

Central Valley Regional Water Quality Control Board

**Meeting Summary
FOOD SAFETY / OIL FIELDS PRODUCED WATER
EXPERT PANEL – PUBLIC MEETING
June 28, 2017
10 a.m. to 3 p.m.**

Attendees

Panel Member	Title & Affiliation
Dr. Stephen Beam	Branch Chief, California Department of Food Agriculture (CDFA)
Dr. Gabriele Ludwig	Associate Director, Environmental Affairs - Almond Board
Dr. Seth Shonkoff	Executive Director, PSE Healthy Energy; Visiting Scholar, Environmental Science, Policy and Management, UC Berkeley; Lawrence Berkeley National Laboratory (LBNL), Energy Technologies Area
Dr. Barbara Petersen	Principal Scientist, Chemical Regulation and Food Safety, Exponent
Dr. Bruce Macler	Toxicologist, U.S. Environmental Protection Agency (EPA)
Mark Jones	Toxicologist, US Army Corp of Engineers
Dr. Ken Kloc (by phone)	Staff Toxicologist, California Office of Environmental Health Hazards Assessment
Affiliated Parties	Title & Affiliation
Raji Brar	Board Member, Central Valley Water Board
Patrick Pulupa	Senior Staff Council, Water Board
Stephanie Yu	Office of Chief Counsel, Water Board
Clay Rodgers	Assistance Executive Officer, Water Board
W. Dale Harvey	Supervising Engineer, Water Board
Josh Mahoney	Water Resource Control Engineer, Water Board
Rebecca T. Asami	Engineering-Geologist, Water Board
Dr. William Stringfellow	Science/Technical Advisor, University of the Pacific, LBNL
Dave Ceppos	Associate Director, Center for Collaborative Policy (CCP)
Alex Cole-Weiss	Assistant Facilitator, CCP

Note: Panel members Andrew Gordus and David Mazzera were unable to attend the meeting.

Action Items

1. **Dr. Shonkoff** to follow up with study team (Dr. Feinstein and Ms. Redmond) about sharing information on University of Colorado, Boulder study.
2. **CCP** to share California Certified Organic Farmers' representative contact information with Dr. Feinstein.
3. **CCP** to develop list of key questions and issues about Duke University study to share with the study team and Water Board staff.
4. **Dr. Feinstein** will consult with Duke study team about providing the Panel with more a detailed project description.
5. **Dr. Stringfellow** to follow up with Weck Laboratories for more detailed analyses of compounds detected in March/April sampling events.
6. **Dr. Stringfellow** to draft the sample and analysis report, and plan for future studies and monitoring activities to share with the Panel before the next Panel meeting.
7. **Water Board** to look into memorializing the commitment to cooperate on the Duke study.
8. **Water Board** to review mercury detects and report back at next public meeting.

Introductions and Agenda Review

CCP facilitator Dave Ceppos opened the meeting with introductions from Food Safety Expert Panel (Panel) members, Water Board staff, and CCP staff. He reviewed the agenda and emphasized that this was a working meeting of the Panel open to the public. He explained that Water Board and CCP staff are working to ensure that public meetings are scheduled in a timely fashion to review recent sampling results, discuss upcoming sampling, and provide opportunities for the public and Panel members to give comments and input to the Water Board.

Materials list

The following items were posted on the Water Board's Oil Fields Food Safety [web page](#) and hard copies were made available to all participants.

1. [Meeting Agenda](#)
2. [Draft White Paper Outline](#)
3. [Draft Scopes of Work for Memorandum of Understanding \(MOU\)](#)

Presentation—Assessing Oilfield Produced Water for Crop Irrigation

Dr. Laura Feinstein, Pacific Institute, and Jennifer Redmond, RTI International, presented on a newly funded three year study of California's produced water. See full presentation [here](#). Study partners include Duke University, California State University (CSU), Bakersfield, the Pacific Institute, and RTI International. The study is funded by U.S. Department of Agriculture (USDA), National Institute for Food and Agriculture (NIFA). The study focuses on California's Central Valley and is designed to reflect a wide range of produced water use and crop types. Dr. Feinstein explained the study team understands the importance of both using alternative irrigation water sources and ensuring crop and food safety. The rationale for the project comes from the ongoing need to conduct independent and peer-reviewed scientific investigation of the safety of produced water. She reviewed the following study goals:

- Perform baseline testing

- Develop a risk assessment framework
- Identify optimal management and policy options
- Involve stakeholders in recommendations

The study has seven overall objectives, four in the area of research, two in extension, and one in education. Each objective yields an output (e.g. manuscript, curriculum, stakeholder engagement). Dr. Feinstein reviewed the list of study team members. Team members have expertise in water, soil, plant sampling, chemical analysis, modeling and risk assessment, environmental policy analysis, stakeholder engagement, and agricultural engineering. Local partners at CSU Bakersfield also have relationships with regional stakeholders and extension agents.

Dr. Feinstein reviewed the study objectives and outputs in more detail.

