ASSESSMENT OF PRODUCED WATER FOR AGRICULTURAL IRRIGATION OF EDIBLE CROPS: IDENTIFYING CHEMICALS OF INTEREST
PROGRESS REPORT
MAY 9, 2019

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GSI Environmental
GSI was retained by the Water Board to assist in 3 tasks:

1. Selection of “Chemicals of Interest”, from a list of known chemical additives and naturally occurring chemicals in produced water, for further evaluation

2. 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

3. Sampling and chemical analysis of crops irrigated with produced water in the Central Valley
TASK 1: PROGRESS UPDATE CHEMICALS OF INTEREST

385 CHEMICALS TO EVALUATE

- 90 NATURALLY OCCURRING
- 312 UNIQUE CHEMICAL ADDITIVES
TASK 1: PROGRESS UPDATE CHEMICALS OF INTEREST

385 Chemicals

- 70 GRAS/Non-Toxic
- 315 Remaining
  - 62 Require Further Evaluation
  - 253 Remaining
    - 64 No Chronic Toxicity
    - 11 Incomplete Information
    - 173 Toxicity Value
    - 5 Radionuclides
      - 122 Published Toxicity Values
      - 51 Derived Toxicity Values

122 Published Toxicity Values
51 Derived Toxicity Values
TASK 1: PROGRESS UPDATE CHEMICALS OF INTEREST

- Draft report submitted to the Water Board and Food Safety Panel
  - Current report is posted online
  - Working on incorporating comments from FSP
- Scope of work originally asked for incorporating fate and transport, including plant uptake, into selection of chemical list
  - Through discussions with the Water Board and Scientific Advisor, fate and transport has not been incorporated into the current work
  - Looking for advice from FSP about how to proceed
    - Issues of incorporating fate and transport, especially for most toxic chemicals
    - Addressing breakdown products
    - Addressing those chemicals without toxicity data
Focus of literature review (from MOU Scope of Work)

- 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)
  - Those with incomplete information (11 Chemicals)
- Fate and transport
- Plant uptake
- Identification of knowledge gaps
TASK 2: PROGRESS UPDATE ON LITERATURE REVIEW

• Currently working with Water Board to finalize methods of literature review, specifically inclusion/exclusion criteria

• Factors being currently considered
  ▪ Date
    - 2000 to present for literature focused on produced water
    - No set restrictions for other literature, given the potential for limited availability
    - Goal to focus on most up-to-date data
  ▪ Method of oil and gas extraction
    - On-shore conventional oil and gas
  ▪ Location
    - Produced water in North America
  ▪ Language
    - English
  ▪ Types of Publications (in hierarchical order)
    - Peer Reviewed Literature
    - Government Publications
    - Scientific Letters
    - Industry Reports
### TASK 3: PROGRESS UPDATE ON CROP SAMPLING

**Samples to date**

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<thead>
<tr>
<th>Produce</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
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<tr>
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<tr>
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<tr>
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<tr>
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<tr>
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<tr>
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<tr>
<td>Cherries</td>
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</table>
TASK 3: PROGRESS UPDATE ON CROP SAMPLING

- Currently working on drafting the 2018/2019 sampling report
- Results appear to suggest no significant difference between crops irrigated with produced and conventionally sourced waters

- Some issues with the lab providing report in timely manner has delayed reporting results
- GSI QC of data found issues that are now resolved
  - Naphthalene contamination reported as false quantification
  - False positive for 2-Chloroethyl Vinyl Ether
- Holding times exceeded for some grape (2018) and some lemon and mandarin (2019) samples
  - Equipment issues that were unable to be resolved prior to holding time exceedance
    - For grapes, equipment malfunctioned mid-process. Review suggested no major problems with the results
    - For some mandarin and lemon samples, equipment malfunctioned post-sample preparation before analysis. Review suggested no major difference between samples inside and outside of holding times
Thank you