May 3, 2009

Mr. David Cuneo, Senior Environmental Specialist
Sonoma County Water Agency
404 Aviation Boulevard
Santa Rosa, CA 95403

Dear Mr. Cuneo,

I respectfully submit the following comment letter concerning the North Sonoma County Agricultural Reuse Project (NSCARP) and the recently released Final Environmental Impact Report (FEIR). I submit this letter on behalf of the Clean Water Coalition of Northern Sonoma County (CWC) and it can best be considered in combination with other expert analyses and comments submitted also on behalf of the CWC (Corson, Johnson, Yates, McEnhill, Wilshire, and Teh). In particular, this letter references information contained in the expert hydrology reports prepared and submitted by Nicholas Johnson and Gus Yates.

I will begin with a brief description of my credentials as an expert in the areas of groundwater and wastewater analysis and water quality, especially as it pertains to hazardous chemicals. I hold a Ph.D. in analytical chemistry and have, for over 20 years, worked as Laboratory Director of a California-Certified environmental testing laboratory. Prior experience includes 6 years in industry serving as a research chemist for various firms including Rockwell International's Space Transportation Division and 2 years as a Post-Doctoral Fellow for the National Oceanic and Atmospheric Administration and Hewlett Packard Corporation. I have been qualified in both the State of California and Federal Courts as an expert in the field of analytical chemistry as it pertains to chemicals contained in environmental samples including groundwater and wastewater. I have also served on the faculty at the University of California, Berkeley and Sonoma State University where I taught courses in Environmental Chemistry and Analytical Chemistry.

My comments in this letter focus on significant potential groundwater and surface water contamination, impacting drinking water resources, due to the NSCARP, which is not adequately assessed in the FEIR. I base my opinions, expressed in this letter, on my expertise with regard to the composition of the tertiary treated wastewater to be used for this project, the concentration and nature of the chemicals remaining in the wastewater after treatment and my over 30 years of diverse experience working in the field of environmental chemistry. I have also reviewed two, independent expert hydrology studies that evaluate the basic water balance in the areas that are potentially affected by the NSCARP as well as reviewing the DEIR and the FEIR, including comment letters and responses. Working in a commercial environmental testing laboratory for the past 20 years, I have had the unique opportunity to see the often-untold stories behind the mistakes that have led to serious environmental contamination and the costs associated with attempting to undo these mistakes. I offer this letter in hopes to help avoid serious and permanent detriment of our drinking water resources due to inadequately assessed impacts of the NSCARP.

It is my expert opinion that the NSCARP poses a direct threat to groundwater and surface water quality and has a significant potential to cause the Alexander Valley and Dry Creek Valley aquifers to become largely unusable as future, direct drinking water sources as a result of groundwater quality degradation due to chemical contamination. It is also my opinion that the NSCARP FEIR is totally inadequate because it fails to identify the unique aspects of this project that will result in this significant degradation of groundwater and surface water quality and dismisses, with a near complete lack of meaningful substantiation, key issues identified in comment letters submitted during the Draft EIR (DEIR) process.

This letter is organized in three main sections. The first section describes the unique aspects of the NSCARP that should qualify this project to be regulated as a Direct Waste Discharge or, at best, a poorly planned Groundwater Recharge Project and not an Agricultural Reuse Project. These aspects of the project were identified in comments to the DEIR and are not adequately addressed in the FEIR. The second section provides information regarding key regulated chemicals of concern that have been either completely un-addressed in the FEIR or inadequately considered in responses to comments submitted during the DEIR process. Finally, in the third section, I will address unregulated chemicals and other water quality parameters of concern that, also, have been either completely un-addressed in the FEIR or inadequately considered in responses to comments submitted during the DEIR process.

1. The likelihood that groundwater quality will be degraded by chemical contamination due to NSCARP should force this project to be regulated as a Waste Discharge or a Groundwater Recharge Project.

No one, even the strongest proponents of this project would consider the tertiary treated wastewater adequate for direct use as a drinking water source. The reasons for this are largely due to what we do not know about the wastewater rather than what we do know. Each year we learn more about the potential hazards contained in treated wastewater. The now disconnected drinking water fountain at the Santa Rosa Wastewater Treatment Facility stands as a monument to this learning curve. When first completed, this State-of-the-Art facility proudly constructed in its design a drinking water fountain to allow visitors to drink the highly purified wastewater. As the operators of this facility grew in their awareness, this fountain was disabled and since then no one is allowed to drink this water due to the potential hazards it presents. This disconnected drinking water fountain provides evidence that the treated wastewater is hazardous for drinking.

It is well established that a wide variety of chemicals pose serious health threats when present in drinking water at the part-per-billion (ppb) or even part-per-trillion (ppt) concentration level. For some of the most common of these chemicals, those that one might expect to find in a drinking water source, test methods have been developed and regulatory action levels, Maximum Contaminant Levels or MCL's, have been established. The MCL's for organic chemicals of concern, that might be expected to get

into the drinking water source, are typically in the low ppb to low ppt range (C22 CCR 64444).

