PRELIMINARY REPORT

Produce Safety after Urban Wildfire

Citizen Science Initiative

UC Cooperative Extension Sonoma

JUNE 2018

Report Contents

SUMMARY

The Northern California fires of October 2017 created poor air quality conditions and distributed toxic air contaminants over the region. Concerned community members started the Produce Safety after Urban Wildfire Citizen Science Initiative with the support of UC Cooperative Extension Sonoma to assess the impact of this toxic smoke on local produce, and took over 200 samples of leafy greens from 25 sites across Sonoma County.

This preliminary report analyzes two of these sites that were most likely to have received deposits of toxic air contaminants from the urban burn.

Based on preliminary findings, we hypothesize that produce safety was not significantly affected by the fires and may be mitigated by washing produce.

Preliminary analysis is inconclusive, but does not indicate a high degree of contamination:

- **Polycyclic Aromatic Hydrocarbons = *inconclusive;*** Due to high method reporting limits from our laboratories
- **Heavy metals = *low concern, except for Nickel*;** No detection of lead, arsenic, or mercury. Nickel was found in 2 of 8 samples at levels exceeding Prop 65's No Significant Risk Level (NSRL). Nickel contamination appears to be mitigated by washing produce.
- **Dioxins = *some concern*;** Concentrations found above the background levels from FDA's Dioxin Monitoring Program, but at levels below NSRL.

During emergency air pollution events of this kind, researchers and public health officials are generally most concerned with the *inhalation* of toxins from prolonged exposure to poor air quality. Vulnerable groups such as children, pregnant women, food insecure communities, and communities already experiencing a higher level of chemical and non-chemical exposures are more likely to experience the health impacts of contamination on produce and may want to take extra precautions.

We conclude the report with the next steps in our testing strategy.

BACKGROUND & SAMPLING METHODS

Urbal Wildfire and Potential Contamination

The fires that spread through Northern California in October 2017 burned over 160,000 acres of wildland, suburban, urban and industrial areas, creating dangerous air quality conditions for the region that lasted long beyond the fires themselves. The wildfire smoke likely included high concentrations of toxic air contaminants.[i] Following the fires, the Food and Drug Administration wrote a letter to the California Department of Food and Agriculture and the California Department of Public Health, stating that "toxic elements, firefighting chemicals, and combustion products such as polycyclic aromatic hydrocarbons (PAHs) and dioxins are of greatest concern." There are well-known human health impacts from the *inhalation* of these contaminants[ii]. Additionally, plants have the potential to absorb air pollutants directly through their leaves,[iii],[iv],[v],[vi] but little research has been done on the risk to human health from *ingesting* contaminants from smoke and ash on produce grown near a wildfire.

Impact on Local Farms and Gardens

Local farms and gardens played a significant role in food relief efforts immediately following the fires, contributing produce to shelters and kitchens. Many farmers, gardeners, and community members have been concerned about how the fire-related air pollution might impact locally-grown produce. Farmers have been unsure of the potential health impacts of the fire on themselves, their workers, and their consumers. School, community, and home gardeners have been concerned about the potential health impact on children and other vulnerable groups.

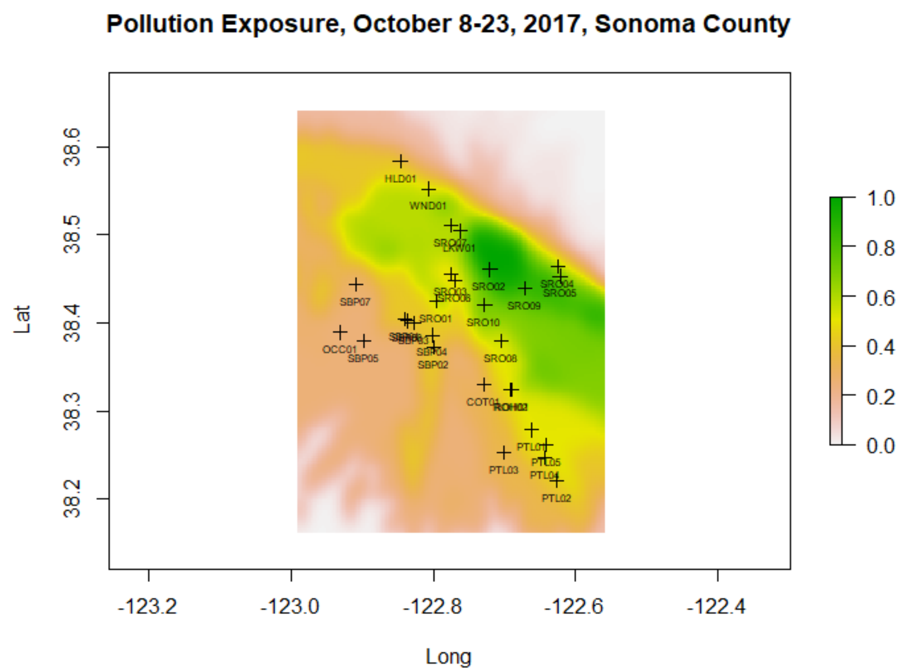
Citizen Science Initiative

In the weeks following the Sonoma County fires, concerned community members came together to launch the Produce Safety after Urban Wildfire Citizen Science Initiative. Sonoma County residents and members of the UC Master Gardener Program of Sonoma County collaborated to take samples from over 25 sites across the region using a sampling protocol created under advisement by UC Environmental Health and Food Safety Specialists. Samples included washed and unwashed produce, each in triplicate, to determine if contaminants are present and whether contaminants can be easily washed off produce. Volunteers focused on leafy greens with large surface area directly exposed to air pollution: kale, collards, chard, and lettuce. In total, over 200 samples were taken and frozen for subsequent laboratory analysis.

