

Central Valley Regional Water Quality Control Board

MEETING SUMMARY FOOD SAFETY EXPERT PANEL – PUBLIC MEETING 9 May 2019 10 a.m. to 3 p.m.

Attendees

The following table summarizes Panel member attendance.

Food Safety Expert Panel Member	Title & Affiliation
Dr. Stephen Beam	Branch Chief, California Department of Food Agriculture (CDFA)
Dr. Bruce Macler	Toxicologist, U.S. Environmental Protection Agency (EPA)
Mr. Mark Jones	Toxicologist, US Army Corp of Engineers
Dr. Barbara Petersen (remotely)	Principal Scientist, Chemical Regulation and Food Safety- Exponent Incorporated
Dr. Andrew Gordus	Staff Toxicologist- California Department of Fish and Wildlife (CDFW)
Dr. Seth Shonkoff	Executive Director- PSE Healthy Energy, Lawrence Berkeley National Laboratories (LNBL)
Dr. Kenneth Kloc (remotely)	Staff Toxicologist- Office of Environmental Health Hazard Assessment
Dr. David Mazzera	Chief, Food and Drug Branch, CA Department of Public Health (CDPH)

Note: Panel Member Dr. Gabriele Ludwig was unable to attend.

The following table summarizes the attendance of affiliated parties.

Affiliated Parties	Title & Affiliation
Dr. Karl Longley (remotely)	Chair of the Board- Central Valley Regional Water Quality Control Board (Regional Board or Central Valley Water Board)
Mr. Clay Rodgers	Assistant Executive Officer- Regional Board & Facilitator
Mr. Joshua Mahoney	Water Resource Control Engineer- Regional Board
Ms. Rebecca Asami	Engineering-Geologist- Regional Board
Mr. Ralph Saucedo	Associate Government Program Analyst- Regional Board
Dr. William Stringfellow	Science/Technical Advisor- University of the Pacific, LBNL
Dr. Robert Scofield	Principal Toxicologist- GSI Environmental, Inc. (GSI)
Dr. Bernard Beckerman	Senior ESG- GSI

KARL E. LONGLEY ScD, P.E., CHAIR | PATRICK PULUPA, ESQ., EXECUTIVE OFFICER

On 9 May 2019, the Central Valley Water Board held a public meeting of the Food Safety Expert Panel (Panel). A summary of the meeting follows. This summary is not a dictation of the meeting. A full video of the meeting can be found on the Central Valley Water Board's web page.

Action Items

- The Water Board needs to post meeting materials to the Food Safety web page.
- The Water Board needs to incorporate comments from the Panel into the meeting summary.
- The meeting summary needs to be posted to the Food Safety web page.
- The GSI Report needs to be reviewed by the Panel and posted to the web page.
- The Water Board needs to schedule the next Public Food Safety meeting.

Introductions and Agenda Review

Clay Rodgers conducted introductions and reviewed the meeting agenda. He stated that this is a public working meeting of the Food Safety Expert Panel (also referred to as the "Panel") to discuss issues associated with the application of oil field produced water (also referred to as "produced water") to crops for human consumption. He stated that comments and questions could be submitted by email and will be read at the end of each agenda item.

Materials List

The following items were posted on the Water Board's web page. Hard copies were made available to the Panel and affiliated parties.

- [9 May 2019 - Meeting Agenda](#)
- 24 January 2019 - Meeting Summary
- [Draft Report on MOU Task 1](#)

Review of 24 January 2019 Food Safety Expert Panel Meeting

The Panel held a public working meeting on 24 January 2019. A draft meeting summary of the January meeting was made available to the Panel prior to this meeting. Panel members were asked if there were any additional comments or revisions that need to be made on the summary. The Panel was provided another two-weeks to review the meeting summary and provide any comments to the Water Board.

Presentation – Waste Discharge Requirements Update

Rebecca Asami, Engineering Geologist, Central Valley Water Board

[Presentation](#) (A copy of the presentation is available on the Food Safety web page)

Rebecca Asami: I will be discussing Order Number R5-2019-0025, which was adopted by the Central Valley Water Board in April 2019. This Order affects produced water reclamation projects in Kern and Tulare Counties and amends waste discharge requirements or “WDRs” that permit the reuse of produced wastewater for irrigation. The following WDRs were amended:

- R5-2015-0127 California Resources Production Corporation and North Kern Water Storage District;
- 98-205 Hathaway, LLC, Kern-Tulare Water District, and Jasmin Ranchos Mutual Water Company;
- R5-2012-0059 California Resources Production Corporation and Cawelo Water District; and
- R5-2012-0058 Chevron USA and Cawelo Water District.

During this presentation, these parties are referred collectively as “Dischargers”.

The adopted Order requires Dischargers to be fully engaged in the Memorandum of Understanding (MOU) between the Central Valley Water Board and the Dischargers. The MOU defines conditions in which the Food Safety Project is conducted. Under the MOU, the Manager (Clay Rodgers – Assistant Executive Officer of the Central Valley Water Board, Fresno) oversees the technical work completed by GSI Environmental, Inc. (GSI), third-party consulting firm hired under the MOU. A copy of the MOU is available on the Food Safety web page.

The MOU outlines three tasks to be completed for the Food Safety Project. The first task is to compile a list of “Chemicals of Interest.” To complete this task, GSI has been reviewing naturally occurring constituents associated with produced wastewater and responses to 13267 Orders issued to the Dischargers by the Central Valley Water Board. A draft report for this task has been completed and is available on the Central Valley Water Board’s web page.

Task 2 is a literature review, which will consist of a compilation of Chemicals of Interest identified in Task 1. My understanding is that GSI has started to complete this task and will have more to report once the draft report is finalized.

Task 3 is crop sampling, which has been a part of the Food Safety Project since 2017. Crop sampling is completed by Advanced Environmental Concepts, Inc., third-party consultant, and is overseen by Central Valley Water Board staff. During the collection of crop samples, Central Valley Water Board staff retain possession of the samples, as noted in the chain of custody, prior to sending the samples to the laboratory for analysis. This year, citrus, cherries, and carrots will be analyzed. Citrus was sampled in February and cherries were sampled last week. Carrots will likely be sampled in July. At this time, Central Valley Water Board staff does not anticipate collecting additional crop samples next year, unless directed by the Panel to do so.

The following summarizes the Order which was adopted in April. Under the Order, Dischargers must provide information necessary to complete the MOU tasks. This includes information regarding crops and harvesting times. This Order also states that the Manager may propose an Order for consideration by the Central Valley Water Board that would prohibit the use of produced water for a Discharger that does not comply with these new requirements. Anyone that would like to review the complete Order can do so at the Central Valley Water Board's web page under "Adopted Orders."

This concludes the presentation.

Questions and Comments from the Panel:

Clay Rodgers: I would like to add a couple of things to this presentation. Water Board staff prepared this Order due to miscommunication issues between the Manager and Permit Holders that resulted in samples being missed. This Order is required of all Dischargers and notifies the Permit Holders that there will be repercussions if information is withheld or samples are missed due to miscommunication by the Dischargers. That is the reason why the Order was adopted. We notified the Panel in January that we would be sampling blueberries. It came to light that the blueberries are not irrigated with produced water; they are grown on well water. I asked and we will be receiving a document from the blueberry growers that certifies under penalty of perjury that these crops have not used any produced water for irrigation. If it changes in the future and produced water is used, then samples will be collected for testing.

Bernard Beckerman will discuss the citrus sampling that was done earlier this year during the citrus season and we have carrots that are pending, which we talked about during the January Food Safety meeting. We don't have any other new crops or root crops that are being grown using produced water, so we want to complete Tasks 1 and 2 and get the White Paper out for your consideration and comment. Comments by the Panel will ensure that the White Paper accurately portrays what the Panel wants, which may include recommendations for additional types of sampling. Right now, I hope to have a draft White Paper to the Panel by the end of the year. The White Paper will present the results and findings of the work completed under the Food Safety Project. GSI is working on the draft Task 1 report, which the Panel has received and submitted comments. The draft Task 1 report was posted on the Water Board web page prior to this meeting.

No questions or comments by the Panel.

Rebecca Asami: For those watching the webcast who would like to submit a question, the email is WaterboardFoodSafety@waterboards.ca.gov.