- Objective 1 includes performing a produced water risk screening analysis by leveraging existing datasets from a different national study on produced water led by Duke University and the United States Geological Survey (USGS). The outputs for objective 1 include a comparison of available data to current regulatory limits and benchmarks.
- Objective 2 includes a baseline survey of blended produced water used for irrigation. The planned analytics are metals, salts, and naturally occurring radioactive material (NORM) tracers. The study team will sample produced water at the point of extraction and at the point of delivery, and will test soils and edible crops. The team will also take strontium isotope measurements in irrigation water, soil, and crops to understand metals uptake in crops.
- Objective 3 includes multimedia human health risk assessment modeling. The model will consider the concentrations of chemicals and the type of irrigation being used. Outputs include human non-cancer and cancer risk estimates for constituents of concern.
- Objective 4 includes a policy scenario analysis for beneficial reuse of produced water for irrigation. The study team will evaluate scenarios and develop criteria to use for potential future expansion or implementation of the practice.
- Objectives 5 and 6 include stakeholder engagement and the dissemination of study results. The purpose of these objectives is to foster a regional stakeholder platform and communicate to ensure transparency and usefulness of results. Outputs include fact sheets, presentations, and workshops (in English, and in Spanish when possible).
- Objective 7 includes the development of a university curriculum and other course materials on irrigation water quality and the water-food-energy- nexus based on the project case study.

Dr. Feinstein reviewed the study limitations and opportunities. She explained that due to resource constraints, the project focuses on human exposure to metals associated with produced water used for irrigation. However, the study team hopes to partner with Lawrence Berkley National Laboratory (LBNL) for data sharing with the LBNL's organic constituent analysis to improve the quality and quantity of the data. Dr. Feinstein commented that farmland access is also crucial to the quality of the data.

Panel comments and questions

Mr. Ceppos clarified for the public that this was the first time the Panel had seen Dr. Feinstein's presentation. Dr. Stringfellow clarified that he was not part of the study, but knows and respects Dr. Vengosh (team member on the study) and Dr. Feinstein's work. Panel members emphasized the importance to focus on organics in addition to inorganics. One Panel member commented on the importance of gathering enough data to support policy recommendations, and several members

emphasized that good data is needed for models to be robust. Dr. Feinstein encouraged Panel members and Water Board staff to continue to provide input and feedback. Panel members agreed that they are important stakeholders in the study. Panel members and Water Board staff expressed interest in continuing to collaborate on the study. Mr. Ceppos reminded the Panel members to consult the Panel Charter for guidance on how to engage with external projects and entities either as a whole Panel or as an individual.

Other comments and questions are summarized below.

- The Panel has been focused on organics, but this study focuses on metals. Why did the study team focus on the compounds listed (e.g. metals, salts, NORM tracers)?
 - Dr. Feinstein: The California study builds upon the Duke-USGS study that Dr. Vengosh (Duke University) is working on. The existing study focuses on metals, which is Dr. Vengosh's area of expertise.
- For compounds that are both naturally occurring and potentially come from irrigating with produced water, how does the study team plan to distinguish between the two?
 - Response: We will use control samples (i.e. from fields not irrigated with produced water) as a baseline.
- Will the study team collect information about specific crop inputs (for example, copper-based pesticides)?
 - Dr. Feinstein: We will conduct farmer interviews on irrigation and growing practices. I hear that you are suggesting we collect detailed information on what has been applied to crops at the control sites so we can understand what compounds might already exist. We know the controls will not be perfect, and we do need to account for variation in some way.
 - Ms. Redmond: One way we are handling the variation is by USGS data on metals found in soils. We use that data to characterize what is typical and naturally occurring in a given region.
- Does the study plan include testing produced water early on in the process?
 - Dr. Feinstein: Yes, the plan is to test the just extracted produced water before treatment, at post-treatment, and at post-blending.
- How will the study team use the isotopes?
 - Dr. Feinstein: I will ask Dr. Vengosh for more details on the isotope method. The plan is to test for inorganic trace metals in both pre- and post-treatment of produced water. Duke University specializes in inorganic analysis, and we would like to partner with LBNL for the organics analysis.
- What is capacity to test food crops at the laboratory or laboratories being utilized for analysis?
 - Response: Both RTI and Duke have labs, but the plan is for the Duke lab to test the food crops. There are different preparation techniques for each food crop, but the analysis is similar after preparation. We can share our protocols on the extraction methods with anyone who is interested.
- Mr. Ceppos: Will Lawrence Berkeley National Laboratory (LBNL) be able to partner on this project through the current contract with the State?
 - Dr. Stringfellow: LBNL is able to share the data from the March-April sampling under the existing State contract I have as a Science Advisor. However, LBNL also has other data on oilfields that might be of interest to the study partners.