The treated wastewater was never designed for drinking; however, the testing methods used to evaluate its potential hazard are largely the same test methods used to monitor drinking water. We do, however, have a less specific test that allows us to evaluate the total quantity of organic chemicals remaining in the wastewater and this test can be used as a general guide to its overall purity. This test measures the Total Organic Carbon or TOC in the water without having to "name" and measure each individual chemical, a task that is not presently technologically possible. Based on this test, we know that the wastewater planned for this project contains a complex mixture of unknown organic chemicals that is at least several million times more concentrated than those on the relatively short list of chemicals that have specifically been tested for. It is, in part, this massive amount of unknown organic chemicals that keeps us from using this water for direct drinking water purposes. A good example to consider is that of dioxin, for which we have a very sensitive and specific testing method. Due to its toxicity, the MCL for dioxin is 0.03 ppt. As seen in Table 3.8-2 in the FEIR, the wastewater averages over 5 billion times this level in unknown organic chemicals, according to Santa Rosa's wastewater facility testing laboratory results. Clearly, it is this untested portion of the wastewater that makes it most unsuitable and why we would never give this water to our children, to our pregnant mothers, or to anyone else, for drinking. Of this, there seems to be little argument.

Safe, beneficial wastewater recycling is based on the idea that filtration of unknown hazards by the soil along with dilution by fresh water recharge (rain) will protect the underlying groundwater where the wastewater is used. In many cases this is in fact the situation. Many soil types have powerful characteristics to both adsorb chemicals and, over time, degrade these chemicals as wastewater is used in controlled quantities for landscape or agricultural irrigation purposes. When these soils are adequately adsorptive, adequately bioactive and the depth to groundwater is adequately large, appropriate amounts of wastewater can be applied for irrigation purposes in a safe and beneficial manner with little or no degradation of the underlying groundwater. The key parameters of adequately adsorptive soils, adequately deep soils and appropriate quantities of wastewater relative to groundwater recharge rates are necessary requirements for beneficial reuse. Unfortunately, none of these three conditions exist in the areas planned for disposal of the wastewater via the NSCARP. These unique conditions associated with this project are largely not identified by the FEIR making it significantly inadequate. I will briefly explain them in this letter.

The first of these conditions is the nature of the soils in the potentially effected areas and their ability to adsorb and degrade the chemicals in the wastewater. Unlike many successful wastewater irrigation projects, the soils involved with the NSCARP are known to be shallow, low in organic material and largely sandy-gravelly alluvial soils typical of our North County river valleys. These soils do not have the potential to adsorb and degrade wastewater contaminants unlike organic rich, deep soils present in successful reuse projects. This fact is substantiated by expert studies conducted by the firm

Kennedy/Jenks Consultants that are referenced in the comment letter by Yates and entitled "Santa Rosa IRWP – Discharge Compliance Project Subregional Soil Column Study" and "Santa Rosa IRWP – Discharge Compliance Project Indirect Discharge Water Quality Constituent Attenuation Summary". These reports support the fact that these soils have uniquely inadequate capacity to adsorb certain wastewater constituents compared to what would be expected of more organic-rich soils.

The second condition I will discuss is the depth to groundwater. In addition to the nature of the soil, i.e., organic-rich versus sandy-gravel, the amount of soil, or in other words, the depth of soil to groundwater is key. Our valley floors, the location of most of the planned vineyard irrigation, cover one of Sonoma County's most precious resources, the source of all of our drinking water, our North County aquifers. However, this covering is extremely thin. I live in the Dry Creek Valley and in August, at the driest point of the year, I can look down into my well and see the groundwater level just a few feet below the ground surface level. This is the case for much of the valley as described in the hydrology reports by both Johnson and by Yates. While there is enough of this sandy-gravelly soil to grow vines there is pitifully little to provide filtration, adsorption or biodegradation of wastewater contaminants.

Finally, I will discuss the condition related to the amount of wastewater planned for disposal versus the amount of fresh aquifer recharge that occurs. Most of this wastewater will be dripped onto vineyards during the summer months. Drip irrigation will not saturate the soils down to groundwater but instead nearly all of the water that enters the soil will be either taken up into the plants or will slowly evaporate into the air. Each irrigation event will consist of dripping the wastewater into the relatively shallow soils and will be then repeated as soon as most of this water is gone. Virtually all of the soluble organic compounds contained in the wastewater will be concentrated in the soils during these irrigation cycles over the summer months. The quantity of wastewater planned for application to the soils is certainly enormous and the total quantity of dissolved organic chemicals, "the solutes", will be concentrated into this shallow layer of sandy-gravelly soils that overlie the groundwater aquifer. This is made clear in the expert hydrologist reports by both Johnson and by Yates.