Presentation – New and Expanding Projects Under WDRs

Joshua Mahoney, Water Resource Control Engineer, Central Valley Water Board

[Presentation](#) (A copy of the presentation is available on the Food Safety web page)

Joshua Mahoney: I will be discussing new and expanding projects that reuse produced water for irrigation. Currently there are five active projects that reuse produced wastewater for irrigation and are regulated under WDRs. The following projects were displayed on the screen:

1. Chevron USA, Inc. and Cawelo Water District
 - i. WDR R5-2012-0058
2. California Resources Corporation and Cawelo Water District
 - i. WDR R5-2012-0059
3. California Resources Corporation and North Kern Water Storage District
 - i. WDR R5-2015-0127
4. Hathaway, LLC, Kern-Tulare Water District, and Jasmin Ranchos Mutual Water Company
 - i. WDR 98-205 (Expanding)
5. E&B Natural Resources Management Corporation, Sherwood Hills, LLC, et al.
 - i. WDR R5-2019-0024 (New)

The projects displayed on the screen are not listed in any particular order. As shown in red on the screen, Item 4 is the Hathaway project that has proposed an expansion of the facility. Item 5 is the E&B and Sherwood project which outlines a new project that will reuse produced water for irrigation. I will go over these projects in more detail in the upcoming slides.

The Jasmin Treatment Facility is operated by Hathaway, LLC (Hathaway), Kern-Tulare Water District (Kern-Tulare), and the Jasmin Ranchos Mutual Water Company (Jasmin Water Company). The facility is currently regulated under WDRs Order Number 98-205 and regulates the discharge of produced wastewater from Hathaway to Kern-Tulare and Jasmin Water Company for irrigation. In 2018, Kern-Tulare submitted a Report of Waste Discharge and technical reports that proposed an expansion of the existing project. Upon review of the proposed project, Water Board staff prepared tentative WDRs that would regulate the reuse of produced wastewater for irrigation, the implementation of a new reservoir for additional storage, and permit the increased flow rate of produced wastewater reused for irrigation, upon satisfying specific requirements outlined in the Order. The tentative order has been sent out for public comment and is anticipated to be considered for adoption at the June 2019 board meeting.

The McVan Area Treatment Facility is operated by E & B Natural Resources Management Corporation (E&B), Sherwood Hills, LLC (Sherwood), and five other landowners that are identified as Dischargers in the WDRs. The McVan Facility previously disposed of produced wastewater via injection wells operated in the Poso Creek oil field. Due to the quality of the produced water, E&B, Sherwood, and the other landowners partnered together to reuse the produced wastewater for irrigation. Upon reviewing the report of waste discharge and technical reports, Water Board staff prepared tentative WDRs that were released for a 30-day public comment period. Water

Board staff responded to the comments and presented the proposed order to the Board for consideration of adoption.

During the April Board meeting, Board members heard presentations and testimony by Water Board staff, Dischargers, and members of the public regarding the adoption of the tentative Order. Upon deliberation, the Board voted to adopt the order as written. The McVan Treatment Facility is now regulated under WDRs for the reuse of produced wastewater for irrigation, storage of produced wastewater in Sherwood's Reservoirs, and the irrigation of 4,400 acres of cropland that consists of nuts, citrus, oil seed and grain.

This concludes the presentation.

Questions and Comments from the Panel:

Bruce Macler: Are there going to be more applications for this in the future?

Clay Rodgers: Yes, our general expectation is that we do expect more new and expanding projects. Particularly in areas with water that is very good quality coming from the eastern part of the Valley, North of the Kern River, that does not need significant treatment to be used for irrigation. We are expecting that people out there would like to use produced water, particularly because Kern County is very water deficient and needs any useable water that is of suitable quality. We have also seen some pilot tests and a fair amount of interest in treating poor quality water, which can contain a lot of salts. The pilot projects consist of doing some kind of treatment, whether it is reverse osmosis or some other treatment to recycle produced water. I can tell you that I personally anticipate, and Karl may have some thoughts on this, that as water becomes more valuable there will be even more interest in this. Depending upon what happens as the Sustainable Groundwater Management Act is implemented, I believe that the demand for water is only going to be increased. This is assuming that the water is of suitable quality and that there are no issues associated with the reuse of produced water for irrigation.

Seth Shonkoff: I know the newest discharge permit is for a new project that will use 100% produced water for irrigation. To the best of my knowledge, this appears to be the first of its kind in California. Do you anticipate more of these projects without blending being proposed?

Clay Rodgers: To be honest with you I do not know. In this case it is for an area where there is not a lot of groundwater and they do not have access to district water or other sources of water. I do not know if most of the valley, where we see intense agricultural activity, if that is the case. Our requirements when we receive a proposed project is to review the application and see if the use of recycled water is appropriate. To be honest, I do not have an answer to that question other than it would depend on the water resources available to the people accepting the water.

William Stringfellow: My understanding is it also has to do with what is in the water besides just salinity, also need to focus on boron concentrations. Some of these projects are going to be restricted due to this type of limiting constituent.

Clay Rodgers: Boron is the big driver because it is difficult to remove from the wastewater and is expensive. If you are dealing with high boron waters that we see on the west side of the valley, that water is going to be difficult to treat and will be expensive. This will definitely restrict the volume of water that people will want to recycle, at least in the near future.

Karl Longley: Boron is the big culprit right now. I expect to see quite a bit of work going on from the Department of Energy considering desalination efforts regarding boron, but that has yet to be seen.

No additional comments or questions from the Panel.

Questions and Comments from the Public:

David Braun: As more of these projects are approved, I'm curious to know if oil field chemicals are used in those fields?

Clay Rodgers: The WDRs have been adopted and the ones that are being considered for adoption require the reporting of all chemicals that are being used, including trade secret information. That information must be reported to the Central Valley Water Board even if we can't report it publicly. We do know what is being used although we don't always have the recipe or the masses.

David Braun: Are the quantities of those chemicals being disclosed?

Clay Rodgers: I think we have most of the quantities that are being used but we don't have the specific quantities and different products. They tell us the products that are being used and how much and we know all the constituents. The trade secret issue is really regarding the recipe. What we require for water sampling is the analyses of the chemicals that can be tested, although there are a few that cannot be analyzed. We have a very good accounting for what's in the water and a very expansive list of chemicals that have been analyzed for in the fruit. The first question normally is, if it is not in the water it is difficult to understand how it gets to the cropland. We have taken a very conservative approach to analyze for everything in the water. Part of the White Paper will be to lay out a plan to move forward and determine if there are specific things that we should be looking for. I should mention that there are some things that are added to the wells, like walnut shells, that cannot be analyzed. There are some other things like that we do not analyze for, because it is clearly not an issue.

David Braun: Do we know the exact quantities of these chemicals?

Clay Rodgers: No

David Braun: So, I have a question for this general group. The Air Resources Board of Los Angeles requires the disclosure of the quantities of chemicals that are going into the ground. These are chemicals of various concerns but because the Air Resources Board is interested in them, one would imagine it is because these are air toxins that are being utilized perhaps next to where people live or population centers. This is water. We are utilizing these chemicals in water that is then being applied to food that presumably everyone is eating, including our children. You have mentioned reverse osmosis. Is this water going through reverse osmosis before it gets on the crops?

Clay Rodgers: No, it is not.

David Braun: There is no reverse osmosis and there is not a lot of filtration. I think you mentioned walnut husks as being a method to maybe separate the oil from the water. We do not know the quantities of the chemicals going into the water, but we do know the quantities of the chemicals. How can we evaluate whether something is safe if we don't know the amounts of chemicals that are going into this water? Presumably, if you are testing this every minute of every day then you might be able to say that this is safe. Let's say you are only testing it one time a day, then perhaps some contaminants could get through. This is in the interest of public health that we are having this conversation. I think that we should be genuine to this process.

Clay Rodgers: I absolutely agree with that. This is one of the reasons why we are engaged with the Food Safety Expert Panel. We have also hired a scientific adviser to help us understand the best way to move forward because we want to make absolutely certain that the food grown is safe. We want to assure that consumers can comfortably consume the fruit without being concerned that there is an increased risk from the use of this water.

David Braun: Would a way to do that be to identify the quantities of chemicals that are being used in these oil fields?

William Stringfellow: I cannot answer your question in full, but part of the process is that we are getting the complete list of chemicals that are being used. In the absence of specific information on how much is being used, we are assuming a lot is being used and working backwards from that. Asking questions like: what are these chemicals, what are the toxic chemicals, and what are the common well-known chemicals? Some things like GRAS (general recognized as safe), which are generally recognized as safe and are like food additives. We are going through all those lists and this is part of the process of what we have been doing for two years now. As a scientist, I want the mass information. If we do not have it, we are assuming the worst and working backwards from there.

David Braun: So you feel strongly that your system of testing or whatever else you are doing, despite not knowing the quantities, will determine if this is safe. You would let little children drink this or put on food?

William Stringfellow: I would not drink untreated irrigation water. It is used for irrigation and held to a different standard than drinking water.

