential.”*

Another issue mentioned was that health studies never look at multiple exposures of toxic substances and in fact, multiple exposures are very common in our everyday life. We seldom use just one chemical to clean our bathrooms, and in fact, almost everything we do on a daily basis brings together multiple toxic exposures at a time. All of these chemicals that end up going down the drain must be 100% removed from the waste stream at all times if they are to merge with the drinking water supply, even non-toxic chemicals which can combine to form toxic substances, if you are to assure the safety of drinking water. Further, it behooves you to assure that all vulnerable populations must be protected before you put the treated wastewater into the drinking water supply.

In the expert panel’s Final Report, they state in their recommendations on page 5 of Executive Summary that the Expert Panel, *“.... recommends monitoring the literature on potential health risks that could present serious harm to health over short durations of exposure to compounds likely to be present in recycled water. Of specific concern are chemicals that adversely affect the development of fetuses and children....This activity could be initiated concurrently with the development of DPR regulations and continued as an ongoing effort.”*

It is a serious concern of ours that rather than talking about the extensive existing literature on the issue, as we have tried to demonstrate in our comments, that they are going to set up a committee to look at it. Why have they not been looking at it before producing this report that substantially fails to define the problem? How can they begin the process of writing DPR regulations before that occurs?

In any case, this effort gives the impression that the State only has a cursory interest in the topic of the impact of chemicals on public health. It does not feel like a serious effort that should move forward. First the information should be gathered, and then the regulations can proceed. Please prioritize the health of Californians before dumping wastewater in the drinking water supply!

Thank you for the opportunity to address this very serious issue.

Sincerely,



Brenda Adelman

ATTACHMENTS:

1. Jude Todd, PhD, *Statement Regarding Use of Recycled Municipal Wastewater in Santa Cruz*, Nov. 18, 2015
2. RRWPC, *List of References on Endocrine Disruption*, Fall, 2014
3. Carol F. Kwiatkowski, et. al., *Twenty-five years of Endocrine Disruption Science: Remembering Theo Colborn*, Environmental Health Perspectives, DOI: 10.1289/EHP746
4. Environmental Health News staff report, *EHN founder honored as environmental health champ*, (re Pete Myers), Oct. 10, 2016
5. Laura Vandenberg, *Comment Letter (to State Water Board)-Amendment to Recycled Water Policy*, June 27, 2012
6. Linda S. Birnbaum, et.al. *Informing 21st- Century Risk Assessments with 21st- Century Science*, Environmental Health Perspectives, April 2016 DOI:10.1289/ehp.1511135
7. Matt Stevens, *Weaker water conservation numbers prompt fears that California is going back to its old bad habits*, LA Times, Oct. 5, 2016
8. Deborah Bennett, PhD, et.al., *Project TENDR: Targeting Environmental Neuro-Developmental Risks. The TENDR Consensus Statement*, Environmental Health Perspectives, July, 2016, DOI:10.1289/EHP358



June 27, 2012

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

RE: Comment letter-Amendment to the Recycled Water Policy

Dear Members of the State Water Resources Control Board,

I am an academic scientist who has worked for nine years on issues related to endocrine disruptors, including assessments of human exposures, meta-analyses of published literature, and benchwork assessing the effects of chemicals on development, behavior, reproduction, and other endpoints in rodents and aquatic animals. My PhD is in Cell, Molecular and Developmental Biology, although my work is also well recognized in the field of Environmental Health Science. I have published more than 25 peer-reviewed studies and two book chapters and have served on expert scientific and risk assessment panels in the EU and the US. I was also the lead author on the most comprehensive review to date on low dose exposures to endocrine disrupting chemicals (EDCs; discussed in more detail below).

