Meeting Summary
FOOD SAFETY
EXPERT PANEL – PUBLIC MEETING
25 July 2018
10 a.m. to 3 p.m.

Attendees

Panel Member	**Title & Affiliation**
Dr. Gabriele Ludwig	Director of Sustainability, Environmental Affairs - Almond Board of California
Dr. Barbara Petersen	Principal Scientist, Chemical Regulation and Food Safety, Exponent
Dr. Bruce Macler	Toxicologist, U.S. Environmental Protection Agency (US EPA)
Dr. Andrew Gordus	Staff Toxicologist, California Department of Fish and Wildlife (CDFW)
Dr. Stephen Beam	Branch Chief, California Department of Food and Agriculture (CDFA)
Dr. Dave Mazzera	Department of Public Health, Food and Drug Branch
Dr. Ken Kloc	Office of Environmental Health Hazard Assessment
Mr. Mark Jones	US Army Corps of Engineers
Affiliated Parties	**Title & Affiliation**
Dr. Karl Longley	Chair of the Board, Central Valley Regional Water Quality Control Board (Regional Board)
Mr. Patrick Pulupa	Executive Officer, Regional Board
Mr. Clay Rodgers	Assistant Executive Officer, Regional Board
Mr. W. Dale Harvey	Supervising Engineer, Regional Board
Ms. Rebecca T. Asami	Engineering Geologist, Regional Board
Mr. Josh Mahoney	Water Resource Control Engineer Regional Board
Dr. William Stringfellow	Science/Technical Advisor, University of the Pacific, LBNL
Dr. Robert Scofield	Consultant, GSI Environmental
Dr. Bernard Beckerman	Consultant, GSI Environmental
Mr. Dave Ceppos	Consensus and Collaboration Program (CCP), College of Continuing Education (CCE), Sacramento State

Note: Panel members Dr. Dave Mazzera, Dr. Barbara Petersen and Dr. Ken Kloc participated via telephone.

Action Items

- The Food Safety Expert Panel (Panel) may submit comments to staff of the Central Valley Regional Water Quality Control Board (Central Valley Water Board or Regional Board) regarding the inclusion of five new analytes as part of the fruit sampling analysis.
- The Panel needs to submit feedback regarding the continued analysis of fruit.
- The Water Board needs to schedule a round-table, working meeting of the Food Safety Expert Panel (Panel).

Introductions and Agenda Review

Dave Ceppos, Facilitator, reviewed the meeting agenda and made introductions. He stated that this is a working meeting of the Panel that is open to the public. Comments and questions can be submitted by email and will be read at the end of each agenda item.

Materials List

The following items were posted on the Regional Board's Food Safety web page and hard copies were made available to participants.

1. Meeting Agenda
2. 25 April 2018 - Meeting Summary
3. Scope of Work for Tasks 1 – 3

Review of April Panel Meeting

The Panel held a public working meeting on 25 April 2018. A draft summary of the April meeting was made available on the project web page in advance of this meeting. Mr. Ceppos asked Panel members if there were any additional comments or revisions that needed to be made on the summary. There were no comments and the summary was adopted as final.

Presentation – Trace Elements/Metals in the Agriculture Environment

Dr. Gary Banuelos, Plant Nutritionist, United States Department of Agriculture

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

Dr. Banuelos opened the presentation by giving some background on his education. While he was attending University, the Chernobyl event took place, enabling Dr. Banuelos to study plant uptake with isotopes. The presentation was on how plants can be a tool to reduce undesirable elements in soil. This extraction process by the plant is based on the concept that plants can uptake undesirable elements that are chemically similar to the other desirable elements. An example of this is a plant that may normally uptake calcium, but may uptake cadmium due to the similar chemistry.
Trace elements are a main point of interest in this presentation. There are three categories for trace elements: (1) metals, (2) non-metals, and (3) metalloids. Normally trace elements have a bad

reputation among the public and are often referred to as heavy metals. It should be noted that there are good and bad trace elements that are being considered.

The trace elements comprise what is found in the environment and can be naturally occurring or may be a result from other activities. Other activities are largely attributed to man-made activities which may include oil spills, municipal drainage, and military operations. These sources occur around the world. In Monterey, Dr. Banuelos has discovered lead and antimony in the sand dunes that were used as a range for military operations. Other extreme cases include urbanization, industry, and agriculture.

Naturally occurring trace elements are found in every region of the world. Trace elements are naturally occurring and are found in the soil due to marine sediments and shale in California.

Additional sources of trace elements can occur from mine tailings, leaded gasoline contaminated areas from previous storage sites, and biosolids (although not a major concern for California since most are not loaded with heavy metals). In Chile, there are numerous mining operations that have led to trace elements in the atmosphere.

For California, a concern is irrigation water. Irrigation has a major effect on the soil. California is the leader in irrigation management and has made some major strides to eliminate flood practices. More common practices used today in California include surface and subsurface drip. Irrigation contributes to the solubility, mineralization, and movement of trace elements in the soil.

Excessive amounts of trace elements can be transferred from soil to crops and crops to humans or livestock. The basic breakdown of this process is “doors” or pathways into the plant that the trace elements can enter. These are most commonly in the root and can allow these unwanted trace elements into the crop. Hazards of allowing crops to uptake unwanted trace elements can include cancer. This has occurred in Bangladesh due to excessively high arsenic levels.