David Braun: If I ate fruit without washing it thoroughly could I actually get some of what might be in that water on the food for my kids?

William Stringfellow: Food is washed and processed before it is delivered to the consumer. So direct contact with the water is not something we are thinking is a major pathway. I will refer to the Food Safety Expert Panel and would be glad to talk with you afterwards about the details.

David Braun: In your opinion, it is not absolutely necessary for us to have the quantities of these chemicals even though the Air Resources Board does?

William Stringfellow: I would prefer that, but in the absence of that information it is actually to the disadvantage of the oil industry and the users because we are assuming worst-case scenarios. If we knew that in this whole oil field filled with thousands of gallons of water and it was using just a sprinkle of this material, it would probably come off the list quicker than it will with us not knowing exactly how much is being used.

David Braun: Would it not be better for the end-user to know exactly what is going in that water?

William Stringfellow: That's a little bit beyond my paygrade to answer that question.

David Braun: You are the person analyzing whether this is safe or not.

William Stringfellow: What I'm saying is if you think about what people use for irrigation, we are using things like the San Joaquin River to irrigate crops. We are not suggesting that anybody drink the San Joaquin River without treatment.

David Braun: There is not any reverse osmosis or treatment, right?

William Stringfellow: No, not to remove salts or anything like that.

David Braun: So you are saying that sample testing that is going on with these foods will determine whether this product is safe for children?

William Stringfellow: I am getting out of my realm of expertise, which is water quality and the relationship between water and the application for irrigation. The safety of food in this country is a complex subject and we have a large system that is dealing with food safety issues.

Seth Shonkoff: The amendments to the discharge permits that require testing for individual chemical constituents is positive. The big gap that I see here is that there is an assumption that we should be monitoring for individual constituents that were put down oil and gas wells. The assumption is that those constituents are stable and that

they remain those constituents after they are injected, mixed in the oilfield reservoir, and come up to the surface. Setting up a whole monitoring program based on constituents that we know most of which probably are not that stable leaves analytical gaps that I think should be filled.

David Braun: What I hear is we can identify some of these constituents and test for them, but we do not know what happens when these chemicals are mixed together? So, there might be some other chemical compound that is created?

Seth Shonkoff: I think it is entirely possible. The toxicity and potential risk of that remains under-studied and relatively unknown.

David Braun: We are not looking at these chemicals and considering that if mixed together, they can be toxic. There is not an analysis of that?

William Stringfellow: I think there is some analysis of that.

David Braun: How thorough would you say that is?

William Stringfellow: As thorough as you can be with the current level of scientific knowledge. I am not sure what your question is but we have a list of chemicals.

David Braun: My question is if this is safe for human consumption. I have a big concern about this.

William Stringfellow: I understand that and that is why this Panel exists.

David Braun: I get that and that is why I want to ask the right questions. There is not a whole lot of the general public here today, but I am sure that the general public would want to know these sorts of things.

William Stringfellow: I think they are good questions, but getting into the details is a little complicated in a public forum. I will be glad to sit down with you and go over stuff that has already been done by the Panel. Going back to the chemical list. We have a list of chemicals, but we would prefer to know exactly how much is used every day. Due to rules regarding intellectual property, we do not have access to that information. In that case we assume the worst case. I can assure the public that is the approach we are taking.

David Braun: If we can have the same sort of disclosures in Los Angeles for the Air Resources Board, I do not see why we cannot have these sorts of disclosures for water that is going on crops that children are eating. I would strongly suggest that if this Panel wishes to come out with a transparent outcome for whether this practice is safe, we need to know what those quantities are.

Clay Rodgers: My first comment is that if I had the absolute quantities, I would not be able to disclose it to the public, members of the Panel, or Dr. Stringfellow. That would

have to be held as a confidential business secret under California law for a trade secret formulation. I worked diligently with the chemical manufacturing companies and their attorneys, to develop a form that we could get all chemicals that are being used. This way we could publicly report that information and be transparent. I did not want to be in situation where I had to state that I know everything in the products but I cannot share it with you. If I had the masses, I would not be able to share that with our experts that are not employed by the State of California. I could not legally do that and I would be subject to penalties if we released that to the public.

David Braun: Do you know how the Air Resources Board in Los Angeles does it?

Clay Rodgers: I do not know how the Air Resources Board in Los Angeles got that.

David Braun: Maybe this could be something this Panel could look into. If they are able to get this information, they would know for instance that an average of seven million pounds of hydrochloric acid is being used annually during operations in Los Angeles, or on average three million pounds of hydrochloric, or hydrofluoric acid, is being used. Now we have those sorts of numbers. I do not understand why we cannot get that sort of information.

Clay Rodgers: We could probably make rough estimates. From a water quality standpoint, the acids are not going to be our primary concern.

David Braun: For ethyl-benzene approximately 40,000 pounds on average is being used in Los Angeles. That is something we want to know how much is being used if it is going on our food. Especially if there is not any filtration or reverse osmosis.

Clay Rodgers: Understand reverse osmosis is to remove certain types of constituents, it does not remove all constituents. Organic compounds probably would not be significantly affected by reverse osmosis. We would need other treatment methods if you we were going to treat produced water for organic compounds. I want to make that clear. Based upon the water quality, this water does not need reverse osmosis because the salinity is very good. It is low already, better than a lot of irrigation water supplies that are currently being used from other sources. We have the water tested. We do not do continuous sampling, but we have periodic sampling. We think the frequency of the sampling with the overall scope of the analyses is providing a good picture of what is in the water. We think the water is a good guide. We have also tested the fruit for all of these constituents to see if anything is showing up in the fruit.

David Braun: What about the chemical combinations, part of what we were talking about previously?

Clay Rodgers: Bernard is going to be talking about that in a little while because that is the toxicological issues that Water Board staff does not have the expertise in. Also, one of the things we have asked them to look at is degradation products. If something were to happen to a compound in this form it may not be very toxic, but could it be toxic in a

different form. We are asking those questions. We have a draft report out on the toxicological issues that is up on the Water Board's webpage. It is a little bit technical, but staff would be happy to answer any questions.

David Braun: I look forward to that, but I think that generally the public is going to have a hard time accepting that this is safe without us actually knowing the exact chemical constituents and the quantities. This is a disclosure issue and if this is something that we are putting into our bodies, we really need to know these things.

Karl Longley: I think you need to refer to the testimony provided by Dr. Gary Banuelos, probably one of the top plant physiologists in the country. Dr. Banuelos pointed out that our concern should not be organics but really the inorganics, because the plants typically will not take up the organics. In fact, they are very rigorously consumed by the microorganisms you find in the soil. We have seen the fact that in our control samples, we will have inorganic uptake when it is there. That is not to say that we should not be looking for organics and their prevalence in the fruit. But there are other issues. One of those issues is if a grove happens to be near a highway you are going to get exhaust fumes off of that highway in the fruit. This is one of the contaminants we have to be careful of, since fruit contamination is a very complex issue. I am confident that using people like Dr. Banuelos and a panel that is highly qualified that we are looking at everything that we can look at with the available science.

David Braun: I think part of that available science will be informed by the exact chemical disclosures and I would be very interested in making sure that we can do that. If it can be done by the Air Resources Board in Los Angeles, I do not see why we cannot have that on something that is going on our food.

Karl Longley: We have been informed by our attorneys we cannot and we will check that .

David Braun: I hope to continue this discussion and I am looking forward to finding out more.

Clay Rodgers: Would let us know who you are?

David Braun: I am David Braun and have been tracking this a little bit. I am a concerned citizen and wanted to make sure we are not getting cancer from our mandarins and things like that.

Clay Rodgers: I have the same concern and that is the reason we put the Panel together. Thank you for your comments.

Andrew Gordus: Chevron has an extensive water treatment facility before it goes out to the irrigation districts. Do the smaller operators also have something similar to treat the water before it is released for irrigation water?

Clay Rodgers: It is not as rigorous as what Chevron goes through since most of the treatment is primarily to separate the oil from the water. The treatment is more for organics than inorganics. The treatment for the inorganics has not been needed based upon the quality of the water. Boron does not exceed water quality objectives and salinity in many instances is actually pretty good.

Andrew Gordus: So there is some treatment?

Clay Rodgers: They all go through oil-water separation processes. Some are just a little more sophisticated than others.

Andrew Gordus: Before the water reaches these irrigation districts, the water is analyzed for all of these constituents.

Clay Rodgers: Yes it is. There are also limits for oil and grease, which are basically the petroleum hydrocarbons. Then we have the testing for the other compounds. Part of the work and the White Paper will be looking at other compounds that we need to be testing for and what is the recommendation from the Panel as we move forward.