I am writing to challenge the assertion that “monitoring of individual CECs is not [necessary] for recycled water used for landscape irrigation.” I encourage you to consider the extensive peer-reviewed scientific literature on the effects of low doses of EDCs before making decisions about chemical safety in the water supply. Although your scientific board, and many toxicologists around the world, conclude that “the dose makes the poison” when it comes to environmental toxicants, this statement is simply not supported by fact when the chemical in question is a hormone, hormone mimic, or hormone blocker.

In 2001-2002, the National Toxicology Program (NTP) addressed whether there was sufficient evidence to conclude that EDCs act at low doses, i.e. at the doses that humans encounter in their everyday lives. As you are likely well aware, humans encounter EDCs in their food, water, air, dust, as well as household products like detergents, upholstery, solvents, etc. Although typical humans are exposed to low levels of these chemicals (often in the nanogram per kilogram body weight range), the US FDA has identified more than 1000 EDCs in current use, a significant percentage of the over 80,000 chemicals currently in commerce (see <http://www.fda.gov/scienceresearch/bioinformaticstools/endocrinedisruptorknowledgebase/default.htm>). In 2002, the NTP addressed whether there was significant support in the scientific literature for *The Low Dose Hypothesis*, the scientific hypothesis that EDCs could affect development and reproduction of animals *in the range that humans typically experience, i.e. the*

low dose range. Although the NTP was hindered at that time by a relative paucity of data, they did conclude that there was evidence for low dose effects for several EDCs including DES, genistein, nonylphenol and methoxychlor [1].

In 2009, I began working with a group of 11 experts in the fields of endocrinology, cancer biology, ecology, developmental biology, and epidemiology on re-assessing scientific support for The Low Dose Hypothesis. These experts are at the forefront of their fields, have served on expert panels around the world, testified before the US Congress, and are collectively the authors of more than 1000 papers on environmental chemicals. Most of these scientists have been working on this issue for decades.

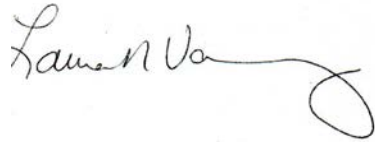
It took us three years to review over 800 published papers from the endocrinology and toxicology literature. Looking at this body of evidence as a whole, we concluded that there was clear and consistent evidence that a large number of EDCs have effects at low doses [2]. In fact, for every chemical where we could identify a low-dose cut-off and low dose studies had been performed, there were low dose effects. These chemicals include herbicides, insecticides, fungicides, preservatives, industrial chemicals, surfactants, plasticizers, pharmaceuticals, flame retardants and anti-bacterial agents, among others. We also identified hundreds of examples of non-monotonic dose response curves, i.e. those where the dose *does not* make the poison. Not only did we identify these types of responses in cultured cells and laboratory animals, but they were also observed in human populations.

Our analysis indicates that low dose effects and non-monotonic dose responses are common for EDCs, and in fact may be *the expected* type of biological response for this large class of chemicals. Most importantly, we have a great understanding of the mechanisms behind these types of effects; hormones act in the body at exceedingly low concentrations, i.e. in the part per trillion or part per billion range. The endocrine system is tuned to respond to these low doses. Thus, low doses of chemicals that mimic hormones follow the same “rules” as the natural compounds. Additionally, while these low levels of hormones can have reversible actions in adults (i.e. an adult female taking pharmaceutical estrogens [birth control pills] will have reduced fertility due to ovulation inhibition, but cessation of pharmaceutical treatment restores her fertility), hormones are known to change the development and differentiation of tissues in embryos, fetuses, and even neonates. These effects will be permanent and irreversible.