An example of a plant up taking unwanted trace elements is the presence of both zinc and cadmium in the soil. In the plant world, zinc and cadmium work antagonistically with each other. If cadmium is in the soil at a higher concentration than zinc, it is likely that cadmium will appear in the plant at elevated levels. The same is true if the concentrations are switched, it would be likely that zinc would be present in the plant at elevated concentrations. To reduce the uptake of cadmium into plants for a specific area, the farmer can add zinc to the soil to inhibit the uptake of the unwanted trace elements.

For cases where metals are observed in high concentrations in the soil, it is important to know the mobility of these. Some trace elements, such as cadmium, require a lower pH in the soil to be taken up by the plant. In Fresno County, the pH of the soil can range from 8.4 to 8.6. If there was cadmium in the soil, it is unlikely that the plant would be able to uptake this material due to the elevated pH in the soil. To fully assess a threat, you need to look at the complete picture of the soil characteristics. Mobility is an important factor. There may be high total concentrations in the soil, but they may not be mobile. Cadmium is an example where the high total concentration in the soil may not result in a toxic situation if the soil pH is high.

Another example is arsenic, which Dr. Banuelos has observed in groundwater evaporation ponds near Hanford. Arsenic, or another form arsenate, can enter a plant through phosphate “doorways”. Knowing this relationship for the plant and that the soil contains arsenic, the farmer can add more phosphate to the soil to reduce the uptake of arsenic. Arsenic is a problem in many areas, especially in Chile and Bangladesh. Sources of arsenic include natural sources, but also it has been used in wood preservatives and can be seen in a lot of older built fences.

Another example is lead. The sources of which include, leaded gasoline or military sites, lead pipes, and ceramics. The most common method for humans to ingest lead in through the soil. Other ways to increase lead intake in humans is through lead-contaminated water, paint chips, contaminated food, or dust.

Direct soil ingestion is the main route of lead contamination for humans and wildlife. If plants are grown in soils that are deficient in phosphorus and no phosphorus fertilizers are added, then plants can accumulate high amounts of lead compounds in roots. Thus, normal soil and plant chemistry prevents plant lead uptake or translocation. Lead only becomes toxic when it becomes bioavailable which means it’s available for the plant to take up. Lead does not tend to move to upper part of the plant. But can be a concern when growing onions, garlic, tubers or sugar beets which are grown directly into the soil. Groundwater quality is something that must always be considered especially when experiencing extreme drought and an increase in drilling. Many trace elements of concern are found in soils in central California. The quality of the water is also a factor regarding what trace elements end up in plants or animals.

What largely determines trace element presence and uptake are properties of the soil such as chemistry, pH, and organic matter. The organic matter is broken down to smaller particles. Once the breakdown of the organic matter takes place, then whatever metals or trace elements that are present in the soil become released.

There is an important relationship between organic matter and the type of microbes and the type of plant species that are growing. The microbes can contribute to the bioavailability of some trace elements. There are many pathways the trace elements can use to enter a plant, that are partially dependent on soil chemistry and properties. One thing that a plant does to protect itself is to drop leaves. The older leaves will accumulate metals and the then to protect the plant then they will drop or lose their leaves. The metals are then redeposited to the soil and bound to an organic form temporarily, then the whole cycle begins again. Essentially, the plant stores the heavy metals in the leaves before it enters the fruit or the edible portion.

Trace elements most commonly enter the plant through the roots. For example, one of the doors in the roots is the sulphate or sulfur door in the plant. Selenium is like sulfur, and the plant can’t tell the difference. If sulfur is in the soil and the plant likes selenium, then sulfur is likely to be taken up. Similarly, if there is phosphorus and arsenic in the soil, and the plant likes phosphorus, arsenic may accumulate in the plant.

Dr. Banuelos discussed the mechanism of ion antagonism and synergism. For example, selenium and sulfate: the selenium will enter through the sulfur door. Phosphate and arsenic: the arsenic will

enter the phosphate door. Cadmium and zinc: cadmium can enter through the zinc door. However, the opposite typically takes place with chloride. If we are using salty soils or poor-quality water that contains salinity and cadmium is present, you can promote the uptake of cadmium in a low pH setting. California tends to have high pH soil so despite the high chloride concentrations often found in water, the high pH helps prevent the absorption of cadmium. Interestingly, one can reduce the degree of mercury by applying selenium.

Some plants have a high tolerance for metals. When a plant has a high metal content, it indicates that the plant has metal tolerance. The plant probably places the metal in its vacuole, which is an empty storage unit within the leaf. However, for some elements, such as lead, the plant may stop the element at the root.

Some plants are hyper accumulators and tend to have excessively high concentrations of metals. The plant tries to keep the transpiration water out of the cytoplasm, because if it were to enter the cytoplasm it would cause damage. The plant may uptake other compounds that can disguise the metal from the plant and will also reduce the metal's ability to damage the plant. The metal stays within the plant but the plant has a mechanism to protect itself. This does not help the human if the human eats the plant. The metal is still present. If a human were to eat the plant, they would still absorb the metal.

Metal hyperaccumulator plants can contain metal concentrations from 10,000 ppm to 15,000 ppm. In the normal plant world, if you were to exceed concentrations of 5 to 10 ppm of metals, you could kill the plant. These metal hyperaccumulators are special plants, which can survive. If one were to eat of these plants, it could cause some type of toxicity to take place. This was first found in a latex tree in Caledonia. The latex that comes out of the tree contains about 26 percent nickel. The tree is doing "phyto-mining", and there is nickel in that area. If one were to have a vegetable and a hyper accumulator growing next to each other, the hyper accumulator would accumulate high concentrations of the metals, while the vegetable grown right next door would not. Hyper accumulators do not tend to attract insects. Animals do not want to touch them or eat them due to the high concentrations of metals. Hyper accumulation could have started as a defense mechanism against herbivores, pathogens, and bacteria.