Bill Allayaud: I am Bill Allayaud with the Environmental Working Group. Since we are in a general discussion, I thought I would weigh in and answer some of Mr. Braun's questions and raise others. I believe it was the presence of Environmental Working Group and Clean Water Action that was the catalyst for the Panel. I think of everything that has happened now in almost three years. A lot of money is being spent on water quality monitoring and food testing and we think that is a good thing. We appreciate the dollars spent by the public and the private sector to do this, but it was a question that needed to be answered and hopefully we will get to the end and say it has been safe all along.

A couple of things to note, the water treatment is not comprehensive or extensive. It is basically running produced water through walnut-shell filters. They do the oil separation at the beginning to get their product, that is what is valuable. Then it goes through the walnut-shell filter, which I would call a crude method of water filtering. Then goes downstream to a polishing pond, which is basically skimming off excess oil. So clearly the treatment is not comprehensive and ends up on the valley floor. I have not been there, but I have seen videos and read it smells like oil and you can see an oil sheen; hence the polishing pond. So say you remove nearly 95% of the hydrocarbons before it goes into the canal for irrigation. What you cannot see or smell are the chemicals used on the site, either brought up naturally like boron elements or added in the drilling or manufacturing / separation process. So it is the unseen stuff, in addition to hydrocarbons, that was thought, could this get into food? I thought this is what the Panel was engaged in to find out. The early answers were that we have tested some fruit and it looks good, but there are very few maximum contaminant levels (MCLs) for most of the stuff coming downstream. You could say we are meeting the state MCLs on X, Y, and Z, but you are not testing for 50 other things that are in the waste stream. So that is why we are concerned.

Lastly on the testimony of Dr. Banuelos. He was the first person that actually appeared before the Panel and the Water Board staff who knows about plant uptake for these constituents. He is an expert and could have ended up on the Panel, but it was great to have him here. One thing I remember him saying is that "I would not grow root crops or tuber crops in that soil." He said woody plants, like almonds, were probably safe. In his research, he is looking at the uptake of various elements by woody plants and he thinks that is a low risk. Some take up certain constituents better, but his work looks at the use of plants to remove certain elements from soil to make it more farmable. The first thing that should have been tested is the soil. Is there build up in the soil? We can have this data and maybe say there is a lot of buildup for constituents. We may not assume boron since we know that can kill an almond tree, as demonstrated at Starr Farms on the westside of the valley. The question is still can these constituents get into a carrot and I do not know why we did not go after soil testing and root crops first. I think that answered some of David's questions and we are getting to those answers. It has been frustratingly slow because other projects keep getting approved. They are using crude treatment and the latest stuff uses non-blended water, which is of more concern. We do not know for sure because of all the invisible things in that water. Hopefully we will get to the answer sooner than later regarding root crops, which Dr. Banuelos warned against doing. I think Mr. Rodgers is absolutely right that there will be more droughts and it is a critical water situation in the San Joaquin Valley. People will have demand for this water from the eastside which is a much higher quality than the westside. Thank you.

Clay Rodgers: I just wanted to add that we are looking to the Panel in the White Paper to make recommendations about future work. We have decided that all of the root crops that come out are going to be sampled. If they grow garlic, carrots, or any root crops, we are going to have them sampled. I will also add that Dr. Longley and I first met with Dr. Banuelos a while ago when the Panel was being put together and I asked Dr. Banuelos to be on the Panel. Unfortunately, his schedule is busy and he was not able to be on the Panel. We were fortunate that he was able to come and make a presentation. There are very few people with the expertise that Dr. Banuelos has and I think he did a great job of helping to inform us on the issues.

Mike Garabedian: I am Mike Garabedian with Friends of the North Fork American River. What is the continuing involvement of plant physiology in the work of the group?

William Stringfellow: I can answer that it is partially included in the Task 2 literature review. The plan is to look at those subjects systematically. It has been part of the conversation and part of the investigation from day one. I think to get it in a formal and structured form is part of what is involved with the literature review

Mike Garabedian: Is their continuing involvement in the work here? What about bioaccumulation? How is your sampling dealing with that? Some crops are heavy accumulators and need to be considered. There is the literature review, but I am just curious about what this will carry.

William Stringfellow: I would say that is part of the continuing evaluation.

Mike Garabedian: Who does that?

William Stringfellow: I think we do it as a Panel and we do it as part of the sampling program related to that.

Mike Garabedian: So there is plant physiology.

Bruce Macler: A couple of us on the Panel have backgrounds in plant physiology. Plant physiology has always been a consideration and will remain one. You have to start by finding out what is in the water and whether the amounts are going to be significant. The presentation that we had a couple meetings ago was really good in terms of laying out where some of the concerns are in terms of movement through the plant into what we eat. We are well aware the roots accumulate differently than the fruit or the leaves. That will all be considered as we move further down the line and as we have more information.

Mike Garabedian: Thank you.

Justin Bass (via email): Is good clean drinking water, also known as fresh water, used for well stimulation or oil drilling in the Central Valley? If so how much fresh water is used for well stimulation or oil drilling annually? Do you have numbers for 2017 and 2018? I have asked the Water Board, Division of Oil, Gas, and Geothermal Resources (DOGGR), oil companies and oil company affiliates. Nobody seems to know. Is anybody accounting for the good clean drinking water used down the oil drilling hole?

Clay Rodgers: That is outside the purview of the Water Boards, so I cannot answer that question. You may be able to get that from the DOGGR, but I am willing to talk to you about this issue if you want to give me a call next week when I am back in the office. Although this is outside the purview of the Food Safety issues. That is more of a water use issue.

Seth Shonkoff: I was going to say that is certainly beyond the purview of this Panel. The best place I would recommend is going to Senate Bill 4, independent scientific study conducted by CCST, in the water section.

Bill Allayaud: Senate Bill 4 mandated that all fracking wells be logged on DOGGRs website, including the water and chemicals used. That is the first time California has been tracking that. The bill passed in 2013, so they should have about two to three years of data. In other parts of the country, they use much greater volumes of fresh water than California due to the geology.

Brian Pellens: I am Brian Pellens with California Resources Corporation (CRC). I would just add that SB 1281 requires extensive accounting for water, both fresh and non-fresh. That is all reported to DOGGR on a quarterly basis.

Clay Rodgers: Do you know if that is available through the web page?

[Brian's response is not audible] Based on Brian's response, they believe you can get that information remotely from DOGGRs web page.

Laura Haider (via email): Please prohibit the use of endocrine disrupting and carcinogenic chemicals like methylene chloride in oil drilling in Kern County.

Clay Rodgers: Comment noted.

No other questions or comments.

Presentation – MOU Task Updates

Bernard Beckerman, Senior Scientist, GSI Environmental Inc.

[Presentation](#) (A copy of the presentation is available on the Food Safety web page)

Bernard Beckerman: This presentation is an updated on the three tasks under the MOU. Task 1 is the selection of "Chemicals of Interest", from a list of known chemical additives and naturally occurring chemicals in produced water for further evaluation. Task 2 is a literature review focusing on the "Chemicals of Interest" in the context of produced water, reuse in agriculture irrigation and other potential sources of these chemicals in the agricultural water supply. And lastly, task 3 is the sampling and chemical analysis of crops irrigated with produced water in the Central Valley

This part is a brief overview of the work completed under task 1. GSI started with 385 chemicals that needed to be evaluated. Of the 385, 90 were naturally occurring and 312 were unique chemicals from additives. There is some overlap between the chemicals, which is why when added together it is over 385.

Bernard provided a quick breakdown of the 385 chemicals into the following categories and explained each:

385 Chemicals to Evaluate

- 70 GRAS (general recognized as safe) or non-toxic chemicals. These are either generally inert or break down into inert chemicals when in water;
- 62 that did not have sufficient information regarding toxicity and required further research;
- 64 were identified as not having any chronic toxicity;
- 11 had incomplete information to assess their toxicity;
- 173 had toxicity data but had to rank into source of toxicity data;
 - a. 122 were based on published toxicity values; and
 - b. 51 had toxicity values derived by GSI; and
- 5 radionuclides.

To summarize where we are currently, we submitted a draft report to the Water Board and the Panel. We received comments from the Panel and are working on addressing their concerns. It should be noted that the report does not cover the full work that was proposed in the scope of work. The full scope of work that was proposed to incorporate fate and transport and plant uptake into the selection of chemicals. Through discussion with the Water Board and the Science Advisor, GSI had some misgivings about setting specific criteria for these fate and transport parameters. Since there was some uncertainty on how these would translate into real-world processes, we are looking for advice from the Panel on how to proceed. What does the Panel think would be the most helpful? Initially, we want to address those as large groups of chemicals in the larger review, such as surfactants and sorban polymers. If the Panel has some specific ideas about what would be most helpful for them, we would really appreciate any input.