- Mr. Rodgers: The March-April citrus sampling was funded by the Water Board. Most of the data the Water Board collects is public, which we share with those who request it. There is some information that is not shared (e.g. confidential personal information about land owners). We are not obligated to share confidential information and do not plan to share it. The additional sampling to be conducted under the Memorandum of Understanding (MOU) will be funded by the oil companies and water districts and overseen by the Water Board. We will share the public data from those sampling events (i.e. excluding confidential information, as is standard practice).
- The Panel is interested in the risk of the consumption of edible crops irrigated with produced water. Please clarify if and how this study addresses consumption risk, and/or other exposures (e.g. from soil or water).
 - Ms. Redmond: The study will address consumer risk. For risk modeling, we use compartment models that start with a potential source and will use collected data on pre- and post-treatment water, soil, and crops. The models will also include data from multi-media testing. We will use standard data on human health hazards, and standard exposure factors from the U.S. EPA, to develop a risk profile that reflects real world conditions. All the data will be analyzed together to develop a probabilistic risk assessment. This assessment will address the likelihood of an increase in both a non-cancer and cancer human health effect. We will run a “worst case scenario” analysis (i.e. large uptake event by the crop and high consumption level of crop by an individual). If we find that there is no increase in negative human health effects in the worst case, then we can conclude there are no issues of concern. RTI has experience with these kinds of issues and projects. For example, we worked with the U.S. EPA to examine human health effects of coal ash waste.
 - Follow up: Why use a model to generate data on crop uptake of metals rather than the empirical measurements of metals in the crop?
 - Response: Our preference is to have empirical measurements. However, we develop models so that when we have gaps in our data, we can make informed assumptions. We need to refine the model to reflect real world conditions in the test areas. Also, we want to be able to do further modeling after the study is completed and not necessarily have to continue to test the crops.
- Why is this study focusing on strontium? Is there data that suggest strontium is prolific or easily taken into the crops?
 - Response: Dr. Vengosh can provide a more detailed answer on why strontium is useful. He has had success in using this isotope in other cases to better identify source water and where the water comes from.
- In regards to the risk modeling approach, will the study team conduct a multi-pollutant risk assessment? What about assays that look at toxicity or carcinogenic effects overall?
 - Ms. Redmond: We will examine constituents individually. We do not typically perform cumulative assessments. It is very difficult to do a cumulative risk assessment to determine the non-cancer risk. For example, it is unclear whether the interactions of constituents are additive or multiplicative. In terms of toxicity assays, we will look at boron toxicity levels in the plants. This is already a concern for farmers for crop health. We will not be doing any other toxicity assays at this time. Our toxicity benchmarks are based off of published, peer-reviewed literature.

- Follow-up comment from Panel member: There is fairly experimental research being conducted at the University of Colorado at Boulder. The team in Boulder is using various assays to look at produced water as a whole, and their preliminary toxicity assays indicate produced water could be quite toxic overall, even if each individual constituent is not at a high enough level to trigger concern.
- Will the Panel be able to see the work plan or just the finished products?
 - Dr. Feinstein: There are a number of opportunities for stakeholder input, and we encourage your input. I will check with others on the project, but we should be able to share a work plan with the Panel, potentially present again or hold conference calls. This invitation extends beyond the Panel to Water Board staff and other stakeholders involved in this project.
- How many samples will be collected and analyzed? Will the team take samples from multiple harvests? How representative will the sampling be for the development of the model? If the intention is to sample water at the point of extraction and again at the point of application, then the study team needs to be mindful of methods and representativeness since there are different blending practices. Be cautious about how diverse the data set is for developing the model.
 - Dr. Feinstein: We are aware of variations in water blending and will attempt to capture as much variety as we can. We can provide a more detailed work plan for the Panel to review that will address sample numbers and the timeline. We currently have outlined categories of the samples—e.g. the variety of crops; farms that never received produced water; farms that have received produced water for a long time; soil management practices.
 - Ms. Redmond: We are still in beginning stages of developing the full study protocol and will consult with our statistician about the number of samples we should collect. We will need to be clear in our results that we will be taking a snapshot.
- This study appears to fit primarily within a regulatory risk assessment paradigm. This framework does not always address public concerns and the average consumer, since it usually concerns “one in a million” risks. It can be difficult to communicate risk effectively to the public.
 - Ms. Redmond: Our goal is continued collaboration. We included an extension and education component in our study to better communicate with the public and stakeholders.
- How does the study team plan to contextualize risk, i.e. beyond a yes or no answer about risk? Also, it is important to consider how products move from the field to the consumer. How is that going to be factored into the assessment? What does the risk assessment address?
 - Dr. Feinstein: The risk analysis is for heavy metals and NORMs.
 - Ms. Redmond: Probabilistic analysis allows us to look at all the results on a percentile basis (from 0 – 100 %). We can pinpoint which percentile to look at and identify the variation between the risks. We can look back at typical risk profiles with the probabilistic analysis. Under the first project objective we will compare our results to standard benchmarks. We can also do a sensitivity analysis. We can look at risks at different levels of consumption. We will have data on concentrations of inorganic constituents in our model. We want to collaborate with Dr. Stringfellow for data on organic constituents. One option is to take additional media samples and send them to LBNL for analysis. Another option to look at compounds that are not empirically tested for and perform some modeling based on existing studies.