After the irrigation season, our winter rains come. Because of the relatively heavy rains we experience, most of the rain water runs off. We see this vividly as our streams and rivers quickly rise during our rain events. As described in the hydrologist reports by Johnson and by Yates, a smaller portion does, however, saturate the soils and percolate down into our groundwater aquifers as groundwater recharge. The soluble compounds that were concentrated in the soil due to summer irrigation with wastewater will then be re-solubilized and carried into the aquifer with the recharge water.

The concentration of these chemicals will be based on two main factors. These factors are simply the amount of wastewater that was applied during the summer compared to the amount of winter recharge water. If the amount of recharge water experienced during the winter is vastly greater than the amount of wastewater applied during the summer then the concentration of these chemicals in the groundwater recharge water will be far less

than that of the wastewater. For example, if the winter recharge is 100 times greater than the summer wastewater application then the recharge water will be at least 100 times less concentrated in these chemicals than the original wastewater. Even with little adsorption and/or biodegradation, this dilution effect would help protect our precious aquifers. But this is not the case.

Unfortunately, the actual situation is far less comforting. Two, independent, hydrology reports, prepared by expert hydrologists show that the amount of wastewater planned for irrigation in the NSCARP is equal to or exceeds the quantity of recharge water. In fact, one scenario shows that the quantity of wastewater will be nearly double the typical quantity of fresh water recharge. The result of this is that the recharge water will not be diluted to a factor of 100 times or 10 times or even 2 times. Instead, the recharge water is likely to be at the same concentration, or up to twice the concentration, as the wastewater itself in these contaminants that are concentrated in the soils during summer irrigation.

This combination of poor absorptivity and low bioactivity of the sandy-gravelly alluvial soil, the shallow depth to groundwater and, especially, the amount of wastewater compared to recharge water may cause, over time, these aquifers to become more contaminated than the wastewater itself. Clearly under these conditions, since all are in agreement that the wastewater is unfit to directly drink, our groundwater aquifers will, over time, also become unfit to drink. This is a mistake we can and need to avoid making. This FEIR fails to address this issue and hence is significantly inadequate.

2. Key regulated chemicals of concern have been either completely un-addressed in the FEIR or inadequately considered in responses to comments submitted during the DEIR process.

Over the past 20 years, I have worked on a daily basis with clients to establish groundwater and wastewater monitoring projects at the direction of State and County regulators. The test methods for these programs are selected based on the history of each site and the potential chemical contaminants that might be expected in each different location. For example, a gasoline station will be tested for the chemicals typically found at gasoline sites while an abandoned plating shop will be tested for a different set of potential contaminants typical of plating operations. Over the years I have become quite familiar with the various lists that include chemicals regulated under California's Title 22 as well as many other chemicals that are regulated under various State policies that address chemicals of concern that have not yet made it through the regulatory process that would list them in Title 22, often referred to as "chemicals of emerging concern". In my experience, it is a misnomer to refer to these chemicals of emerging concern as "unregulated". My clients that routinely spend thousands or millions of dollars each year monitoring for these chemicals at the requirement of State regulators would certainly agree with the idea that these chemicals are, in fact, regulated. They are just not regulated under Title 22.

I will begin with a look at the wastewater-monitoring program that is in place and how it relates to overall wastewater quality. Again, I have become quite familiar with the list of

chemicals that our clients are required to test for in a wide array of regulated activities. One list is contained in California's Proposition 65. These are the "Chemicals Known to the State to Cause Cancer or Reproductive Toxicity", a growing list of approximately 737 chemicals or classes of chemicals. The typical list of chemicals required of our clients to test for in their groundwater and wastewater samples comes directly from California's Title 22. Appendix 10 provides a list of those chemicals considered by the State to be "hazardous". It is a list of approximately 791 chemicals. A sub-set of this list appears in Appendix 9 of Title 22. We routinely test for this list of chemicals in both groundwater and wastewater as a requirement placed on our clients. This list is divided into sub-categories according to the analytical testing methods used for each of these chemicals of concern. The major divisions include: Volatile Organic Compounds (a list of 71 different chemicals), Semi-Volatile Organic Compounds (a list of 118 different chemicals), Chlorophenoxy Herbicides (a list of 4 different chemicals), Organophosphorus Compounds (a list of 11 different chemicals) and Dissolved Inorganics (a list of 22 different chemicals or elements).

Recently, I spent a morning at the North Coast Regional Water Quality Control Board reviewing the City of Santa Rosa's, Santa Rosa Subregional Water Reclamation Facility's Discharge Monitoring Reports. I very surprised to see just how few of the Title 22 chemicals are actually monitored for in the discharged wastewater. I was amazed to find that one sample per month is tested for a list of chemicals that includes only 3 Volatile Organic Compounds, 11 Semi-Volatile Organic Compounds. And once each quarter, in other words only four times per year, one sample is tested for a somewhat longer list that includes only 36 Volatile Organic Compounds, 54 Semi-Volatile Organic Compounds and 12 Inorganics (metals).