Stopped presentation for questions:

Mark Jones: When I read the scope of work for Task 1, the idea was to come up with a list of Chemicals of Interest that would then feed into the literature review for Task 2. It seems like that is not happening. Beyond plant uptake are fate and transport issues, in general, that are factored into concentrations used in coming up with the list of Chemicals of Interest. We may not be able to get the exact values, but we should be able to get a sense on some of them. When I look at your Table 7 (list of toxicity criteria), which by itself is misleading, people could interpret the wrong thing.

Bernard Beckerman: How so?

Mark Jones: That is simply a list of toxicity, but that does not get into what might actually be in the crops. This is what we are ultimately looking at. So, that is only part of the picture and I think that needs to be made clear.

Bernard Beckerman: We tried to talk about that at the beginning. This is about a hazard identification, which is different than a risk assessment. These are chemicals that have the potential to create hazard or create risk. We do not know enough about them at this stage here to make that assessment. We have Task 2, which is going to review this in more detail. Then we have Task 3, sampling crops for what we know. Then we are going to be able to identify what we can measure.

Mark Jones: Are you intending to come up with a list of Chemicals of Interest?

Bernard Beckerman: We are going to defer to the Panel. Should we try and attempt to incorporate things like fate and transport into the list? We whittle this list down with the caveat that there is the potential that fate and transport may remove chemicals that some may see as a concern. We can do that. But, we see that as one of the hurdles that need to be addressed before we can move forward in creating this well-defined list of Chemicals of Interest.

Mark Jones: Then what do you intend to do with what you have here as Table 7?

Bernard Beckerman: This meeting will help address that issue. Right now we are in the position where we are starting at the top of the list and moving down. We will be looking at some top number of these chemicals unless we make some decisions otherwise about how to screen them out.

Mark Jones: Will you be looking at water quality data?

Bernard Beckerman: Yes.

Mark Jones: When I look at Table 7, most of this looks like they are naturally occurring and we have water quality data for. So, that is information that could be incorporated right away.

Bernard Beckerman: Yes.

William Stringfellow: That is exactly the kind of feedback that we need. Part of why we did not keep diving into using fate criteria to eliminate compounds, versus using a conservative approach, is there are criteria that I think can be used, such as biodegradation testing, that would eliminate a lot of the compounds of the list. I think there needs to be agreement among the Panel that those are appropriate criteria.

Mark Jones: I think that information, as much as possible, definitely should be included.

William Stringfellow: If we can agree that there are criteria that fits the compounds on the list, we have good quality measurements for that compound, and it has not been found in this monitoring, then it is okay to put that on the resolved list. Then we do not need to write an extensive fate and effects report on that particular compound. We cannot write a 4 or 20 volume thesis on each of these compounds.

Mark Jones: Which is why we are trying to get it narrowed down with this list of Chemicals of Interest.

William Stringfellow: I think they have done that to a certain point and now we have to take the next step.

Mark Jones: I do not see that though. I see a list of toxicity hierarchy here. I do not see anything that narrows anything down.

Robert Scofield: In the report, we went through the initial task and we realized that the state of science regarding plant uptake and soil absorption was not something that we can say, "we only need to worry about these 15 chemicals. These are the only ones that have the opportunity to get into the plants". There just is not enough information about the fate and transport. So what we did is look at the most toxic. The reason for toxic priority was to make sure we do not miss anything that has high toxicity. Now we are going to look at biodegradation and absorption to soil and put them into categories to see what is most important. In addition, we have some plant, crop, and water quality data to help with this process.

Mark Jones: When I read the scope of work, one of the factors is that it may be at higher detectable levels in irrigation water.

Robert Scofield: That will be incorporated and will probably be the most important determiner now as we take this list and narrow it down into the higher priority chemicals.

Mark Jones: I would suggest incorporating the water quality data but focus on chemicals that you might want to get concentration data for. In some sense, get some concentrations for some of these unknown chemicals. Not so much naturally occurring but some of the additives.

Robert Scofield: It would be valuable if we could go back and say this is a chemical that is very high on the toxicity list, "do you use four ounces of it a year or four tons"? We are planning now to rank the toxicity chemicals and focus on those that are the highest toxicity. We realize other factors will need to be considered too.

Mark Jones: That is one of the things I asked for, what is the next step? This report basically ends at Table 7.

Robert Scofield: We will clarify that and make it a stronger focus in the next draft.

Seth Shonkoff: In reviewing one of the tables, you list how you sort of knock certain chemicals off as probably not concerned. One of these chemicals is GRAS. In my review of the GRAS chemicals that were selected, I did not see anything that seemed to jump out at me as particularly concerning. What we are doing is setting up a structure for how to evaluate chemical constituents on an ongoing basis into the future. I think we should be careful about relying too heavily on GRAS, considering that most of those compounds have not gone through a systematic review in terms of their toxicity and there are rarely updates. Again, I do not see a problem with what you have assigned as GRAS and knocked off the list in this report right now. But, if we are setting up a systematic and objective process into the future, I think we should think through the use of GRAS and under what conditions.

Bernard Beckerman: I mean this as more of an operational question: would you be comfortable instead of using GRAS we identified them as food additives or known food supplements? Would this be a more reasonable way to screen out those particular chemicals from the list?

Seth Shonkoff: This is a little bit hard for me to answer in absolute terms what the process should be on top of GRAS, which is a fine first cut. But in general, these are dynamic systems. These 385 compounds are likely not going to be the compounds that we would see in ten years from now. I am sure some will be the same, but there will be some different ones too. There will be an ongoing assessment of this based on the disclosure in the WDRs.

Regarding the degradation product issue for fate & transport, people can have a variety of ways of thinking about this. In my opinion, we should take a little bit of a cue from the municipal wastewater reuse world. I think it would be useful to incorporate some sort of non-targeted testing of produced water, which may come from split sampling. I know this might go beyond the scope that is currently laid out for GSI, but I am not quite sure how else we would figure this out. With that being said, I am entering into the record that it would be useful to do some non-targeted testing to see what is in the water. I am less concerned about doing non-targeted testing of fruit because the science is even more complicated than compared to water. If there is no problem in the water, then I would not expect there to be a problem in the fruit.

Bruce Macler: Seth if we were to do that what would be your criteria for saying this is not a problem? This has bedeviled folks for decades, if not longer. It could be posed that there is a mixture and a mixture can be a problem when things degrade, but we do not see that epidemiologically. You can put it out there, but how are you going to make a decision? What would you say is okay and not okay based on?

Seth Shonkoff: I would not go so far as to say I am ready to answer that question. I think it should be considered. I think it is considered across multiple analogous sectors and I do not see why it should be off the table with an emerging water source. There was just a large report put out in the municipal wastewater reuse space that recommends this for chemicals of emerging concern and things that we cannot find going chemical by chemical. I do not see the point of not thinking through how that might look.

David Mazzer: On the third item that is addressing chemicals without toxicity data. I am sure you have done this before, but what is your general process in figuring out what to do? How do you identify those chemicals and what are some of the things you think about when you group them?

Bernard Beckerman: Those chemicals were identified after going through whatever kind of search we could to identify the chemical, literature, or knowledge about the toxicity. For chemicals with no information, when we want to group them, we look at what these are used for. A lot of these chemicals are complex polymers and not monomers, these are normally not chemicals that people address. For some of the chemicals we do read across studies, where we identify similar chemicals that have similar functional groups. These we use as a surrogate to develop some sort of understanding of toxicity. In this case, we are dealing with complex molecules and we are not sure how the shape and the available functional groups could potentially interact inside the human body, or if they will even interact or be absorbed by the human body. In some cases, because the polymers are so large, they are likely just to pass through. This does not mean that they cannot potentially interact with tissues through the human body though. We can go through the process in general but that does not necessarily allow us to categorize them in a quantitative way. Since we do not fully understand the structure of the polymer, that can ultimately change its toxicologically properties.

David Mazzer: Thank you. I wanted you to walk through what your thinking was and then talk about surrogates. In your experience when you start sorting chemicals that do not have a lot of data, is the assumption for those that you default into a very conservative assumption? Or do we pull them into a parking lot of wait to see? What has been experienced with that group of chemicals? What would you generally do with unknown chemicals?

Bernard Beckerman: For these kinds of chemicals that is a little bit outside of my experience. These are truly unique chemicals that are really not encountered normally.