- Dr. Stringfellow: There are many projects being done at the federal level on produced water. With limited resources, we should cooperate. What might be some of the benefits of cooperating on the study? Is the curriculum being developed only for Duke University or CSU Bakersfield?
 - Response: The intention is for the curriculum to be useful across universities. The initial goal is to disseminate it to Duke and CSU Bakersfield and work with graduate students there. It certainly could be provided to other universities.
- Only 10% of oil is extracted in CA. What oilfields are you focusing on?
 - Response: This study is limited to California. Dr. Vengosh has an ongoing project with USGS about produced water quality nationwide. The particular oilfields have not been selected for our study given that we need to determine access.
- Risk goals are based on values, and the variation in risk should be contextualized and connected to societal values. Financial resources limit the scope of many scientific studies. However, this is a charged issue. When these results are communicated, limitations and justifications need to be very clearly explained. It is very important that the science is communicated clearly, including what we do not know.
- There is a need to address issues about baselines and how those are determined.
- It might benefit the study team to look at the work done by Dr. Shonkoff and Dr. Stringfellow on constituents of concern (COCs) disclosed under the California Water Code Section 13267 orders. Dr. Shonkoff is happy to follow up with the team about which COCs to include.
- Mr. Pulupa: From the regulatory perspective, point in time analyses (i.e. snapshots) do not necessarily demonstrate long-standing practices. This is particularly true in the last several years with the drought. This impacts control sites as well. We would like for this information to help the Water Board make regulatory decisions moving forward. We would also like for the data to be compatible with further studies and clearly explain the limitations.
- Mr. Rodgers: It is important for the study team to understand the geologic uniqueness of oil fields in Kern County, where the oil has migrated a long distance from marine deposited source rock and to freshwater zones. The Water Board does not detect high boron levels in the produced water, which can be the case in other types of oilfields. Other water sources we use to blend produced water sometimes has higher boron levels than the produced water. This uniqueness might make it difficult to compare Kern County with other parts of California or other parts of the US where oil extraction and produced water occurs.

Public Comment

- Keith Nakatani, Clean Water Action. Two comments:
 - Thank you for providing a clear description of the study. I recommend that the Water Board formalize a collaboration and/or process to engage with the study team. I heard an openness to working together and I would like an agreement to be made so that exchange of information can happen on a more frequent basis. We need to maximize limited resources.
 - The public continues to be frustrated about the planning process for public meetings and the lack of information provided beforehand. The Dr. Feinstein's presentation on the study was not made available beforehand, nor was Dr. Stringfellow's presentation. It would help the process to make these materials available before the meeting at least seven days in advance.

- Robert Gore, California Independent Petroleum Association. I recommend the study team define carefully structured parameters. Focus on what is in the water and what is in the crops and proceed from there. California is unique and it is important that everyone understands the uniqueness of the situation. I urge continued civility and would like to keep our discussion on the study at hand.
- Laura Beer, Upstream Water and Waste Analyst, Chevron. Email comment. Who is the person that is in charge of the policy aspect of the study?
 - In addition to Dr. Feinstein, Dr. Erika Weinthal from Duke University will be directing the policy aspects of the study.
- Jane Sooby, Senior Policy Specialist, California Certified Organic Farmers (CCOF). Email comment. “Thank you for convening this panel and continuing its important work beyond its initial year. Using oil waste water as an irrigation source holds potential to address water shortages in California, but its safety has not yet been thoroughly investigated. We are glad to hear of the Duke University study. We hope that preliminary results will be available before the year 2020. CCOF would consider being a cooperator on the study. Feel free to follow up with us on this point. Meanwhile, in addition to testing agricultural products grown with produced water for presence of petroleum-derived compounds, CCOF urges the Water Board to test soils to which produced water has been applied. Certified organic farmers are required to maintain or improve the quality of soil that they manage. Organic farmers rely on State and local agencies to ensure the delivery of safe irrigation water that doesn’t negatively impact soil health or product safety. We want to make sure that certified organic farmers who are provided produced water by their irrigation district are not inadvertently contaminating their soils by using this source of water. Soil health is critical to the long-term viability of organic agriculture. CCOF requests that the Water Board focus on the impacts of produced water on soil health, not only on food safety at the point of harvest. We need to understand any potential accumulation of materials in soil that may be taken up by crops and then consumed. We appreciate that the expert panel is spending time carefully considering sampling and testing protocols. It is important to continue sharing these methods so that others can replicate the tests. Finally, we want the Panel to be aware that their work has national implications. Use of oil wastewater for irrigation was raised at the National Organic Standards Board (NOSB) meeting held in Colorado in April. The NOSB is the Federal Advisory Board to the National Organic Program, which oversees organic certification nationally. Many consumers are concerned about the safety of this irrigation source. The work that this Expert Panel is doing will inform policies across the country. Thank you for your important work.”
- Bill Allayaud, Environmental Working Group. In other states that are potentially allowing this practice, were there studies done beforehand? If so, what were the results? I assume the study team will look to similar studies. Please confirm if the study is examining soil material and potential build-up of chemicals. However, the emphasis on salts seems misguided. There are additional constituents of concern beyond metals and salts—inorganic or otherwise. We want to make sure the study team tests for the right constituents, especially those that are added upstream in the oil extraction process and are potentially trade secrets.
 - Dr. Feinstein: I do not think there have been any studies on oilfield produced water in irrigated food crops. Panel comment: There are studies on fodder crops irrigated with produced water.
 - Dr. Feinstein: Yes, soil is intended to be part of the sampling. There are definitely data gaps. My understanding is that the Water Board has made progress on getting information from oil companies about constituents. In some cases the information is