Hyper accumulators may be useful in soil remediation. For example, the fern is a hyper accumulator of arsenic. Most farmers probably would not want to grow ferns as a crop. Ferns may also be useful in removing arsenic in groundwater.

Excluders do not take up heavy metals in significant concentrations. The plant's ability to exclude may eventually be overwhelmed and it may eventually be taken up by the plant. Some examples are the *Silene vulgaris* (bladder campion or maidenstears), *Lotus Corniculates* (bird's-foot trefoil) and *Viola calamiaria* (pansy) all refuse to take up heavy metals. These plants can also be helpful in soil remediation. For example, if heavy metals are found in alfalfa producing regions, then it is helpful to grow bird's-foot trefoil.

To use excluders or hyper accumulators to clean soil, soil characteristics and chemistry must be considered. For example, total metal content and soluble metal content are key features. The soluble portion is the bioavailable portion.

Biological management of soluble trace elements can be used at polluted sites. First, one must look at microflora and biological communities. A lot depends on what type of crop is growing, not all plants can be used in the same fashion. Associated with every crop is a different set of microbes. The microbes work hand in hand with the plants.

Phytoremediation can be used on organic and inorganic pollutants. Organics can be found in the soil and plants can be used in organic degradation. For example, some soils have high levels of TCE, salinity, and boron. These levels represent a compound problem, and most soils will contain a variety of contaminants. So, one must prioritize a specific compound or use a specific plant.

Phytoextraction can also be used in soil remediation. For example, the poplar tree is one the fastest growing trees. The microbes that are associated with the poplar roots possess the ability to degrade particular organic compounds. These compounds can be taken up by the tree. Therefore, by growing the poplar, not only does one get the benefit of harvesting the tree, but the remediation benefits as well.

Certain factors can affect the success of phytoextraction. Time is an important factor in phytoextraction. It is also important to consider the cash value of the plants being grown. Especially in places like the Central Valley, it is helpful to show farmers that they can make a profit while growing plants that can participate in phytoextraction.

For example, biomass has commercial value for gasification or for biofuel production. Dr. Banuelos mentioned that he established the first biofuel plant in central California. But oil prices didn't go up and high PG&E costs made it difficult to bring biofuel plants to the central Valley.

Poplar trees can be used in boron removal. Poplar trees have an assertive root system. The poplar tree can find water and will accumulate the boron or cadmium. They grow five meters in height every year. When the poplar is harvested, you effectively remove contaminants from the soil. Willow trees work in the same way for various trace elements.

Stanleya pinnata (desert prince's plume) can be used for phytoremediation of selenium. Dr. Banuelos mentioned that the plant can clean the soil down to a depth of 30 centimeters and remove approximately 20 percent of the selenium. Selenium and other trace elements are found in a volatile form. Phytoremediation distributes the metals in a volatile form, and next they land and the whole cycle begins over. Therefore, phytoremediation is only a management tool they do not permanently remove any contaminates. Hence phytoremediation more realistically should be called "phyto management."

Brassica plants (cabbages, cruciferous vegetables, and mustard plants) can be used in selenium removal**.** For example, canola is used grown on the west side of the Central Valley. The soils in these areas are high in boron, salts, and selenium. The canola grown in enriched in selenium and is

fed to dairy cows. The seeds can be used to make biodiesel, although the cost of pressing the seeds is very high.

The prickly pear can also be used for soil remediation. Prickly pears are convenient because they do not need to be irrigated, they absorb water molecules from the atmosphere. They also remove selenium and boron, but do not deposit anything into the fruit. Dr. Banuelos has a grow site in Kettleman City. The site used to contain evaporation ponds, and as a result the soils at the site are high in salts. At the site, Dr. Banuelos uses plants to remove boron, arsenic, and selenium.

Another example of a plant that can be used for soil remediation is the guayule. The guayule is typically grown in Arizona. It is drought tolerant, salt tolerant, boron tolerant, and tends to accumulate metals in the leaves. The plant is used for making latex. The latex made by the guayule is useful for people that are allergic to standard latex. There is one problem with the plant. Guayule is not considered attractive, and as a result, many farmers are not interested in growing it.

Cover crops can be used for mining site reclamation. Mining sites tend to be high in arsenic, mercury, and cadmium. At these sites, organic matter can be applied to grow crops. This is called phtyo- stabilization, because the movement of specific trace elements is inhibited.

After soil remediation, the plant material can be used as a gasifier to produce bioelectricity**.** You ask what do you do with the plant material? Biodico Westside, LLC in Five Points is producing different forms of electricity through “gasification.” In gasification, the plant material is combusted. This does not get rid of heavy metals. The heavy metals remain in the ash.

Some plants can be used to remediate water and wetlands. They can absorb heavy metals and even organic matter. These plants can also be harvested. Vetiver grass and *Puccinellia distans* (salt marsh grass) are plants that can be used to remediate water. Wetland cells can be used for selenium removal. Wetland systems can be very useful in water remediation. Dr. Banuelos uses wetland systems to remediate water in China.

In conclusion, Dr. Banuelos emphasized that plants can be used to take trace elements and metals out of soil and water. In order to remediate, it is important to know which contaminant is in the soil, and what the possible pathways are. Knowing these things can help one decide which plant to grow.

Questions and Comments from the Panel

- **Dr. Gabriele Ludwig** asked if Dr. Banuelos if he could explain uptake again and asked for further explanation on organic uptake. Dr. Ludwig also asked if there was a database that could inform people on up take.