Robert Scofield: I think the question is going to be a key in of this study. Part of what we are commissioned to do is to look at what the data gaps are. These will be a big group of chemicals like these polymers and really, we do not know the toxicity. Part of the reasons they have not been tested is that category of chemicals is generally not considered to be very toxic. We will try and parse those out to say, "these are probably not toxic." For others we might say, "those are showing up frequently, but we do not know the toxicity of it." That is part of what we are looking for is uncertainties and data gaps. Then we will try to put some priority to them. I think you know as we get further into all of this literature, we are finding that there is going to be a lot of questions about this. What will help us is that we are looking at pretty low concentrations. There will be some overall findings, but the gaps will be a part of that as well.

David Mazzer: Thank you for your patience with my questions. I really wanted the Panel and the public to hear a little bit more detail about what you had touched on in your draft report and how we get to that group of chemicals without data.

William Stringfellow: I have a question for the Panel. What do you think about the idea that polymers are not a priority problem? There are guidelines from the Environmental Protection Agency (EPA) that, in general, put polymers on a pretty low priority list. Does the Panel have a particular opinion or want to form one about this? This would be really helpful.

Mark Jones: There are going to be unknowns and that is probably what the outcome is going to be. To provide that kind of information might be a little bit better information to have. We said they are probably occurring in low concentrations, but we do not know that. The more information we can get on that the better.

Robert Scofield: It is hard to know what they are being used for and I do not know where or how, in the process, they are being used.

David Mazzer: There are two divergent paths that I think are important. There is the stuff that is really interesting to know, but from a regulatory standpoint I cannot act on things that I do not know anything about. They can be identified as unknowns and things that we can look for in the future, but we cannot take regulatory action on unknowns. From my department's perspective we would not be able to do anything with chemicals that do not have data, surrogate, or something tangible that shows that there

is a potential risk or public health impact. From my perspective, that is our limitation and that is where we have to draw a line. This is not to say that we would not look at these in the future. To some degree we would work with our folks at the Water Board and other places to monitor these things and test for them. We cannot take regulatory action against things we do not know much about. I know that might not give comfort to people who are worried about these things, but that is our limitation. The question about polymers is: if we do not know much about them and we do not have any definitive information that groups them into some kind of category that has toxicological data or some risk associated with it, we would not be able to do anything about that.

William Stringfellow: You would not be able to do it either way: to say these are not a problem or they are a problem?

David Mazzer: We need some type of standard or reference to take action on that.

Stephen Beam: I just wanted to echo those remarks since the California Department of Food Agriculture (CDFA) would be in the same situation. We have to identify something that clearly could affect public health before we could take any kind of action. I think it is important to note again that there are going to be things that are put in a parking lot and we will have to say that we just do not know. We are going to have to make decisions and recommendations on what we do know. Part of the work is to identify data gaps. I do not think we should expect anything else out of this process. With respect to large groups of chemicals where we do not have any toxicity data or evidence that they are indeed a public health risk, they should not be called out as being a concern. This could be used as an area to inform the public, but we also do not want to unnecessarily alarm the public for no reason. Not knowing does not mean danger.

Mark Jones: Some of us did provide comments.

Bernard Beckerman: We are working on the comments since some required substantive addressing. If there were really easy ways to address some concerns or comments, I made those changes. The substantive comments that need additional addressing are still being worked on.

Mark Jones: It would be nice to get a response to what the comments were to see what you did and what the comments are.

Bernard Beckerman: Sure.

Presentation Continues

Bernard Beckerman: This section focuses on the literature review for Task 2. The following are components of the literature review explained during the presentation:

- Review of produced water used in agriculture,
- Other sources of chemicals including agricultural and natural sources,

- Ambient levels,
- Known levels in foodstuff,
- Chronic oral toxicity:
 - Those that require further evaluation (62 chemicals), and
 - Those with incomplete information (11 chemicals),
- Fate and transport,
- Plant uptake, and
- Identification of knowledge gaps.

Currently working with Water Board to finalize methods of literature review, specifically inclusion/exclusion criteria. We have been looking at the criteria and noticed that some do not impact it that much. Factors that are being considered are the following:

- Date:
 - For literature focused specifically on produced water, we are proposing literature review published from 2000 to current. This will represent current technologies used in the industry and also represents about 90% of the literature published on produced water for irrigation. If the Panel thinks we should look at all published data, we can do that. But I am not sure this will add substantively towards our understanding.
 - For other literature, we are not proposing to set restrictions given the limited availability for some chemicals.
 - Goal to focus on most up-to-date data.
- Method of oil and gas extraction:
 - Looking specifically at on-shore or conventional sources of oil and gas.
- Location:
 - The location will focus primarily in North America, but if there is limited availability we may expand this search. Using this will be helpful for the technologies that are used here and the type of production too.
- Language:
 - English.
- Types of Publications (in hierarchical order):
 - Peer reviewed literature,
 - Government publications,
 - Scientific letters, and
 - Industry reports.

For a quick update on Task 3. The slide shows crop samples that have been completed and are summarized below:

- Almonds sampled in 2017 and 2018;
- Apples sampled in 2018;
- Carrots sampled in 2016 and 2018;
- Citrus sampled in 2016, 2017, 2018, and 2019;
- Garlic sampled in 2017 and 2018;

- Grapes sampled in 2017 and 2018;
- Pistachios sampled in 2017 and 2018;
- Potatoes sampled in 2016 and 2018;
- Tomatoes sampled in 2018; and
- Cherries sampled in 2019 (sample results are not available at this time).

An update on the progress for crops and samples results is summarized below:

- Currently working on a draft report for 2018 and 2019 sample results;
- Initial review of the results appear to suggest no significant difference between crops irrigated with produced and conventionally sourced waters. We have found things like strontium, barium, and copper, which were previously identified.
- Some issues with the laboratory providing reports in a timely manner has delayed GSI from reporting results to the Panel.
- GSI did a quality control review of the reports and was able to resolve the outstanding issues. The issues were:
 - Naphthalene contamination reported as false quantified value.
 - False positive for 2-chloroethyl vinyl ether.
- There has also been some holding time exceedances for some of the grapes in 2018 and some of the lemons and mandarins in 2019.
- Equipment issues that were unable be resolved prior to holding time exceedances:
 - Review suggested no major problems with the results.
 - No major difference between samples inside and outside of holding times.

This concludes the presentation.

Questions and Comments from the Panel:

Mark Jones: My question is regarding slide 6 of the presentation. Here it says you have 62 chemicals for further evaluation.

Bernard Beckerman: Those chemicals were identified on slide four which would require further evaluation. These were the polymers and surfactants that we do not have good toxicological information on and that we are looking at potentially reviewing during the literature review.

Mark Jones: So these are not part of the 122 and 51 group on slide 4?

Bernard Beckerman: No.

Mark Jones: Again on slide 6. We have mentioned this previously, but using the existing water quality data to add to this.

Bernard Beckerman: Yeah.

Clay Rodgers: Regarding slide 7, you said the method of oil extraction that you were going to focus on was on-shore and conventional oil and gas activities. I think it would be prudent to perhaps expand that a little bit to unconventional methods, such as hydraulic fracturing. Just to look at it from a literature standpoint whether we should expect any differences. At this time, we do not have any unconventional water being recycled, but I envision a case in the future where somebody is going to come to us with water they want to treat from a hydraulically fractured field. I want us to think about that in the White Paper. What should the Water Board do? Is that going to be an issue? What should we do if that situation arises? I do not want to leave that question completely unanswered.

Seth Shonkoff: To do something like that in literature review, I am sure you can do that. But to do this systematically, I would imagine that you would need a whole other chemical disclosure process. You may already have some of those chemicals in the current list, but I would assume that you would have to make another list.

Clay Rodgers: One suggestion may be to see what the chemical differences are.

Bernard Beckerman: I would like to frame the discussion a little bit regarding the scope of work and then we can move things back and forth. There are two separate things going on in the literature review, one is the review of these chemicals and the other is the review of our understanding of produced water being used for agricultural irrigation. I do not see there being a problem in basically expanding the first section, which is our understanding of produced water and irrigation, and looking at all sources or methods of oil and gas production. I am not sure it will impact the second half, which is looking at the chemicals that we already know are on the list. As the list continues to be extended, these new chemicals can be slotted into the process that have been developed through the first two tasks. I do not see this being a huge issue.

Seth Shonkoff: I do not see it as a huge issue. I just think that when there are new fields with new processes and a different set of associated constituents, that seems like a new project.

Clay Rodgers: I do not disagree with you. There will likely be some ongoing work, because one of the questions I want answered in the White Paper is what happens if somebody uses a new chemical in the fields. Is there a process to evaluate this? I do not expect that it is always static. Do we somehow say that nobody can use anything new. That is a difficult standard for us to enforce, similar to CDFA. We have to have reasons for the actions that we take. I would like to set up a process that if they use compound x, which has not been used or reported before, it will automatically go into the water sampling. We get regular updates on the chemicals that are being used and one of the big questions is if anything new is being used.