- incomplete or in a format that makes it difficult to include in a scientific study (for example, no Chemical Abstract Service registration number). We will make as much use as possible of information about upstream inputs, but there will be a limit.
- Ms. Redmond: We include metals and salts partly to assess the produced water in terms of crop health and longevity. Testing for salts already occurs and it does not require additional resources to test along with inorganic metals. We are looking at potential longevity of use of produced water overall, including if crops can be grown with the water. We will have control sites, but we may have lingering data gaps—these can be partially addressed through national data sets and regional data analysis.
 - Follow up comment: Why is this study moving into crop health safety rather than food safety? Farmers already know how to protect their crops and would not pay for salty water from the water district. Also, it would be helpful to know what chemicals are being used by the oil companies that could end up in the produced water.
 - Response: We are testing for a limited suite of constituents and the study will be limited by resources and what we can sample.

Following discussion, Panel members decided to follow up with the study team with a list of specific questions and issues. Dr. Feinstein said she would consult with the team about providing a more detailed work plan for the Panel to review and comment on. Mr. Ceppos said CCP will coordinate a follow up conference call and will work with the Water Board to help ensure full transparency in the process, including procedures to ensure the conversation occurs in the public record.

Mr. Ceppos asked the Panel and Water Board if they wanted to comment on the suggestion to formalize the coordination between the Panel and study team. Mr. Rodgers indicated the Water Board is willing to meet and assist with the project, but emphasized any formal cooperation would have to guarantee each party could freely remove themselves from the collaboration and that there would be no exchange of financial resources. Mr. Pulupa said one option is for Mr. Rodgers or the Water Board to write a letter expressing the desire to work with the study team and cooperate on the project.

Update – Results of March 2017 Citrus Sampling Events

Dr. Stringfellow gave an update on the March-April 2017 citrus sampling events. (See [meeting materials](#) webpage for full presentation.) He reviewed the objectives, which included collecting citrus samples from the current season, analyzing for known COCs, and archiving samples for later study or repeat analysis. In late March and early April, samples were collected by a contract sampler and/or Regional Board staff. Samples were sent to Weck Laboratories. Dr. Stringfellow reviewed the sample collection and processing procedures, including the list of analytes (organics and metals) and the particular U.S. EPA methods used for analysis, which included low level detection methods.

Dr. Stringfellow reviewed the laboratory results and provided additional context and an assessment of the result. Five organic compounds came up with a measurable result in the laboratory, as well as three metals:

- 1,2,4, Trimethylbenzene—This compound is a normal groundwater contaminant and is found in gasoline. Equal levels were found in both the fruit samples irrigated without produced water (control samples) and the samples irrigated with produced water (treated samples). Results demonstrated no statistical difference between treated and controlled, which indicates a potential false positive. This chemical is very similar to limonene, a

naturally occurring compound in citrus. The molecular weights of the two compounds are very close. The mass spectrum analysis showed molecular weight peaks in the sample above the molecular weight of 1,2,4-trimethylbenzene, but in the molecular weight range of limonene. This further indicates a false positive. Dr. Stringfellow's conclusion was that the results misidentified limonene as 1,2,4-trimethylbenzene.

- Acetone—This chemical is naturally occurring in fruit. Results found acetone in both control and treated samples. Previous studies indicate this result is not surprising. There was no clear pattern in the distribution between control and treated samples.
- p-Isopropyltoluene—This compound is also known as p-cymene and is related to terpenes (e.g., limonene). It is naturally occurring in plants (e.g., aromatic herbs). It was found in equal concentrations in both control and treated samples. This compound does not cause concern.
- Phenol—This compound showed up in one control sample of Valencia oranges. Phenols occur naturally in fruit and are antioxidants. This result was not surprising.
- sec-butylbenzene—This compound was found in one treated sample only. It was detected at the quantitation limit, which is the smallest amount that can be detected. A similar compound, N-butyl benzene, can be found in cooked fruit (e.g. in pies). This result is potentially a false positive, and there is no reason to think it is a health concern. The team will follow up with a more detailed analysis.
- Barium—This metal was found in both control and treated samples. It is naturally occurring in fruit. The data indicate similar levels in both treatment and controls.
- Copper—This metal was found in both control and treated samples. It is naturally occurring in fruit. Slightly higher concentrations were found in the control samples. Copper is a trace nutrient important for the human diet and does not raise concern.
- Strontium—This metal was found in control and treated samples. It is naturally occurring in fruit. The concentrations detected were ten times lower than national mean according to previous studies. Detected levels were consistently higher in samples from sites irrigated with produced water. There are many variables associated with strontium levels and the results need further scrutiny.

Dr. Stringfellow reviewed next steps, which include writing the sample and analysis report, and plan for future studies and monitoring activities. The final report will include the full list of compounds that were tested for.