Considering the requirements typical of many of our clients' projects that involve very specific sites with extremely limited potential "spheres of influence" when compared to that of NSCARP, it is simply amazing to me just how minimal the monitoring requirements are on the wastewater coming from the Santa Rosa facility. Due to these minimal requirements, we really know very little about the wastewater quality.

The above discussion focuses on chemicals that are, in fact, regulated under Title 22 and chemicals for which the laboratory at the wastewater facility has the ability to measure. Yet, there appears to be no requirement for monitoring these compounds and therefore there is no data available on these chemicals, with respect to the historical and ongoing wastewater quality, to be considered in this FEIR. There are discussions within the FEIR on wastewater quality, yet there are no monitoring requirements that would have allowed the actual quality to be assessed. This is clearly a significant deficiency within this FEIR and certainly unjustifiable when one considers the level of monitoring requirements placed, by State regulators, on projects that have so much less potential to do harm.

Beyond the list of chemicals within Title 22, there are many more that our clients are required to test for due to their established toxicity and the potential that they may be present in groundwater or wastewater at any particular site. These "chemicals of emerging concern" would also have a similar potential to be present in the wastewater

planned for NSCARP. Action levels, similar to the MCLs, have been established for these chemicals of emerging concern by the State of California Department of Public Health (CDPH) as Notification Levels (NLs), Preliminary Health Goals (PHGs), or draft MCLs. These action levels have been established based on the known toxicity of these chemicals. According to Health and Safety Code §116455, a drinking water system must notify the governing body of the local agency in which the users of the drinking water reside when a chemical in excess of a notification level is discovered in a drinking water source.

Regulatory testing methods have been developed and established for these chemicals with the capability of accurately measuring these chemicals in water down to levels below the NLs , PHGs or draft MCLs. Most of these testing methods have been promulgated into Federal law as approved Environmental Protection Agency (EPA) test methods. In many cases, these chemicals have been added to existing methods as new "target compounds". It has been an interesting and challenging experience to see this continually updated, growing list of chemicals be added to the requirements of our laboratory. It is also interesting to see that each time we add a new target chemical to our test methods we begin to find it in more places that we might have expected. Since we are still learning about these newly listed chemicals, it is not always clear why they might occur at sites where we would otherwise not expect to find them. A short list would include gasoline station sites that are contaminated with 1,4-Dioxane, machine shops that are contaminated with N-nitrosodimethylamine (NDMA), rural agricultural sites contaminated with perchlorate, sites where diesel fuel has been cleaned from the groundwater that now show high levels of the carcinogens hexavalent chromium and bromate.

Due to the large quantities of these chemicals that are used, many of them would be expected to occur in the Santa Rosa wastewater from a variety of potential sources including industrial and residential. One often-overlooked source is that of contaminated sites that are undergoing investigation and/or cleanup. Five or ten years ago, many of our clients would apply for an NPDES permit to discharge water into rivers or streams as a result of their investigations and clean up efforts. As discharge requirements became more and more stringent, it has become far more cost effective to bring these contaminated waters to the treatment facility for disposal. Acceptance criteria for the wastewater treatment facility are far less stringent than the requirements for an NPDES discharge permit. This is just one example of the new and varied sources of contamination that effect wastewater composition. Having personal knowledge of the wide and sometimes unexpected composition of these waters has provided me with specific insight regarding the potential for wastewater to contain a wide array of chemicals regulated and not regulated under Title 22 and hence not tested for, or monitored for, in the wastewater.

Many of the chemicals listed in Title 22 have long since been banned from manufacture or use in the United States and for this reason detections of these compounds in our laboratory become less and less over time. However, we do see the chemicals that are manufactured and used in the US, in thousand ton quantities, with increasing frequency,

irrespective of whether they are listed in Title 22 or not. The few chemicals mentioned above present good examples.

Production quantity of 1,4 dioxane is in excess of 10,000 metric tons per year and there are nearly 400 facilities that produce 1,4 dioxane in the US. 1,4 dioxane is used in cleaning products, including laundry detergent, it is used in some shampoos, it is used as a solvent in the production of pharmaceuticals, adhesives, magnetic media and has hundreds of other common uses in industry as well as in household products. It has a relatively high water solubility and, due to its common use, 1,4 dioxane is expected to be found in wastewater. Due to its toxicity, the drinking water notification level for 1,4 dioxane is 3 ppb. Yet, 1,4 dioxane is not addressed in the FEIR and is not monitored for in the Santa Rosa wastewater.