The next question is regarding new compounds after the Panel has completed its work and the White Paper is done. I would like to set-up recommendations from the Panel that says what do we do now? Is there is a process that we should follow? Do we get

GSI to evaluate this and go through the process again? Do we reconvene the Panel? I am trying to look into the future so that after we are done we do not end up with the same question right in front of us again.

Seth Shonkoff: I am not a regulator and I may not be fully up to speed on chemical policies and regulations that you need to adhere to in your decision making. There are some examples of how to handle chemical use in oil and gas development when you are talking about sensitive receptors. One of them is from the North Sea Pact, which countries that develop gas in the North Sea have to adhere to a certain list of acceptable chemicals that are allowed for use. They cannot use other chemicals, and if they want to use another chemical they have to take it upon themselves to show that it meets a variety of characteristics: biodegradable, non-toxic, etc. This is specific to a marine ecosystem and may or may not be appropriate for the issue we are taking about. I do not know if that is out of the scope for an American regulatory division or not. That is actually a question I am very interested in.

Stephen Beam: I think it all depends upon the authority available to the department. The Water Board or the California Department of Public Health (CDPH) has certain things that we can and cannot require and it all comes down to what the legislature grants us. If legislation allowed something like this, you can envision a model where you might have a list that you say is acceptable. Then you would have a framework that would not put the burden necessarily upon the regulatory agency to determine if it is safe, but on the user. It is very similar to say a drug approval model, where the Food and Drug Administration (FDA) has criteria for which they are going to evaluate a drug. They are not going to do all the studies for you; they say come to us with your data and we will review it. So, a similar model could be put into place, but it would have to be appropriate for the type of process that we are discussing. I am not saying that drugs and this are equivalent in terms of risk, but there are ways of approaching it. It would require a legislative change to get there eventually.

Clay Rodgers: That really would come down to a legal question. We have specific regulatory areas and authorities and some of the issues we are talking about are getting pretty close to those limits. We do not advocate for legislative activity, but things like that may be appropriate to be handled by a different branch of the government.

William Stringfellow: Going to Task 2, does anyone on the Panel have a specific opinion on the applicability of using biodegradation tests as a way to eliminate chemicals as priorities? There are standardized testing for biodegradation. They are typically in aqueous solutions and you observe the degradation of the parent compound. Then based on various criteria determines if it is readably biodegradable. I have experience in this area of biodegradation and environmental fate of these chemicals and I think it is a good criteria to assign for lowering the priority for chemicals that are biodegradable versus chemicals that are not. If the Panel can give a definitive decision regarding the use of these types of criteria that can help dwindle down the list, which is one of the major objectives of Task 1. Regarding the list and decision points, we need to make sure everybody is on board as much as possible. Seth mentioned some questions

about GRAS. If I put in another line and was able to show that these are easily biodegradable based on the Organization for Economic Co-operation (OECD) Die-Away Test and US EPA tests, would that be acceptable for lowering the priority of that chemical based on biodegradability?

David Mazzer: How much work for that and how would you describe the workload on that?

William Stringfellow: The workload is low because we already have done a lot with this list of chemicals. This would be searching through databases to find toxicological data for these constituents that was already done. For these standardized degradation tests, data has already been collected. I believe this is more a matter of saying, "this is an acceptable criteria".

David Mazzer: I am speaking for myself, not the rest of the Panel. I believe that kind of information would be useful, as long as it is not a massive workload that requires a bunch of research and another contract.

William Stringfellow: If I said that one chemical is more biodegradable and, therefore, is less of a problem in irrigation water than another one.

David Mazzer: I would find that useful.

Mark Jones: I thought that was one of the criteria that was identified. I agree it is useful.

Seth Shonkoff: You asked for a thumbs up or down, so I will give you 5/6 of a thumbs up. I am a co-author of papers that have basically dwindled away compounds using biodegradation criteria. In general, I think it is informative. The only reason I am giving it a 90% is because there are some papers on produced water quality that have looked at the degradation of glutaraldehyde, for example. Glutaraldehyde is a very popular compound in oil and gas production and it breaks down readily into daughter products, some of which are more toxic than glutaraldehyde and some that do not have toxicity information. I do not know how to eliminate that problem. I think we should do the biodegradation screen, but I think that we need to keep our eyes open for things like glutaraldehyde.

William Stringfellow: Part of what is going on between Tasks 1 and 2 resulted in internal debates about where the cut-offs are and how do we handle this. My opinion is to move this thing forward, keeping in mind what Seth said, and asking if this is enough of a criteria or not? We moved it forward with toxicity data and this is an advancement because there is chronic data. We need to continue moving this forward and get the Task 1 list done. I would like to dwindle this down quite a bit more, but we need to have this discussion publicly. We need to make sure everyone is on the same page.

Robert Scofield: We mention this in the report that there are factors in the process of the water moving from: (1) produced water, (2) to irrigation water, (3) to blended water,

and (4) then irrigation. We know biodegradation, hydrolysis, absorption in the soil, and plant uptake are important. The issue is that we really do not have firm biodegradation factors to say anything less than X is out. My sense is when we look at what is in the water, we can work back to rationalize. We can state that this may not be in the water because it probably degraded, absorbed to the soil, or did not get taken up in the crops. We will not know if something soluble is taken up in the plant, why did it not end up in the edible portion. I doubt that we will have literature for that, but we will identify all those issues. We do not think we will have an algorithm or precise cut-off of each of the chemical properties that will let us rationalize if it is in the plant or not. All those factors will be taken into account and I do not know how they will shake out, but they are all important.

William Stringfellow: Stay tuned for Task 2 on incorporating those factors. Lets get this list going and then we will proceed.

No other comments by the Panel.

Questions and Comments from the Public:

Laura Haider (Via Email): If someone only eats food from a few poor traditional farmers, who do not add phosphorus and selenium etc. to their soil to reduce toxic metals, would they be exposed to more toxic metals? Also, we need to educate farmers. Did you read the study linking strontium to autism, and how significant are the results? The study is Aurora et al. Fetal and Postnatal Metal Dis-Regulation in Autism in Nature Communications, Volume 8.

Barium was measured at up to 160 times the drinking water standard in 78% of fracking wastewater from Kern County. Ingesting high levels of barium over an extended period may increase blood pressure (EPA's 2015 article).

Justin Bass (via email): This question is for the employee who works for California Resources Corporation (CRC). Approximately how much fresh water does CRC use for well stimulation or oil drilling annually? Please answer in gallons or barrels of fresh water. Thank you.

Clay Rodgers: The literature review will be conducted to look at issues like that, particularly for some of the metals that may be present in the oilfield wastewater. Nobody in the room seemed to indicate that, as of today, they are familiar with that. There was a comment about whether we are considering high barium that has been detected in hydraulically fractured wells? That is part of the reason why we are doing the water sampling, to know how much Barium ends up in the water. Also, part of that is to identify the difference between wells that have been unconventionally drilled (e.g., hydraulically fractured) versus conventional wells, which is where the recycled water originates from. Just to clarify for areas sending recycled produced water, we are not aware of any hydraulic fracturing activities that have occurred in those fields. The

geological environment is not suitable for hydraulic fracturing to occur. We do not see that as something that is probably going to happen.

Brian Pellens (CRC): I am responding to the email from Justin Bass. CRC is a net freshwater producer and I would be happy to get the information to the individual directly if I could get the contact information.

Brian Pellens provided his contact information to Water Board staff, which was subsequently emailed to Justin Bass.

Mike Garabedian: Are you looking into the following issues in terms of agricultural production: product quality, seed quality, tree health, vine health, soil structure, soil productivity, long and intermediate term interaction with agricultural chemicals, tilling, odors, and runoff? My biochemistry and plant physiology courses were in 1967. Recently I had some cause to look at some issues, which I found this whole field has emerged with regard to plant biochemistry and that there are many issues including polymers. Seems like a lot of topics that you are talking about right now need that kind of information and knowledge.

David Braun: My question is to the CDPH about polymers and chemical constituents that we are not able to identify the deleterious effects on the body. How are we able to identify whether these chemicals are bad for us or not? Are there EPA standards? As new chemicals come out, do we have faith that they are safe. There seems to be a pattern from the last three years of chemicals being used that are found to be toxic and unacceptable for use in agriculture that are now being used. We have also seen health impacts associated with these. How confident can we be in the existing standards that as new chemicals are identified that we are actually getting accurate information?