    - **Dr. Gary Banuelos** Organic molecules generally must be broken down before they can be taken up by the plant. Once in the plant, organic molecules are often sent to the vacuole. Poplars are a good example of plants that can take in organic molecules. It’s the number one plant that I recommend at old military sites. Dr. Gary Banuelos stated that there isn’t a large database to point the public to.

- **Dr. Bruce Macler** asked for clarification: does the fruit and nuts have a tendency to uptake metals, since that has been the focus of the Food Safety Expert Panel? He asked Dr. Banuelos if he could elaborate on the tendency for metals to be taken up through the xylem. Do fruits and nuts tend to accumulate metals in the leaves? Especially in regard to almonds, pistachios, and citrus. Pistachios have numerous storage sites for metals.

    - **Dr. Gary Banuelos** stated that he is currently studying pistachios. These trees are grown with poor-quality water. Dr. Banuelos is studying the effects of this and seeing what is finding its way into the plant/ nut portion. He is also looking into the woody parts of the plant because those parts may have to be saturated with a metal before it moves into other parts of the plant. The Central Valley has two different types of soils- east and west side soils. Dr. Banuelos stated that he has not investigated citrus. However, in China, Dr. Banuelos found that some fruit can accumulate heavy metals. He believes that the fruit he observed in China had exceeded their ability to safely store heavy metals (mainly arsenic).

- **Dr. Bruce Macler-** Dr. Macler mentioned the protective nature of the pH soil. He also mentioned that he had recently read a paper put out by Stanford. The paper found that fertilized soils had a tendency to switch chromium from trivalent to hexavalent. Hexavalent chromium can become bioavailable. Dr. Macler asked if Dr. Banuelos observed soils change over time?

    - **Dr. Gary Banuelos** stated that he had observed soils changing. The growers add things to the soils through fertilization and change the soil chemistry. This can affect the nature of metals, including solubility and bioavailability. Each situation is site-specific and dependent on plants grown and soil types.

- **Dr. William Stringfellow-** asked Dr. Banuelos if he was certain the fruit is the last place that the metals or unwanted constituents accumulate.

    - **Dr. Gary Banuelos** stated that he wasn't sure about all fruit but would generally concur with that thought. It's going to last on the loading zone which is called the phloem.

- **Dr. William Stringfellow** asked Dr. Banuelos if he knew which fruit indicators vs. excluders are.

    - **Dr. Gary Banuelos** Generally indicator plants tend to grow in metal contaminated places. Plants can indicate the presence of a particular metal. But there is not a database for this.

Public Comments and Questions

- **Bill Allayaud, Environmental Working Group –** Mr. Allayaud stated that he has been following the Food Safety issue for a couple of years. Bill Allayaud noted that consumer reports have warned against eating too much rice, because it contains arsenic. There is

also naturally occurring arsenic in groundwater. Mr. Allayaud stated that he is more concerned about crops grown directly in the soil.

  - **Dr. Gary Banuelos** Once it is known what contaminant or metal is in the soil, one can figure out which plant can be grown. In soils that are heavily contaminated with metals, it is better to avoid growing tubers, carrots, garlic, or beets because of the potential for absorption.

- **Bill Allayaud, Environmental Working Group –** There are a lot of things used by the oil companies that aren't naturally occurring. But may mimic naturally occurring compounds. Mr. Allayaud asked Dr. Banuelos if he had found that plants tend to take up chemicals that are not naturally occurring.

  - **Dr. Gary Banuelos-** Dr**.** Banuelos mentioned that the poplar tree, which attracts a unique microflora, seem to be able to take in hydrocarbons. It is possible that they can take up a variety of produced water constituents.

- **Bill Allayaud, Environmental Working Group –** There are probably synthetic and naturally occurring contaminants that could end up in the water. Mr. Allayaud asked Dr. Banuelos if he has observed plants accumulating compounds from poor quality water in this way.

  - **Dr. Gary Banuelos** clarified that naturally occurring hydrocarbons will be broken down by microflora associated with the poplar tree. For example, natural hydrocarbons can be taken up by the tree and stored in the wood of the poplar tree.

- **Bill Allayaud, Environmental Working Group –** Mr. Allayaud asked Dr. Banuelos if he found that water filled plants tend to accumulate trace elements more than a woody plant.

  - **Dr. Gary Banuelos** stated that when it comes to woody plants, he has mainly observed the ability to accumulate metal in the nickel accumulator in in Caledonia. Perennial crops do not seem to possess the ability to hyper accumulate.

- **Bill Allayaud, Environmental Working Group –** Mr. Allayaud asked for clarification on a watery plant's ability to accumulate.

  - **Dr. Gary Banuelos** Dr. Banuelos said it depends on the pH of the soil. Low pH or arid soils can contribute to the Cadmium.

- **Bill Allayaud, Environmental Working Group –** Mr. Allayaud asked if the west side of San Joaquin Valley is generally alkaline.

  - **Dr. Gary Banuelos** – Dr. Banuelos stated that soils on the west side are generally alkaline. The east side of the San Joaquin Valley tends to have two different types of soils. The pH of east side soils can vary from 6.0 to 8.8.

- **David Ansolabehere, Cawelo Water District –** Mr. Ansolabehere pointed out that there are regulated levels for constituents, maximum contamination levels (MCLs), and the water typically does not exceed these. Mr. Ansolabehere stated that metals in the irrigation water are about half the MCLs. He asked Dr. Banuelos if he thought, based on these levels, that there are any concerns.