Similar conditions exist for a number of these chemicals of emerging concern. These are chemicals used in massive quantities that would be expected to appear in wastewater. These include: perchlorate, NMDA and other nitrosamines, hexavalent chromium, bromate, polybrominated diphenyl ethers, bis phenol A, perfluorooctane sulfonates, hexabromocyclododecane, ethoxylates, pentachloronitrobenzene, fuel oxygenates, formaldehyde and acetaldehyde. These are chemicals that have been shown to exist in municipal wastewater yet there are no data presented in the FEIR with regard to their presence in the Santa Rosa wastewater, a clear deficiency in this document.

Another class of chemicals of significant concern and inadequately addressed in the FEIR is that of pesticides. Most of the pesticides listed in Title 22 are no longer in use. What we see in the environment are, naturally, predominantly the pesticides that are presently in use. For many of these chemicals, there are adequate testing methods, they are known to be highly toxic but are not regulated under Title 22 or the California Toxics Rule. Examples of these test methods and associated chemicals of concern include: EPA Method 527 for the pesticides dimethoate and Terbufos sulfone, EPA Method 525.2 for the herbicides Acetochlor, Alachlor, and Metolachlor, EPA Method 535 for the herbicide metabolites Acetochlor ethane sulfonic acid, Acetochlor oxanilic acid, Alachlor ethane sulfonic acid, Alachlor oxanilic acid, Metolachlor ethane sulfonic acid, and Metolachlor oxanilic acid.

The FEIR for NSCARP does not address the reality that hundreds of chemical contaminants that are regulated due to their extreme toxicity, many of which are listed in Title 22 and many that are not, are potentially contaminating the wastewater. For many of these chemicals, adequate test methods exist and even regulatory action levels have been issued. Yet, these chemicals are not monitored for in the wastewater.

3. Unregulated chemicals of concern and other wastewater quality parameters have been either completely un-addressed in the FEIR or inadequately considered in responses to comments submitted during the DEIR process.

I have described above that as each new test method is developed and applied to environmental samples including groundwater and wastewater, it becomes clear that these chemicals are often more prevalent than one might hope. It also becomes clear that there is a much larger list of chemicals present that we do not have test methods for. As laboratory director, I also help numerous industrial clients in their product development efforts and raw materials quality control measurements. This experience provides a unique perspective into the wide array of chemicals that are used in Sonoma County, nearly all of which are not listed in Title 22 and do not appear on any lists of chemicals of emerging concern. Sonoma County's Office of Emergency Services can provide a list of chemicals used in the County along with the associated quantities. This is important information and it should be contained in the FEIR. Most of these chemicals are not regulated under Title 22 or under any other State policy regulations with regard to potential water contamination. Without specific regulations, it is likely that many, if not most, of these chemicals can be disposed of legally by putting them into the sewer system. For these reasons these chemicals may eventually end up in the Santa Rosa treatment facility.

Recently, the US Geological Survey (USGS) established the Toxic Substances Hydrology Program and developed testing methods capable of measuring a list of approximately 95 chemicals to be used as indicators of wastewater contamination. These chemicals include human and veterinary drugs (including antibiotics), hormones, detergents, disinfectants, plasticizers, fire retardants, insecticides and antioxidants. A recent report by the USGS reveals that one or more of these indicator chemicals were detected in 80 percent of the streams sampled and 82 of the 95 chemicals were detected at least once. Mixtures of these chemicals were common; 75 percent of the streams had more than one, 50 percent had 7 or more and 34 percent had 10 or more. The most frequently detected chemicals included N,N-diethyltoluamide (insect repellent), triclosan (antimicrobial disinfectant), tri (2-chloroethyl) phosphate (fire retardant) and 4-nonylphenol (nonionic detergent metabolite). Steroids, nonprescription drugs and insect repellent were the chemical groups most frequently detected. Detergent metabolites, steroids, and plasticizers generally were measured at the highest concentrations, reported to be in the ppm concentration range. These chemicals are found in streams as a direct result of municipal wastewater discharge.

One emerging result of this type of contamination is the growing occurrence of, what is called, intersex in fish populations. A recent study of intersex abnormalities in fish conducted and reported by the US Fish and Wildlife Service and the USGS in the Potomac River watershed found that at least 82 percent of male smallmouth bass and 23 percent of the largemouth bass had immature female germ cells (oocytes) in their reproductive organs. The study indicates that intersex is more widespread than previously known and is not related to a single chemical but is, instead, likely due to the synergistic effects of several endocrine disrupting chemicals found in water as a result of municipal wastewater discharge.

The list and various classes of unregulated, toxic chemicals one might expect to find in the wastewater planned for use under NSCARP is large and growing and largely unknown. Pharmaceuticals, personal care products, various industrial chemicals including those used in high technology manufacturing and research including nano-technologies, represent a growing and continually changing array of inputs to our wastewater treatment facilities. These facilities are not necessarily designed to treat these wastes and provide little or no monitoring of them in their effluents or discharges.