Questions from the Panel

- Regarding the results for 1,2,4-trimethylbenzene, were there any other secondary compounds that the mass spectrum analysis could represent besides limonene?
 - Response: The lab has not followed up with me yet on that. Limonene was the closest compound I could identify.
- One big issue is how to address what is naturally occurring in the fruit and the potential for mischaracterization in the analysis. Also, many plants will produce organic compounds of interest under stress conditions or during ripening. What is known about citrus and organic compounds in the ripening stages or under stress conditions related to salt or water? You may need to consider the stage of ripening in the sampling, testing, and analysis procedures.

- Response: A lot of analysis has been done with fruit in terms of what is naturally occurring and what is not. I have not looked particularly for studies on stress or drought, but there is a lot of literature on ripening and flavor. We are reviewing that literature for additional context. This round of sampling has demonstrated the need to closely examine the full detailed spectrum analysis from the lab. I approach these issues from both a narrow and systems perspective. In terms of the individual scientific analysis approach, we have to carefully examine the spectra results. For some of the inorganic compounds, we can examine the isotope signatures in the water and potentially in the strontium to gather more information about where things are coming from. That approach would go beyond a monitoring effort.
- It is surprising that there was not more interference in the results, especially in the peel. The results mostly show compounds registering at the parts per billion level, which is a highly sensitive analysis. Even at that level we are not seeing much, which raises the issue about where to best spend resources.
 - Response: The soils have more information about what has happened over time. Water samples are only a point in time. Interfering compounds in the soil will be less complicated.
- How do you plan to address the strontium levels?
 - Response: I do not want to take strontium off the analytes list yet because we are finding it. Everything I have read suggests the strontium levels detected are well within the safe range.
 - Follow up: There is a need to figure out where the strontium is coming from and determine if there is a connection to the produced water or not.
 - Response: We would ideally use the isotope method to trace the sources.

Public comment

- Deb Wirkman. Email comment. Regarding Dr. Stringfellow's presentation on the citrus sampling and analysis, has mercury been detected in the produced water and if so, why was it not included in the analyses?
 - Dr. Stringfellow: I cannot speak to mercury detection in produced water.
 - Dave Ansolabehere, Cawelo Water District: We have looked at mercury in the District and the results have always been non-detect.
 - Mr. Rodgers: The Water Board's list of compounds to monitor includes mercury, since it is important, but we do not typically find it in the regions of interest for this project. It is more common in areas such as old gold production zones or hot springs.
 - Panel comment: Mercury requires a different type of analysis (an additional cost).

Update – Food Safety Project Update

Mr. Rodgers, Water Board, gave an update on the project. The MOU has been fully executed this morning. The Water Board provided the three draft scopes of work for MOU implementation tasks with Panel members. These tasks include 1) a literature review, 2) additional assessment of chemical hazards, and 3) continued sampling of agricultural commodities (grapes, nuts, etc.). Panel members requested additional information about next steps related to the task scopes, whether or not the Water Board will rely on disclosures mandated under state water code (Section 13267), and if the sample locations would be subject to public records requests.

Mr. Rodgers confirmed the Water Board will continue to work with the oil companies to disclose chemicals and there will be ongoing disclosures as chemicals change. He commented that if, however, those chemicals are trade secrets, the Water Board will not be able to share that information with the public or the Panel. The Water Board is working towards complete knowledge of all the chemicals that could end up in the wastewater. The Water Board intends to keep the specific locations confidential, especially because property access for sampling depends on landowner permission. Also, the exact location of the individual samples are not important for the overall interpretation of the data.

Mr. Rodgers clarified that the scopes of work are not for contracting directly with the irrigators and/or producers of the wastewater. MOU partners will be able to provide input and can issue a request for information, and will be responsible for selecting the entity to implement the work (with right of refusal by the Water Board). The irrigators and producers will directly contract with the chosen entity to implement the tasks. The Water Board will have technical control over the work, including final conclusions and recommendations with input from the Panel and technical advisor. Since there is a coalition of producers and irrigators who are acting as a group under the MOU, the expectation is that they are determining the cost share approach as a unit.

Mr. Ceppos requested clarification on the timeframe associated with the implementation of MOU tasks and if there will be an additional window of time for public feedback on the scopes. Mr. Rodgers explained the Water Board intends to have summer crops sampled, either under the MOU tasks or through additional contracting with Cawelo Water District's third party contractor as was done in March-April 2017. The Water Board is open to feedback from the public by email at any time, and may consider another public meeting in the late summer to address summer crop sampling.

Letter to the Water Board on the makeup of the Panel

Mr. Pulupa said that on June 12, a group of representatives from environmental and public health organizations sent a letter to Pamela Creedon, Executive Officer of the Central Valley Water Quality Control Board, asking for the removal of two panel members due to perceived conflict of interests in past employment. He explained that the Expert Panel was convened by Water Board staff to provide expertise from related to food safety. The conflict of interest provisions that pertain to Water Board staff do not pertain to the voluntary panel. In the letter, the group requested the Water Board use the model used by the California Council on Science and Technology (CCST), wherein conflict of interest disclosures are completed in advance of panel formation. Mr. Pulupa noted that this Expert Panel is a different type of entity with a different output. The Water Board holds all final decision making power and retains oversight over all Panel outputs. The intent of the Water Board was to convene a diverse set of opinions, including industry stakeholders, in the Panel. The Water Board acknowledged the receipt of the letter and understands the concerns, but does not plan to change the makeup of the board at this point.