  - **Dr. Gary Banuelos** – Dr. Banuelos stated that continued use of poor-quality water can damage soils over time. He said that when irrigating with poor-quality water, it's a good idea to rotate fields. This is because even if the plants don't take in a particular constituent, it might accumulate over time.

- **David Ansolabehere, Cawelo Water District –** Mr. Ansolabehere asked whether water that meets drinking water standards should be considered poor quality.

  - **Dr. Gary Banuelos** Dr. Banuelos stated that it depends on whether the use of the water is a continued use. The problem is that the farmer can't always know everything that is being applied. Monitoring and soil sampling can be helpful in keeping soils healthy.

- **Dr. Bruce Macler** – Dr. Macler asked Dr. Banuelos if he had noticed anything in the produced water quality that was of interest, particularly with the organic constituents.

  - **Dr. Gary Banuelos**- Dr. Banuelos stated that he has not yet looked at water quality data on the produced water.

Dave Ceppos, Center for Collaborative Policy (CCP), gave the Panel a lunch break. After the meeting resumed, Dave Ceppos asked Central Valley Water Board staff to check for email questions.

Email Questions from the Public

- **Ravi Bhatia of Tri Hydro Corporation**: Ms. Bhatia's email states, "Good Morning, my coworker forward the Food Safety Panel information to me. My practice area is air quality regulation which sometimes includes agriculture, food, and beverage industries. I was curious to learn if an air quality practitioner might be added to the Panel or if more volatile air toxics might be added to develop thresholds below which they might be excluded. Thank you."

- **Dave Ceppos, CCP-** Mr. Ceppos stated that the Central Valley Water Board will respond to Ms. Bhatia accordingly.

Presentation on MOU Tasks: Dr. Robert Scofield, Ph.D., M.P.H. and Bernie Beckerman, Ph.D.

The intent of this presentation is to provide an update to the Panel regarding work of GSI, Environmental, Inc. (GSI) completed on MOU Tasks 1-2. *A copy of the presentation is available on the project web page.*

GSI was given three tasks to complete (MOU Tasks 1-3). The tasks include identifying chemicals of interest, completing a literature review, and sampling crops.

- **Dr. Robert Scofield, GSI** – Dr. Scofield stated that most of the modifications were minor and meant to add detail to the steps GSI will take to complete the tasks. One of the things that GSI will focus on is how likely it is for chemicals to make it into the fruit. A lot of this work has already been completed by Dr. William Stringfellow, science advisor to the Central Valley Water Board. Dr. Scofield stated that they plan on using the US Environmental Protection Agency's (EPA) contaminant candidate list (CCL List). GSI will use the EPA's process to compile a list of Constituents of Concern. GSI will also consider consumption levels. For the literature review, GSI is going to take an in depth look at toxicity information and consider exposure levels. The literature review will use a Cochrane style review. The project will be brought to the Central Valley Water Board and Panel as it progresses. Dr. Scofield stated that he understands the importance of transpareny in the process.

- **Dr. Bernie Beckerman, GSI** – Dr. Beckerman stated that he has been reviewing the expanded list of oil field additive constituents, which are posted to the Central Valley Water Board's web page. His focus thus far has been to focus on the constituents with high oral toxicity. In reviewing the constituent list, he has also been considering health relevant doses, and whether there are health related concerns with long-term chronic exposure. Dr. Beckerman stated that most of the crops have low uptake levels when compared with acute effects.

- **Dr. Bernie Beckerman, GSI –** Dr. Beckerman stated that to conduct the review, GSI broke up the list into four different categories. The first category is what is already being analyzed for, those that do not appear to pose any threats (wood dust, silica, etc.), chemicals that should be monitored for the last category is the remainder chemicals, those that do not fit into any of the categories. These chemicals need further evaluation. GSI will look at both what they are and whether it's found in the produced water. The chemicals that should be monitored include: (Bis – (2-chloroethyl) ether, Benzyl chloride -2-Naphthylamine, cyclohexylamine, and acrylamide).

Questions and Comments from the Panel

- **Mark Jones –** Mr. Jones inquired if creating the list was time critical.
    - **Dr. Bernie Beckerman, GSI** – Dr. Beckerman stated that creating the list is time critical because crop sampling was occurring. Some constituents of focus have been identified by considering criteria such as high oral toxicity, or toxicity due to chronic exposure.

- **Mark Jones –** Mr. Jones asked if GSI was going to consider mass or concentration data.

    - **Dr. Bernie Beckerman, GSI** – Dr. Beckerman stated that mass information was not considered because we do not have access to mass data.

- **Mark Jones**– Mr. Jones asked if there were analytical methods for each constituent. He said that he recalled mass data being provided in the past. Note: Mass data was provided as a part of a series of orders issued by the Central Valley Water Board in 2016 but was not collected as a part of the most current effort by the Central Valley Water Board.

    - **Dr. Bernie Beckerman, GSI** – GSI has contacted a lab about this.

- **Clay Rodgers, Central Valley Water Board** – Mr. Rodgers stated that the Central Valley Water Board sent Orders that were limited in scope. The information collected includes trade secret information. Mass data could be used to establish recipes. Therefore, mass data was not collected. Reverse engineering a recipe could occur if there was mass data. The information was collected and compiled in a way that could be shared with the public.

- **Dr. Bruce Macler-** Dr. Macler stated that GSI should be cautious when using the EPA's CCL list. He noted that the CCL list is mostly a wish list of things that people should consider. Also, that list is mostly used for contaminants in drinking water.

    - **Dr. Bernie Beckerman, GSI** – Dr. Beckerman states that he understood Dr. Macler's point. He also stated that the method used is a multi-criteria method, that will allow GSI to identify data gaps and chemicals of concern.