What we do know is that the chemicals that do make it through the treatment process are particularly resistant to biodegradation, adsorption and filtration. In order for these chemicals to pass through all of the various stages of treatment they will be highly selected in their nature; highly soluble, highly resistant to further decomposition or filtration by the sandy-gravelly soils of our North County valleys. This idea is strongly supported by the White Paper Report on Trace Contaminants, prepared by Padre Associates and included in the FEIR as Attachment 1 in Appendix I. This paper states "Municipal WWTPs effectively remove particles present in sewage. As a result, trace constituents that exhibit an affinity for particles usually are removed during primary and secondary treatment. This means that most compounds that are discharged in wastewater effluent are polar (i.e., highly soluble) and will not be removed to an appreciable degree from surface water by sorption on suspended particles or sediments in a reservoir environment." This White Paper correctly explains the inherent nature of the contaminants in the treated wastewater as being highly soluble and resistant to adsorption onto particles or sediment. The same situation exists for biodegradation. Biodegradation is one of the main processes used in wastewater treatment to reduce the concentration of various chemicals. Therefore, those chemicals that remain must be considered to be recalcitrant to biodegradation. It is for these reasons that deep, organic rich soils are an absolute requirement for relatively small amounts of wastewater to be adequately purified in reuse projects in order to protect the underlying aquifers. The fact that the soils involved in NSCARP are very shallow, are not organic rich and very large volumes of wastewater are planned for use is not addressed in this FEIR.

This White Paper, it was prepared to address concerns brought out in certain comments to the DEIR. It is my opinion that it does a very poor job of it and instead argues with itself on many points, argues with logic on other points and otherwise supports the concept that the wastewater poses a significant threat. This paper acknowledges the existence of various unknown chemicals in wastewater that have significant human and animal toxicity. In its introduction, the author claims that our ability to measure an increasing number of chemicals in the environment is due to "ongoing improvements in analytical sensitivity over the past decade". As an expert in analytical chemistry, I can say that this is not true. There have been very few significant improvements in analytical sensitivity over the past decade. Our ability to measure an increasing number of different chemicals in the environment is simply due to the fact that we are now interested in looking for these chemicals and have begun the process of developing methods that target this larger list of chemicals. The introduction does correctly cite that "One of the significant routes for these "trace constituents" into (the) environment is through the resulting discharges from wastewater conveyances and treated systems."

This White Paper makes the unsubstantiated claim that the "concentration of trace constituents in the reclaimed water will likely decrease during both of these steps (storage in reservoirs and land application) due to natural attenuation mechanisms such as phototransformation, sorption, and biotransformation. This idea is in direct opposition to the concept presented in this same paper that the chemicals remaining in the wastewater are unlikely to adsorb to particles since they passed through a treatment system largely based on adsorption to particles. This same logic applies to phototransformation and biotransformation. The Santa Rosa wastewater treatment facility exposes the wastewater to extreme UV light radiation as its method of disinfection. Those chemicals that are easily phototransformed would already have undergone this process. The treatment system also subjects the wastewater to powerful levels of microbial degradation causing most biotransformations that are possible to have already occurred. For these reasons, the remaining chemicals are highly selected to be resistant to further degradation by sorption onto soils, or degradation by light or microbes. This White Paper also fails to discuss the well known fact that transformation by either light or microbial activity can render chemicals to be more toxic than they were prior to transformation, rather than less toxic.

The position taken by the author of this White Paper is clearly biased in defense of the complete safety of wastewater and makes many poorly substantiated claims to this concept. Several examples follow. In section 3.3 "Land Application of Reclaimed Water" the blanket statement is made that "A compound that has sorbed to a soil surface will not easily leach to the groundwater and is less available for uptake into plant roots". As a professional chemist I find this statement to be, frankly, silly and simply argumentative. The likelihood of leaching of a sorbed molecule into the groundwater is dependent on many factors. Specifically, it depends on how strong the attraction is between the soil surface and chemical and the water solubility of the chemical. The White Paper correctly identified the chemicals remaining in the treated wastewater as being "highly soluble" and that "most compounds that are discharged in wastewater effluent are highly soluble and will not be removed to an appreciable degree from surface water by sorption". Although the statement is made that chemicals sorbed to soil are less available to plant roots, this same paper states, in Section 4.0 on Potential Impacts that "the veterinary pharmaceuticals diazinon, enrofloxacin, florfenicol, and trimethoprim have been shown to be taken up into carrot roots, and florfenicol, levamisole and trimethoprim are taken up into lettuce leaves". This paper contains one contradiction after another.

This paper cites references to biotransformation soil column studies to address concerns over hormones, certain surfactants and acidic pharmaceuticals. However, the paper cites studies that have not used soils similar to those in the Alexander or Dry Creek Valleys. The Kennedy-Jenks soil column studies that used soils from the Alexander Valley and Santa Rosa wastewater show that little or no depletion in measured wastewater chemicals was observed during their tests.