Discussion of MOU technical oversight, white paper outline, and long-term path

One Panel member emphasized the importance of the Panel having the opportunity to review the final work plan developed by the entity who will implement MOU tasks, and requested clarification on what the Water Board means by full technical oversight of the MOU implementation. Mr. Rodgers explained that under the MOU, there is no technical discussion allowed among the irrigators, producers, and dischargers. All the technical information and data will come straight to the Water Board, and the Water Board will direct technical discussion and recommendations. The Water Board will have discussions with

the irrigators and producers about completing the contractor selection process, since those entities will be responsible for funding implementation. One Panel member asked for the public to comment on their comfort level in regard to the separation of technical oversight in MOU implementation. One member of the public commented that adequate safeguards appear to be in place in the MOU to make sure the operators and producers are not interfering with the results.

Panel members and Water Board staff discussed the white paper outline. Comments are summarized below:

- The white paper should not only address the current safety of the produced water, but also lay out the parameters produced water needs to meet before it can be used.
- The paper needs to include a thorough discussion section on caveats and limitations. In particular, it needs to address what the data mean in relation to naturally occurring compounds.
- Add a section on data gaps and uncertainties to inform recommendations.
- The outline should include a section clearing stating the study problem or question, and the study goals and objectives. The white paper should articulate how the study will help further the understanding of the problem.
- The white paper should include a paragraph explaining the regulations and standards for produced water in comparison with other water (e.g. drinking water, other irrigated water sources).
- The Water Board should consider adding soil analysis to the project and inclusion in paper.

Panel members suggested developing the front end of the white paper sooner rather than later to better inform the overall thinking. Mr. Ceppos asked the Water Board about the timeline for the completion of the white paper. Mr. Rodgers said the timeframe depends on how the MOU tasks progress and results from summer crop sampling. The Water Board wants a clearer understanding of the data gaps in order to further identify what role the Panel can play to inform potential Water Board actions. The Water Board will begin to prepare a more detailed draft of the white paper and will add a standing agenda item in future meetings to review white paper progress.

In addition, the Water Board wants the entire Panel to provide input on the soil sample issue and suggested that be added to the agenda for a future meeting or conference call to discuss in more detail. One Panel member commented that almond harvest will begin in five weeks, and would like to address soil sampling sooner rather than later. While perennial crops may not experience as much soil disturbance, annual crops do. Dr. Stringfellow recommended that the Panel to come to some kind of consensus about soil sampling and/or other proposed studies. Mr. Rodgers emphasized that the main focus of the Panel and project is on food safety. There may be other venues the Water Board can pursue to look at livestock watering issues or worker safety issues (e.g., California Department of Food and Agriculture). Soil sampling falls within the overall area of food crop issues, but is not the primary food safety issue from a consumption standpoint.

Next Steps

Dr. Stringfellow requested that in addition to moving forward with reviewing the MOU scopes, the Water Board convene Panel meetings to identify what needs to happen in addition to monitoring, and identify specific studies that should be done in the short-term or long-term. Mr. Ceppos reviewed the list of potential agenda items for the next meeting, which include:

- Soil Sampling Discussion
- Update on white paper
 - Expanded outline and timeline on preliminary sections
- Update on the Duke Study
 - Potential “formalization,” i.e. mutual expression of commitment to cooperate
 - Follow on work—more detailed work plan, questions/issues from panel
- Update on contracting process and MOU tasks
- Potential interim update in late summer

General Public Comment

Mr. Ceppos asked for general public comment from members of the audience. Water Board staff read aloud comments received by email.

9. Keith Nakatani, Clean Water Action. I strongly support the suggestion to include a discussion section between results and conclusions about what the study should achieve. I strongly support soil sampling. This has been called for from variety of public interest groups. There is a timing issue with soil related to the rainy season. Last time I recommended root crop sampling. I reiterate my request that Panel member-only meeting minutes be made public. In regards to the scheduling of the public meeting, the meetings should be substantive and timely. Materials need to be posted in advance. The trade secret obstacle is a significant issue and calls into question any results that are generated.
 - Response: if there are roots crops, they will be part of the sampling program. Carrots and potatoes are not being grown this year.
10. Bill Allayaud. EWG. Sampling of roots crops is critical. I want the Panel to be aware of amendments being made to permits for Chevron and California Resources Corporation requiring additional actions be taken at the oil filtering ponds. This is essentially an open admission that oil leaves the ponds. We are dealing with oil products that are reaching the valley floor and then being used to irrigate crops. The water is lightly treated, it is not safe to drink. This is a critical issue.
11. David Ansolabehere, General Manager, Cawelo Water District. I would like to address the amendment to the permit. That amendment is not for the Chevron-Cawelo permits, it is the CRC-North Kern permit and the facilities there. They are not Chevron and Cawelo facilities, which is where the walnut shell filters are. There is no free oil in the Chevron-Cawelo facilities that any aviary or wildlife can access.
12. Deb Wirkman, via email. “This is a follow-up comment to the answers to my question about mercury during public comment after Dr. Stringfellow's presentation today, A quick review of the water quality data posted on the Food Safety Expert Panel Website indicates that mercury has in fact been detected in some of the produced water so if this water is being used for irrigation then I want to ask that mercury including organomercury be carefully considered for inclusion in the food safety study. Also please be sure to include root crops in the food safety study!!”
 - Mr. Rodgers: If the Water Board detects mercury we will add that to our list of COCs to test for.