- **Dr. Robert Scofield, GSI –** Dr. Macler stated that using the CCL List approach is mostly a winnowing process. Using the approach gives GSI a way to figure out which chemicals are of concern and which are not toxic. It allows GSI to develop a master list.

- **Clay Rodgers, Central Valley Water Board-** Mr. Rodgers mentioned that some crop sampling (grapes and almonds) was occurring on the day of the meeting and the following day. Mr. Rodgers said that he is interested in the Panel's opinion on the five constituents identified by GSI (Bis – (2-chloroethyl) ether, Benzyl chloride -2-Naphthylamine, cyclohexylamine, and acrylamide). Mr. Rodgers mentioned that he thought these constituents should be added to the fruit analysis, provided that there were analytical methods for them. He said that he would also consult with the Central Valley Water Board's Executive Officer about changing monitoring and reporting programs to include these constituents in the analyte list. Mr. Rodgers again requested the Panel's input on the five constituents, and GSI's proposals to move forward with the project.

- **Mark Jones –** Mr. Jones mentioned that he did not think that permanently adding the five constituents to monitoring programs was necessary.

- **Clay Rodgers, Central Valley Water Board-** Mr. Rodgers mentioned that changes can be made in the monitoring programs if there are technical reasons to change them. For example, enough data to indicate that there are no potential threats from the constituents. Or that the constituents have no potential to end up in the water.

- **Dr. Stephen Beam-** Dr. Beam asked for clarification on the monitoring and reporting programs (what is included, what is the framework, etc.). He asked what it would mean if one of the constituents was detected, given that there may not be any toxicological or public health significance.

- **Clay Rodgers, Central Valley Water Board-** Mr. Rodgers stated that if a constituent is consistently not found in the water, it helps determine if there is a concern about it being in the fruit or nuts. If it's not in the water, the chances of it being in the fruit is greatly reduced. Mr. Rodgers stressed that taking samples gives a more complete picture.

- **Dr. Robert Scofield, GSI –** Dr. Scofield clarified that these five are ones that have published data, making them easier to identify as a risk. He stated that it would be important to investigate whether they are in the produce. Also, these were added to the list because the laboratory is able to analyze for four of the five constituents, the last one the laboratory is still considering. Dr. Scofield noted that one of the constituents (acrylamide), can accumulate naturally in the fruit. This is true even if it's not in the irrigation water. If you don't find a constituent in the fruit but it is in the water or vice versa, that is something to consider. Of the five, cyclohexane is the one that is still being considered by the laboratory. The other four have analytical methods.

- **Dave Ceppos, CCP-** Mr. Ceppos asked Dr. Beam if his questions had been answered.

    - **Dr. Stephen Beam –** Dr. Beam said that yes, his question had been answered. He wanted to know what dischargers are required to test for regularly.

- **Dale Harvey, Central Valley Water Board** – Mr. Harvey stated that dischargers are required to test for general minerals, volatile organic compounds using EPA 8260B and polycyclic aromatic compounds using EPA 8270. They are also required to test for additives, as long as there are analytical methods.

- **Dr. Stephen Beam-** Dr. Beam asked if dischargers are required to report analytical methods.

    - **Dale Harvey, Central Valley Water Board-** Mr. Harvey stated that yes, but the five chemicals are not a part of monitoring and reporting programs.

    - **Clay Rodgers, Central Valley Water Board-** Mr. Rodgers stated that the number of constituents that dischargers are required to test for is extensive.

- **Dave Ceppos, CCP-** Mr. Ceppos asked Central Valley Water Board staff if there were comments from the public submitted via email.

Email Questions and Comments from the Public

- **Deb Workman,** "Hello. Question for GSI- What about chemicals that may result from the breakdown of additives. For example, in the soil."

    - **Dr. Robert Scofield, GSI-** Dr. Scofield stated that GSI is considering that with the list of oil field additive constituents. GSI is looking to see what some of the additives might break down to.

Questions and Comments from the Public

- **David Ansolabehere, Cawelo Water District** – Mr. Ansolabehere stated that 14 additives on the list are already being tested for in the irrigation water.

- **Dave Ceppos, CCP-** Mr. Ceppos asked the Panel if there was any opposition or comments regarding adding the five constituents to the monitoring and reporting programs. He looked to Clay Rodgers for comments.

    - **Clay Rodgers, Central Valley Water Board-** Mr. Rodgers asked the Panel if they thought adding the constituents was a good idea. He asked the Panel if they had other ideas and stated that Panel members could reach out via email in the coming weeks if they had any comments.

- **Mark Jones –** Mr. Jones commented that some of the constituents are already covered in SVOC scans. He stated that there is probably already water quality data for those constituents.

- **Clay Rodgers, Central Valley Water Board-** Mr. Rodgers asked Mr. Ansolabehere if there was a date that he needed to hear from the Panel by, considering that sampling was occurring.

    - **David Ansolabehere, Cawelo Water District-** Mr. Ansolabehere stated that he needs to let the laboratory know if analytes are going to be added. He requested direction by 27 July 2018.

- **Clay Rodgers, Central Valley Water Board-** Mr. Rodgers stated that GSI had already contacted the lab. Lab staff probably were aware that there might be a request for additional analytes. Mr. Rodgers stated that Panel members should give comments by noon on 27 July 2018.

- **Dave Ceppos, CCP-** Mr. Ceppos stated that in the spirit of transparency, any comments made by the Panel regarding the analytes would be made a part of the public record.