The concept of low dose effects and non-monotonic dose responses **is not at the fringe of science**. The Endocrine Society, the world’s largest professional association of clinical and research endocrinologists, has released two recent statements regarding EDCs, and has repeatedly reiterated the conclusion that low doses of EDCs are harmful to humans and wildlife [3, 4]. This conclusion has widespread acceptance in the field of endocrinology due to the strength of the published data. Additionally, following the publication of our review [2], Dr. Linda Birnbaum, Director of the National Institutes of Environmental Health Science (NIH) and one of the world’s leading toxicologists wrote an editorial stating: “the question is no longer whether nonmonotonic dose responses are ‘real’ and occur frequently enough to be a concern; clearly these are common phenomena with well-understood mechanisms...It is time to start the conversation between environmental health scientists, toxicologists, and risk assessors to determine how our understanding of low-dose effects and nonmonotonic dose responses influence the way risk assessments are performed for chemicals with endocrine-disrupting activities. Together, we can take appropriate actions to protect human and wildlife populations from these harmful chemicals and facilitate better regulatory decision making.” [5]

On page 13 of your revised policy, it is stated that “Regulatory requirements for recycled water shall be based on the best available peer-reviewed science.” The low dose literature that we reviewed in our recent analysis was all peer-reviewed science, and our analysis was peer reviewed as well. Yet this vast body of science has not been considered or addressed by the board. Thus, I respectfully ask this committee to reconsider suggestions that exposure of human and wildlife populations to EDCs, including pharmaceuticals, should not be concerning if the concentrations of these chemicals are “low”. Clearly, relying on the centuries old adage that “the dose makes the poison” is not sufficient to protect public health.

Sincerely,

A handwritten signature in black ink, appearing to read "Laura N. Vandenberg". The signature is fluid and cursive, with a large loop at the end.

Laura N. Vandenberg, Ph.D.
Tufts University Center for Regenerative & Developmental Biology

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ENVIRONMENTAL CHEMICALS

Large Effects from Low Doses

Laura N. Vandenberg, PhD; R. Thomas Zoeller, PhD; J.P. Myers, PhD

Virtually all safety standards for chemical exposures are determined through a process that assumes that high-dose testing will reveal relevant risks because “the dose makes the poison.” For many well-studied contaminants this is a reasonable assumption, but for compounds that behave like hormones, it is demonstrably false.¹ The public health implications of this conclusion are enormous, because it means that many—likely dozens, plausibly hundreds, possibly thousands—of today’s chemical safety standards are too weak by orders of magnitude.

The basis for this conclusion derives from endocrinology. In endocrinology, it is well established that the impacts of hormones (such as estrogen) at high doses can differ from those in the “physiological range” of normal circulating levels of hormones in serum; it is at these concentrations that hormones interact with their receptors to cause physiological and developmental changes by altering gene expression. Indeed, hormones at abnormally high doses are often overtly toxic, through mechanisms that have nothing to do with receptor action.

As research has expanded into the effects of endocrine-disrupting chemicals (EDCs), it has been shown that they follow the same rules that hormones follow.¹ Unfortunately, this runs counter to the core assumption that forms the basis for all toxicological testing done to establish regulatory standards: High-dose testing will be informative about low-dose impacts.

The EPA defines an EDC as “an exogenous agent that interferes with the synthesis, secretion, transport, binding, action, or elimination of natural hormones in the body that are responsible for the maintenance of homeostasis, reproduction, development, and/or behavior.”² Although Rachel Carson examined the effects of many environmental chemicals on health and reproduction in her landmark book *Silent Spring*,³ work on EDCs really took shape in 1991, when a group of scientists met at the Wingspread Conference Center in Racine, Wisconsin, to discuss research on the effects of environmental chemicals on sexual development. The Wingspread attendees produced a consensus statement stating, “We are certain of the following: A large number of man-made chemicals that have been released into the environment, as well as a few natural ones, have the potential to disrupt the endocrine system of animals, including humans.”⁴

EDCs are now understood to be any chemicals that interact with the endocrine system, including chemicals that act as agonists and antagonists of hormone receptors, including estrogen, androgen, thyroid, glucocorticoid, retinoid, and others. To determine the mode of action of these chemicals, both



in vivo (animal) and in vitro (cell culture) assays have been developed. While most chemicals on the market today have never been tested for safety, much less for endocrine disruption, these assays could be used to test new chemicals for hormonal activity prior to their entry into the environment through the food supply, packaging materials, or as waste; they are also widely used to test for their hormonal activity many chemicals that are already in use. Chemicals with a wide range of uses, including detergents, plastics, cosmetics, pesticides, pharmaceuticals, and flame retardants, among others, have been shown to have endocrine-disruptor activities.