13. Sue Chiang, Director of Pollution Prevention, CEH, via email "Thank you for the opportunity to listen in to the Food Safety Expert Panel meeting via webcast and to submit comments via email. I would like to reiterate an earlier speaker's comment and stated concern about the continued lack of notice of the upcoming Food Safety Expert Panel's meetings – there was only 6 to 7 business days given and I believe the meeting agenda was only shared with the public yesterday. I'm unclear when the meeting materials have been made available but this is not enough notice for the public to adequately engage in this process. I also would like to raise larger concerns about the make-up of the Panel and preserving the integrity of the Panel's work. On June 12th, over a dozen organizations submitted a letter to the Central Valley Regional Water Quality Control Board raising conflict of interest concerns with 2 members of the Food Safety Expert Panel – Mark Jones and Barbara Petersen. Given these panel members' present and past employment, we question whether they can provide an objective scientific review of the issues. In a June 8, 2016 letter submitted to Chair Longley, some of our organizations raised conflict of interest concerns about Mark Jones, who at the time of the Panel's inception was a paid consultant at ERM, a firm that was retained by the oil and gas company California Resources Corporation (CRC) to conduct a study on the same issues that the Food Safety Panel is exploring. At that time, we urged the Central Valley Water Board to follow the model of the California Council on Science and Technology's (CCST) SB 4 Independent Scientific Assessment of Well Stimulation in California, in which all panel members publicly disclosed their financial and other conflicts of interests. The Central Valley Water Board's response in July 2016 failed to address the broad issue of panel members disclosing their conflicts, and asserted that there was no conflict with Mr. Jones' appointment since by that time he was no longer employed by ERM. We question the notion that such a conflict can dissolve within such a short timeframe, and note that Jones was the Program Director for and signed off on the ERM report (Development of Risk-Based Comparison Levels in Chemicals in Agricultural Irrigation Water) which was submitted for consideration by the Food Safety Panel. It is a clear conflict to have Mr. Jones on a panel that is charged with evaluating the merits of evidence that he produced, regardless of where he is currently employed. Dr. Petersen also has direct conflicts and should not serve on the Panel. These conflicts were not disclosed when Dr. Petersen joined the Panel, but only came to light at the 4/21/17 Food Safety Expert Panel meeting, through a short written note at the very end of the Revised Project Charter (drafted by Central Valley Water Board staff). The note stated that Dr. Barbara Petersen's participation on the Panel has been funded by Chevron through the majority of 2016, and that she is now being paid to participate by CalFLOWS, an oil and gas and agribusiness industry trade group whose directors include representatives from Chevron, Aera Energy, and certain large agricultural firms. CalFLOWS openly states that its purpose is to defend and promote the reuse of produced water in agriculture, and the corporations behind the group have a clear financial interest in the outcome of the Panel's findings and recommendations. Dr. Petersen's associations with Chevron and CalFLOWS represent clear conflicts that make her unsuitable to serve on the Panel. Furthermore, Dr. Petersen's employment with the consulting firm Exponent raises serious questions of industry bias. In her profile at Exponent, it states that her experience includes, "Chemical defense strategies for international (including issues regarding heavy metals in toys and other consumer products) and U.S. regulatory needs, Canadian defenses and California issues including proposition 65." By including candidates with a history of working for industry against government regulation, the Central Valley Water Board jeopardizes the scientific reliability and public credibility of this process. While Dr. Petersen has a resume that shows expertise in the subject matter at hand, it is inappropriate for representatives of consulting firms that work for corporations with strong financial interests in a particular outcome of the panel's deliberations to serve on the Panel. We have asked that these

2 panel members be removed due to the issues that have just been stated here –with some additional details included in the June 12th letter. We also requested that the Central Valley Water Board establish a policy requiring that panel members publicly disclose their relevant financial and other conflicts of interest. To date, we have not received a response from the Central Valley Water Board to our June 12th letter – let alone, any kind of acknowledgement that it was received. Please let us know what the response is to our request.”

14. MaryKay Benson. Email comment. Can we in CA can stop irrigating crops with oil wastewater? Can we stop the irrigating our food crops and watering livestock with the toxic chemical oil/gas field wastewater that is chock full of carcinogens, some Prop 65 banned chemicals and endocrine disruptors, plus has 38% undisclosed chemicals used as "trade secrets?"

Mr. Ceppos reminded the Panel that they are under no obligation to respond to the letter but can do so if they choose. Mr. Ceppos proposed a Panel only meeting to address the follow up issues and said CCP will work with the Water board to determine the best schedule moving forward. Mr. Rodgers said the Water Board does intend to get information out sooner. The Water Board may need to have a meeting on short notice given the speed at which certain processes occur. He thanked the Panel members and members of the public for their valuable comments and input. Mr. Ceppos adjourned the meeting.