In section 4.0 “Potential Impacts” of this White Paper, the author states that “Overall, while there are currently many unknowns about possible synergistic effects, and of long-term chronic exposure to low levels of complex mixtures of compounds, the risk assessments that have be (been) performed have not indicated an unacceptable risk to humans.” However, the references cited for the argumentative position deal solely with pharmaceuticals in surface waters and do not at all address the “complex mixtures of compounds” in treated wastewater and it makes little sense that if there are “many unknowns about possible synergistic effects, and of long-term chronic exposure” it is possible to establish a meaningful risk assessment.

Interestingly, in this same section on potential impacts, this paper states that “Very little is known about the effects of trace constituents in water used to irrigate domestic animal feed. It has been suggested that endocrine disruptors in domestic animal feed and water may be responsible for fertility problems in ruminants”. The FEIR is clearly deficient in addressing this link, proposed in the White Paper, between mammalian fertility problems and the presence of trace constituents in wastewater used to irrigate food crops. The following section of this paper cites that “Removal (of wastewater chemicals) can be enhanced by applying advanced treatment technologies such as advanced oxidation, activated carbon adsorption or membrane filtration.” The FEIR is deficient in its lack of assessing this alternate approach to further purifying the wastewater making it far safer for a variety of uses including agricultural reuse and groundwater recharge.

One additional parameter that poses significant risk to the North County aquifers and surface waters due to NSCARP is that of biological contaminants. Most of the data that exists for wastewater reuse projects deals with water that has been chemically disinfected and contains a residual level of chemical disinfectant. The Santa Rosa wastewater is extremely unique in its lack of chemical disinfectant. This wastewater is disinfected using UV radiation instead. Similar to the situation that exists for unknown chemicals that remain in the wastewater, unknown bacteria, viruses, protozoan and other parasites also exist in the wastewater. The completely inadequate approach of testing for only one form of biological contaminant, coliform, is the standard by which disinfection of the wastewater is monitored. Unlike chemical contaminants, biological entities that remain in the wastewater can, upon leaving the treatment facility begin to multiply in pipelines, distribution systems and storage reservoirs. Some examples of the threat these biological contaminants can pose are provided below.

Cryptosporidiosis is a parasitic disease caused by the protozoan, cryptosporidium. Many are familiar with this, often fatal, disease due to the fact that it is one of the most common water-borne diseases worldwide. It is spread through water that has been contaminated with feces (such is the case with wastewater). The parasite is transmitted to humans when they drink water that has been contaminated with the environmentally hardy cysts. The UV disinfection system at the Santa Rosa wastewater treatment facility is not monitored for its effectiveness for destroying these hardy cysts. Other water borne diseases caused by drinking feces contaminated water include the protozoa caused diseases Amebiasis and Giardiasis, the bacteria caused diseases Campylobacteriosis, Cholera, Salmonellosis, Shigellosis, Typhoid fever, Legionnaire's disease, Pontiac fever,

and the viral diseases Hepatitis, and Viral gastroenteritis. These pathogens are not monitored for in the wastewater and would be expected to pass through the waste treatment system to some, unknown, small degree. Once these pathogens leave the treatment facility they can begin to populate in the wastewater. These pathogens could then infect pipelines and storage reservoirs and ultimately infect groundwater aquifers and drinking water wells of the North County. The FEIR does not address this serious concern or take into account the unique aspect of how the Santa Rosa wastewater is disinfected. Also not addressed in the FEIR is the potential effect of failures with the UV disinfection system. My short review of monitoring reports for this year, 2009, held at the Regional Water Quality Control Board show that this system can fail from time to time allowing non-disinfected waters to be released from the facility. For example, on March 3, 2009, the UV treatment system did not function properly for approximately 2 minutes allowing 17,130 gallons of non-disinfected water to be discharged from the facility. The FEIR is inadequate because it does not address the impact that these types of system failures could have on infectious pathogen concentrations in the wastewater distribution system including storage reservoirs. The reports also indicate that Total Coliform requirements were not met on March 5th, March 6th and again on March 8th of this year (2009). The FEIR does not address how these types of failures might impact pathogen levels in the wastewater. This is critical because, once again, unlike chemicals, these pathogens can multiply in the wastewater over time.

Recently, there is growing concern over what are being called “Super Bacteria”. Microbiologists at the University of Michigan have conducted studies that suggest that wastewater treatment facilities are a significant source of antibiotic resistance bacteria. The resistant bacteria used in the study were found to be as much as ten times more resistant once they had been through the wastewater treatment process.

In addition to its use in drip irrigation of vineyards, according to NSCARP, the wastewater is also planned for use in overhead spraying as a means of frost protection. When frost protection is required, it is required by nearly every vineyard in the Valley floor. I live in the Dry Creek Valley and on cold spring mornings I often see the rather impressive sight of the entire valley floor in full spray. The FEIR does not address the potential health effects of the aerosol created during these frost protection events. Several of the pathogens discussed above can be transmitted via inhalation and the widespread aerosol created during frost protection in narrow valleys would have the potential of bringing a serious health threat to our local populations if infected waters are being used.