David Mazzer: The CDPH oversees all the food manufacturers in the State. We work with CDFA closely, as partners, since they do most of the agricultural work and oversight. You ask some big questions that are not easy to answer. There are a lot of unknowns in that whole area of unknown chemicals and emerging chemicals. So I am going to try and parse this data out into something that hopefully makes sense to you and me. There are chemicals that we know about and those primarily have standards that have been set by some agency. These agencies can be a federal agency or another state agency like the Department of Pesticide Regulation or OEHHA. Our other partners usually set some type of standard that we will then use as the level that cannot be exceeded in commodities that we regulate. Many of the agencies serve this function where they are out there doing some kind of survey of those commodities they oversee. They test and compare those against known standards. Confidence in this approach is pretty high. There is a lot of money and time that goes into generating those standards. There is a process for putting those standards through peer review and public comment. Then the standards get promulgated and are used by regulatory agencies resulting in a fairly high confidence.

Now remember that those standards change over time. There is usually a process in place for those agencies to review those standards. This may involve something like the following: new information emerges, gather the information, do additional testing, re-review the standards, and evaluate whether to change the standard. That is a pretty standard process that has gone on for a long time and the confidence is fairly high. I think the issue is the unknown chemicals and standards that we are dealing with and what that means in terms of public health. Our department has statutory language that allows us to react when there is an emerging issue that we deem deleterious to public health. We can do something about that through promulgating a regulatory process, which can set a new standard. That requires that we have data that has been substantiated and has gone through some kind of peer review process. That allows us to mitigate the risks to public health. You have heard the Panel talking about emerging chemicals of concern. Other agencies are looking at this problem in drinking water and air like you mentioned earlier. That is the challenge that we are dealing with is how the chemicals may or may not impact health. I cannot answer definitively how to do this effectively, we just have to work our way through these processes and panels to see what we come up with that makes sense.

David Braun: The chemicals could be deleterious and we do not know it because we have not been able to identify them. Is that possible? So, we will continue allowing the process without knowing.

David Mazzer: Or you could think of that from the reverse side, if we do not know what we do not know, then how do we know what to do?

David Braun: Would you keep ingesting it?

David Mazzer: I would ingest it because I would not know. I do not know how to answer that question because there is no risk to evaluate. An unknown is an unknown.

Bruce Macler: This is analogous to developing drinking water standards. When we look at drinking water, we start with a list of things we are worried about. These might be harmful or they might not. This is called the contaminant candidate list. Then you look at if something actually occurs in drinking water? Then we have to see whether we know anything about the toxicity. You need to have the occurrence and the toxicity before you go forward, because that is the nature of the statutory requirements for setting a drinking water standard. It is true for lots of other things as Dave already was mentioning.

So, if you do not know the toxicity you cannot really go forward. We have a lot of things still on that contaminant candidate list, but the workgroups that are assigned to try and set standards cannot go anywhere. What we are doing here is making that laundry list of things that we worry about that could be in the produced water and conceivably go from produced water to irrigation, to soil, to plant, to fruit, and to you. We take a look at that and then we will have to make a judgement what is likely to get to you. Then we are going to have to look at the toxicity at the same time, kind of in parallel. If we do not

know the toxicity, we are really not going to be able to do anything about that. It is not to say that it should not stay a worry, we just cannot do anything about it because we do not know. It will then be up to the Panel to make a determination as to what do we do about it when we do not know the toxicity. There are lots of things that we did not know the toxicity for that do not turn out to be toxic. Some of these polymers and things are probably not toxic. Even if they were toxic, they are probably not going to get into what we eat. I just wanted to bring that out if that helps clarify it a bit. There are going to be dilemmas that the Panel is going to have to face in terms of what we recommend.

David Braun: That helps, but I am having a hard-time understanding, for instance, these standards that you mentioned for the North Sea and chemicals that have to be approved or identified before they can actually be used. That is a sensitive ecosystem, but I do not know of a more sensitive ecosystem then where our food is being produced and it is deeply disconcerting that we are not approaching this with high standards like the North Sea. It is really disconcerting that we are not approaching this process with some sort of precautionary high standard when our food is concerned. Bill had mentioned something about soil samples, which I think would be good. I remember the 1970's when we were recycling our water. We had a red wood tub where we would take our water out from our washing machines. We were not using that on our garden because we knew it was not clean water. The use of water that is not tested frequently brings me to the question, is there random sampling currently of the water?

Clay Rodgers: No, it is periodic.

David Braun: Is that every day?

Clay Rodgers: It is quarterly.

David Braun: Quarterly?

Clay Rodgers: Four times a year.

David Braun: Who is taking those samples?

Barbara Petersen: That is as often as any drinking water is tested.

Clay Rodgers: That is done at numerous sample locations.

David Braun: Who is taking these samples?

Clay Rodgers: This is the standard process for the Water Board. Samples are collected and paid for by the Discharger. The Discharger submits the results to the Water Board under penalty of perjury that what they have done is accurate.

David Braun: No one has ever seen a corporation lie before under oath. Is there any independent testing going on?

Clay Rodgers: The Water Board has a small amount of money available to do independent sampling and take split samples as quality control. Unfortunately, I do not have the resources to be able to do that very often.

David Braun: I would hope we would be able to find the money somewhere to ensure that public health is being protected. I think there is a 16 billion dollar surplus within the State of California. Perhaps we could ask the Governor and Legislatures to assign a little bit more money to protect public health. It is deeply alarming that there is not independent water sampling. I have deep concerns that there is not random sampling going on and the sampling that is going on is being taken by Chevron, is that right?

Clay Rodgers: The Discharger takes the sample. For Chevron the Discharger is Cawelo Water District. They receive and distribute the water and they actually produce and certify the reports.

David Braun: Who sits on the board for Cawelo Water District?

Clay Rodgers: The general manager is sitting just behind you and I do not know who the board members are.

David Braun: I would imagine that Chevron would want everybody to feel good about the testing process as well. If the public is feeling good about it, Chevron would probably feel good about it too. There is no downside to having independent random testing of the water. This is not water we are putting on the side of the road to irrigate the brush, this is stuff we are putting into our bodies. We should know what is in the water when deciding whether this is a safe process. If CDPH is going to sign off on this we need more independent testing, rather than the testing that is being done by the Dischargers.

This concludes the comments.

General Public Comments

Bill Allayaud: Our concern about build up in the soil is not just that food grown in that soil could be more likely to uptake the elements, but that when you work the soil dust could become airborne and workers could be inhaling it. There are known problems with inhaling things that are in dust and farm workers that are out there on a frequent basis could be inhaling the airborne dust. That was another reason behind soil testing.

Justin Bass (via email): The first question is will there be labeling on food grown with oil field produced water? The second question is, will there be epidemiology studies of people who eat food grown with oil field produced water?

Clay Rodgers: If there was to be food labeling that is outside the purview of the Water Board, so I cannot answer that. Epidemiological studies on people is also outside the purview of the Water Board.

David Mazzer: On the first question, food labeling requires either regulation or statutory changes so there is not going to be anything at this point. I cannot say that it would not happen in the future, but at this time it is not going to come from this process.

In terms of epidemiology, the CDPH does have a group that does epidemiological studies on environmental health issues. That generally requires there to be an issue identified that they can then do research and studies on. So, there are resources at the state level and our department to do that. It requires a process and someone to identify an actual problem. It is possible, should one identify a problem that would need an investigation.

Bill Allayaud: The organic food growers in Kern County have watched this area closely because they are worried about being decertified as organic in case something shows up in their food. I do not think they are doing their own testing, but I know they are keenly aware of all the monitoring that's going on now and to me they are kind of the first line of defense, or the first line of people that would be raising their hand to this issue. It is a hugely growing business in this state and their profit and their reputation is based on not having contaminants. So, we should keep our eye on the organic growers.

Action Items

1. The Panel should submit comments on the meeting summary from the last public meeting by 17 May 2019.
2. GSI is working on comments submitted on the report for Task 1 by the Panel.
3. GSI will look into unconventional methods of well stimulation.
4. The Panel to consider how the Water Board would handle new chemicals used in the oil fields. This is for the Recommendations section of the White Paper.
5. Staff at the Water Board is going to start assembling parts of the White Paper. Staff plans to have a draft of this report to the Panel members before the first of the calendar year.

Closing

Clay Rodgers: All the agenda items have been covered and the Water Board appreciates the public and Panel for attending. This is an issue that is critical to the Water Board. We are not the agency responsible for Food Safety, but we do permit this practice. Our normal authority is associated with water quality, but we do want to work with our sister agencies because we are concerned that the food is safe and we want the public to feel the same.