In 2002, the National Toxicology Program (NTP) examined evidence for what has been termed “the low-dose hypothesis,” i.e., the theory that EDCs could have actions at low doses.⁵ What is meant by “low doses”? Typically, these are doses in the range of what humans experience in their every-

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Environmental Chemicals

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day lives—residues on food, in the air, in dust, and in drinking water. Low doses are often within the range that traditional toxicological testing has determined to be “safe.”

The question is whether EDCs are safe at the doses the typical person experiences. To determine what doses are safe, regulatory toxicology usually starts by administering large doses of a chemical to animals, identifying the highest dose at which no effect is found, and then extrapolating downward to calculate a safe dose. Those “safe” doses are rarely tested. Yet EDCs, like hormones, defy the toxicological dogma: Low doses can have effects that are not expected from high-dose exposures. In fact, these effects can be observed at doses orders of magnitude beneath the highest dose that produces no effect using traditional approaches. The mechanisms by which chemicals cause high-dose effects usually are completely unrelated to mechanisms that EDCs employ at low doses, and the effects of high and low doses can be on completely different endpoints.

In our review of the EDC literature, we found hundreds of examples of these types of responses, termed nonmonotonic responses, in cultured cells, animals, and even human populations.¹ Many of these chemicals have effects at low doses, providing strong evidence that calculated “safe” doses of these chemicals are not, in fact, safe.¹

Are these chemicals adversely affecting human health? Many of the earliest epidemiology studies examining the effects of EDCs studied occupationally or accidentally exposed individuals, i.e., people who were exposed to relatively high doses, either acutely or over longer periods of time. Now a large number of epidemiology studies have focused on environmentally exposed individuals, i.e., people who are exposed to EDCs from everyday life. These studies show that many of the effects observed in cultured cells and controlled animal experiments accurately predict what epidemiologists are observing in human populations: associations between human exposures and disease endpoints consistent with the “low-dose hypothesis.”

So where do we go from here? As scientists, these findings suggest for us that EDCs, as a chemical class, act very similarly to the hormones they mimic or block: They act at low doses, with effects that are more pronounced when exposures occur during critical periods of development. Just as hormones have nonmonotonic relationships between dose and effect, nonmonotonic effects of EDCs are expected. This means that high-dose testing is insufficient to establish the safety of low doses. In our review,¹ we propose some changes to the way risk assessors determine safety of EDCs: 1) “safe” doses of chemicals, and chemicals in the range of human exposures, should be tested; 2) regulators should assume that EDCs produce nonmonotonic dose responses; 3) more sensitive endpoints should be included in chemical testing.

What can the average person, or patient, do to reduce EDC exposures? This is, of course, an important issue for health care practitioners and others invested in improving public health. Several studies suggest that making small lifestyle changes can have dramatic effects on exposure levels.⁶

Patients should be encouraged to make lifestyle choices that reduce known EDC exposures. However, the lessons learned from the published literature seem to be clear: Even low doses, including reduced exposures from changes in consumer behavior, cannot be considered safe. Thus, widespread changes to chemical safety regulations are likely to have the widest effects on human health.

We encourage physicians, nurses, public health administrators, and others working in the medical field to read our recent review and to get involved with the many scientific societies that support new approaches to chemical regulation that better reflect current scientific understanding than do standard toxicological procedures.⁷ Your expertise provides an important voice to help the risk assessment community develop new approaches to chemical risk assessment, especially as it pertains to EDCs. Hormones are important signaling molecules that dictate the health of individuals throughout the life course, and therefore the effects of EDCs simply cannot be ignored.

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