Conclusion

I have been an expert in environmental chemistry, working as a professional in this field, for over 30 years. During this time I have gained significant experience and insight into issues concerning groundwater contamination. The FEIR, repeatedly, relies on the comment that “wastewater reuse in California is regulated by Title 22”. I have pointed out in this letter two key facts related to this concept. Firstly, most of the large, yet limited, list of chemicals regulated under Title 22 are not monitored for in the NSCARP

wastewater. Secondly, most of the chemicals of real concern that are likely to remain in the treated wastewater are not currently listed in Title 22.

I believe it is critical to recall that the chemicals that so tragically contaminated Love Canal, New York and Times Beach, Missouri were disposed of completely legally! Regulations at the time were clearly inadequate to address these situations in advance of the disasters that rendered these towns still uninhabitable some 20 years later. In the hypothetical situation where an EIR was required for the burying of chemicals at Love Canal or the spraying of contaminated dust control oil at Times Beach, they might have claimed the lack of regulations limiting these practices as providing adequate support of the lack of significant environmental impact. However, a truly adequate EIR would clearly have identified the nature of these pending disasters allowing concerned individual to properly evaluate these projects in terms of their overall environmental impacts.

Such is the case here. The NSCARP FEIR is inadequate, as explained in some detail in this comment letter, because it fails to identify the unique aspects of the wastewater and its planned disposal locations and the resulting environmental impacts it is likely to cause. An understanding that, due to these unique conditions, this project is essentially a project that involves direct discharge to the groundwater aquifers is not identified in this FEIR. The State of California does have newly constructed regulations governing these types of projects such as the California Department of Health's Draft Regulations on Groundwater Reuse Projects. These regulations require a far greater degree of testing and monitoring and, in turn, require a far greater degree of water quality than is present in this tertiary treated wastewater. For example, the total amount of unknown organic chemicals, referred to earlier as "TOC" must be 100 times less than is often present in Santa Rosa wastewater. Areas of the State that are following these guidelines are using advance treatment procedures, similar to those suggested in the FEIR White Paper, namely advanced oxidation, micro filtration and reverse osmosis. These processes not only remove most of the chemicals of concern they also remove most biological agents of concern. This highly purified water has been found suitable for reuse, not only for irrigation purposes but also for later drinking water uses once it has been re-injected deep into groundwater aquifers.

This FEIR is inadequate because it does not recognize the unique conditions involving drip irrigation during the summer that concentrates into the shallow soils all of the chemicals that are dissolved in the wastewater that are then leached into the groundwater with less volume of winter recharge water. The FEIR is inadequate because it fails to recognize the fact that groundwater recharge from this project can be as concentrated or even more concentrated in certain chemicals than the wastewater itself. This FEIR is also inadequate since it also does not address the impact of surface waters due to run off from both frost protection and over irrigation. These issues are discussed in the Yates report. It is interesting that my short review of monitoring reports that I made one recent morning at the Regional Water Quality Control Board revealed that discharges to surface waters via this route are apparently common. For example, on June 10, 2008, 4,500

gallons of recycled water was discharged into the Laguna de Santa Rosa from the Todd Road irrigation system caused by "over irrigation by two users plus one leak".

The White Paper on Trace Constituents concludes with the assurances that "As more data become available regarding trace constituents levels, discharge and treatment standards will be revised as necessary at the treatment facilities prior to discharge or reuse." It goes on to state: "Such a mechanism will provide ongoing protection to both the environment and public health." This statement, in the context of wastewater that has never been tested for, and will not be monitored for, all of the constituents that we do have test methods for and standards for falls short of making any sense. Beyond this, one might imagine that the, before mentioned, hypothetical EIR for Love Canal or Times Beach might have contained a similar statement. However, it is my experience that once contaminants have caused significant degradation of an aquifer, the approach suggested in this White Paper and in the FEIR, are like closing the barn door after the horse has already gone out. The costs and lack of adequate cleanup technologies prohibits its restoration and, prior to any possible restoration, that water source can cause serious health effects in those that drink from it. This fact is not addressed in the FEIR.

The recycling of waste oil in an attempt to address the ever-present dust problem in Times Beach Missouri while disposing of an otherwise nuisance waste seemed, on the surface, to be a good idea at the time. Upon closer examination, unfortunately in hindsight, this idea turned out to result in an ecological disaster. The recycling of Santa Rosa's waste water to address the ever-present limited water supplies in Sonoma County while disposing of an otherwise nuisance waste may also seem like a good idea. However, it is the role of an adequate EIR to insightfully provide the information needed to avoid an ecological disaster. This FEIR, in my opinion is inadequate because it fails to do just that.

Sincerely,

Richard A. Kagel, Ph.D.