- **Dr. Bruce Macler-** Dr. Macler stated that he was comfortable with the Central Valley Water Board adding these constituents.

- **Dr. Stephen Beam-** Dr. Beam stated that he would like to know more about how the five constituents were chosen. Dr. Beam requested some information in writing regarding toxicological literature used to identify these.

    - **Dr. Robert Scofield, GSI-** Dr. Scofield stated that a memo had been sent around regarding the five constituents.

    - **Dale Harvey, Central Valley Water Board-** Mr. Harvey stated that the Central Valley Water Board had received the memo and would send the memo to the Panel.

    - **Dave Ceppos, CCP-** Mr. Ceppos stated that any of the emails would be made a part of the public record. Mr. Ceppos then introduced the next segment of the meeting, which was an update on the project.

Presentation- General Project Update

Sampling has continued from 2017 to 2018. The same crops which were sampled in 2017, are being sampled in 2018. There have also been some documents added to the Food Safety web page. Finalized crop reports and an updated constituent list were of the documents uploaded.

- **Dr. William Stringfellow-** Dr. Stringfellow stated that the final crops reports are on the web page. He stated that the results in the crop reports have already been discussed at previous meetings. The reports were subject to review by the Panel and Central Valley Water Board staff. Mr. Stringfellow stated that he would respond to comments on the reports. There might be slight changes to the reports, but they will stay largely the same. They generally summarize the crop sampling efforts of 2017.

- **Clay Rodgers, Central Valley Water Board-** Mr. Rodgers stated that the crop reports would be an item on the next meeting, to allow members of the public to read the reports and give comments.

- **Rebecca T. Asami, Central Valley Water Board –** Ms. Asami mentioned that all the crop sampling field notes from 2017 have been put on the Food Safety Web Page. There have been a lot of comments from the public about not being able to find things on the web page. Ms. Asami stated that if any member of the public was interested in reviewing a particular document, she would provide PDF versions of the documents. Ms. Asami's email is available to the public.

- **Dale Harvey, Central Valley Water Board-** Central Valley Water Board staff had reached out to the Duke people to set up a meeting. There had been a meeting set, but it did not end

up happening. Central Valley Water Board staff are waiting for Duke people to reschedule. Mr. Harvey moved onto another topic. He pointed out that there is water quality data for some of the five constituents- about 30 results within Chevron's system. The results are mostly non-detect. He asked the Panel for comments about these results. Specifically, if a constituent is not in the water, then does it need to be analyzed for in the fruit?

- **Clay Rodgers, Central Valley Water Board-** Mr. Rodgers stated that throughout the project, water quality data has not been used to determine whether the fruit should be tested. Sampling has been as comprehensive as possible, even for constituents not found in the water. If there are several non-detect results for a constituent, is that enough data to suggest that it doesn't need to be detected in the fruit? Mr. Rodgers stated that this is a question that should be considered as sampling continues into the summer, and perhaps a question that can be revisited in the next meeting. Mr. Rodgers stated that as the project continues, the Panel should give comments on data gaps, toxicological issues (especially as MOU Tasks 1-2 are completed), and how to identify if a constituent should be included in the fruit sampling.

- **Dave Ceppos, CCP-** Mr. Ceppos stated that Central Valley Water Board staff should formalize the question, so that the question can be entered into the record. Then the question can be addressed at the next meeting.

Questions and Comments from the Panel

- **Dr. Barbara Petersen-** Dr. Petersen stated that the Panel should stay focused on the original goal, which is to measure the potential impacts of using produced water. She stated that if constituents are detected in fruit, but not in the water, it leaves questions unanswered about the water use. It may be hard to identify a source or distract from what the Panel is ultimately trying to do.

- **Dr. Andrew Gordus-** Dr. Gordus stated that the amount of water quality data available may be sufficient. He stated that in the beginning of the project, several years ago, the Panel looked at water quality data. He stated that based on water quality data, there may not be a need to measure certain constituents in the fruit, especially considering the cost of analysis.
    - **Dale Harvey, Central Valley Water Board-** Mr. Harvey clarified that there were 30 data points, and that staff would need to look at each data set to see where samples were taken (upstream vs. downstream) and what the data means.

- **Dave Ceppos, CCP-** Mr. Ceppos reminded folks that this topic was going to be put on the agenda for another meeting. Mr. Ceppos wanted to touch base on the Duke Study. He clarified that the Duke people had nothing of significance to report, which seemed to be mostly why the meeting was canceled. Access to land may have been an issue for the Duke Study.

- **Clay Rodgers, Central Valley Water Board-** Mr. Rodgers stated that he was under the impression that they had gained some access to land, being irrigated with produced water.

- **Dave Ceppos, CCP-** Mr. Ceppos stated that for the record, David Ansolabehere does not have any information on the Duke Study. Mr. Ceppos then asked if the public had any comments. There were none, and so Mr. Ceppos moved the meeting to the next topic.

Presentation- Update on New Food Safety Related Projects

Josh Mahoney of the Central Valley Water Board gave an update on the status of new projects that have been proposed to the Central Valley Water Board. The projects had been presented during previous public meetings of the Panel. Mr. Mahoney stated that Central Valley Water Board staff are working on drafting Waste Discharge Requirements (WDRs), and that the WDRs might be presented at the December Board meeting. One of the projects is for a new discharge, the other project is an expansion project for a reservoir that is already in use. There will also be a new pipeline to construct. Mr. Mahoney presented a map, showing the audience what the discharge flow path would be if the project is approved.

Questions and Comments

- **Dr. Karl Longley, Central Valley Water Board-** Dr. Longley asked if the projects were north of Bakersfield, and if the water quality roughly matched similar Food Safety projects.
    - **Josh Mahoney, Central Valley Water Board-** Mr. Mahoney stated that both is correct. He also clarified that the Guzman reservoir project is for Hathaway, Kern Tulare Water District, and Jasmin Ranchos Mutual Water Company. The Sherwood Hills project is the new project.
- **Dr. Karl Longley, Central Valley Water Board-** Dr. Longley asked which crops will be grown as a part of the project.
    - **Josh Mahoney, Central Valley Water Board-** Mr. Mahoney stated that citrus, some nuts, grapes and silage crops will be grown.
- **Clay Rodgers, Central Valley Water Board –** Mr. Rodgers stated that when it comes to silage crops, it is important to consider what the silage crops will be used for. Central Valley Water Board staff will look into how the crops will be used.
- **Dave Ceppos, CCP-** Mr. Ceppos opened the floor to public comment.

Public Questions and Comments

- **Bill Allayaud, Environmental Working Group-** Mr. Allayaud pointed out that some construction on the projects has begun, even though the permits have not been approved. He asked if that was normal procedure.
    - **Clay Rodgers, Central Valley Water Board-** Mr. Rodgers mentioned that there has been some work on the project, but the discharger does that at their own risk. If the permit is not approved, the cost and the construction would be for nothing.

- **Bill Allayaud, Environmental Working Group-** Mr. Allayaud asked for clarification on projects being built before permits were approved. For example, would one build a hotel on the coast before getting the permit.
    - **Patrick Pulupa, Central Valley Water Board-** Mr. Pulupa stated that it happens quite commonly. A project will be built based on land authorization. Permits from regulatory agencies are often obtained after the project is built.
- **Bill Allayaud, Environmental Working Group-** Mr. Allayaud asked for clarification about discharging. The discharger cannot discharge without a permit.
    - **Patrick Pulupa, Central Valley Water Board-** Mr. Pulupa stated that Mr. Allayaud was correct. A permit will not be issued if the water quality is not up to standards. The builders build at their own risk.

Project Update: Crops Grown with Produced Water

- **Dale Harvey, Central Valley Water Board-** Mr. Harvey pointed out that an updated crop list has been added to the Food Safety web page. Cawelo Water District and North Kern Water District have provided updated lists of crops grown in the districts. There are new crops being grown that have not been reported before. Mr. Harvey stated that if any member of the public has questions about the updated crop lists, they could contact Central Valley Water Board staff.

Questions and Comments from the Panel

- **Dr. Barbara Petersen-** Ms. Petersen stated that she would be willing to put together consumption estimates on the crops listed.
- **Dale Harvey, Central Valley Water Board-** Mr. Harvey stated that the list is pretty much complete. There is a need to clarify which crops are grown for human consumption.
- **Dave Ceppos, CCP-** Mr. Ceppos moved the meeting to the next topic.

Memorandum of Understanding: US EPA and the State of New Mexico

Dr. Macler stated that the State of New Mexico and the US EPA have signed a Memorandum of Understanding regarding produced water. New Mexico is looking at using produced water for a number of uses, including irrigation. They will start looking into research and regulatory stuff. The document came out of New Mexico's Department of Energy, Minerals, and Natural Resources.

Questions and Comments

- **Dave Ceppos, CCP-** Mr. Ceppos asked if Dr. Macler could share the document.
    - **Dr. Bruce Macler-** Dr. Macler stated that the document is public and will be shared with the Panel.

- **Bill Allayaud, Environmental Working Group-** Mr. Allayaud stated that he appreciated getting the agenda in advance. He also stated that he had met with officials from the US EPA and DOGGR. The officials also talked to Central Valley Water Board staff.

    - **Clay Rodgers, Central Valley Water Board Staff-** Mr. Rodgers stated that Central Valley Water Board staff, State Board staff, William Stringfellow, and Seth Shonkoff were present in a similar meeting. He pointed out that New Mexico is a water tight state. The practice of recycling produced water is being looked at by other water tight states. Finding other sources of water is something that will be looked at, including produced water.

General Questions and Comments

- **Dave Ceppos, CCP-** Mr. Ceppos stated that Dr. Gabrielle Ludwig requested that the Panel have a roundtable or working meeting. Dr. Ludwig made the request to discuss the long-range critical path of the Food Safety Project.

- **Clay Rodgers, Central Valley Water Board-** Mr. Rodgers supported the idea of having working meeting of the Panel.

- **Dave Ceppos, CCP-** Mr. Ceppos reminded the public that the working meetings are internal meetings. The working meetings are summarized, and the summaries are part of public record. He asked the Panel if there was any opposition to having a working meeting.

- **Dr. William Stringfellow-** Dr. Stringfellow suggested the working meeting be in person.

- **Dave Ceppos, CCP-** Mr. Ceppos discussed the Action Items from the meeting:
  1) The Panel will give the Central Valley Water Board comments on the five constituents, and potentially add them to the analyte list.

  2) Central Valley Water Board staff will reach out to the Panel and schedule a working meeting of the Panel. Mr. Ceppos thanked the Panel and asked Mr. Rodgers if he had anything to add.

- **Clay Rodgers, Central Valley Water Board-** Mr. Rodgers thanked the audience and the Panel for attending. He also thanked Mr. Ceppos and stated that this would be the last meeting that would be facilitated by Mr. Ceppos. He thanked Mr. Ceppos for his service to the Panel and the Central Valley Water Board.

- **Dave Ceppos, CCP-** Mr. Ceppos thanked Mr. Rodgers, and adjourned the meeting.