Soil contamination is also a concern for the community. Community-led soil sampling will be initiated in June 2018 to test for persistent chemicals at 7 months following the fires.

PRELIMINARY ANALYSIS METHODS

Site Selection
We selected two high priority sites out of our 25+ sites to analyze first. We created a meteorological model of particulate matter deposition from the urban burn area in Santa Rosa, and used this model to choose sites that were most likely to have chemicals from the smoke settle on their crops.



Samples, Tests, and Labs
We provided two varieties of leafy greens (kale, lettuce) from the two sites to TestAmerica in Sacramento for analysis for PAHs, CAM17 metals, and dioxins and furans. We then sent another set of samples from the same two high priority sites to Enthalpy Analytics in Berkeley to help validate our first results. With this second lab, we tested for PAHs in chard samples from both sites, and we tested for dioxins using collards from one site.

Determining Risk: Proposition 65
In order to determine whether levels of contaminants on produce were "safe", we compared our laboratory results to the "No Significant Risk Level" (NSRL) established by California's Occupational and Environmental Health Hazard Assessments (OEHHA) under Proposition 65.

Proposition 65 is officially known as the "Safe Drinking Water and Toxic Enforcement Act of 1986". It was enacted as a ballot initiative to protect drinking water and inform Californians about exposures to chemicals shown to cause cancer, reproductive harm, and neurological impacts. Under the law, businesses selling products containing these chemicals at levels that pose significant risk must inform customers with a Prop 65 warning on the package.

"No Significant Risk Level" (NSRL)
According to the OEHHA website, Proposition 65 *"defines "no significant risk" as a level of exposure that would cause no more than 1 extra case of cancer in 100,000 people over a 70-year lifetime. So a compound can be unlabeled if a person exposed to the substance at the expected level for 70 years is estimated to have a 1 in 100,000 chance or less of getting cancer due to that exposure. The law also has similar strict cutoff levels for birth defects and reproductive harm."*[1]

We selected this measure because it is a conservative measure and because of the legal requirement to label products for sale that are known to be above Prop 65 levels.

POTENTIAL HAZARDS FROM SMOKE [vii] [viii] [ix]

Polycyclic Aromatic Hydrocarbons (PAHs)
are a class of very small carcinogenic chemicals that come from the combustion of organic materials. Traffic-related air pollution is a common source. They also enter the diet through grilling, drying, and smoking foods. PAHs generally have a low degree of *acute* toxicity to humans, with effects occuring only over time. Some PAHs impact brain development in fetuses and children.

Heavy Metals
are persistent contaminants. They exist naturally in soil, but can be emitted in toxic levels from industrial activities. During an urban fire, they could be present in smoke from burning buildings and cars. Some are critical nutrients for life, like iron for red blood cell function. Others, like lead, arsenic, and mercury, can be carcinogenic, toxic to many organ systems, and cause developmental effects on fetuses and children.

Dioxins & Furans
are persistent organic pollutants. They are created through the combustion of plastic products and can travel long distances through air pollution. They bind to fats and will accumulate up the food-chain, including breast milk. Toxic effects inclue immune toxicity, developmental, and hornomal effects. Children and breastfeeding infants are more at risk for long-term health impacts.

PRELIMINARY RESULTS

Polycyclic Aromatic Hydrocarbons (PAHs): INCONCLUSIVE

Our preliminary tests did NOT detect any Polycyclic Aromatic Hydrocarbons (PAH). However, it is possible that the plants contained some PAH concentrations, but that that these were below our tests' abilities to detect.

After receiving test results, we analyzed the Method Reporting Limits (MRL) from our labs, and found that both laboratories have method reporting limits that are far higher than the Prop 65 NSRL threshold. For example, for one type of PAH, benzo(a)pyrene, the plant tissue concentration that would lead to the NSRL is 2.86 ug/Kg, while our average MRL across both labs is 60.83 ug/Kg. Any plant contamination above the Prop 65 threshold but below our MRL would have been missed in our analysis.

This means that from this test, we are unable to confirm or deny whether our samples contain PAHs at concentrations that pose a significant health concern.

"Method Reporting Limit"
A method reporting limit (MRL) is the lowest concentration of a chemical that a lab test would be able to detect in a sample. This is also sometimes refered to as the Detection Limit (DL), Limit of Detection (LOD), or Estimated Detection Limit (EDL) depending on the test.

<u>*NEXT STEPS:*</u> We are seeking other laboratories and testing methods that would allow us to assess the presence of PAHs at concentrations of around 1 ug/Kg.

Heavy Metals: ***LOW CONCERN, EXCEPT FOR NICKEL LEVELS ABOVE NSRL***

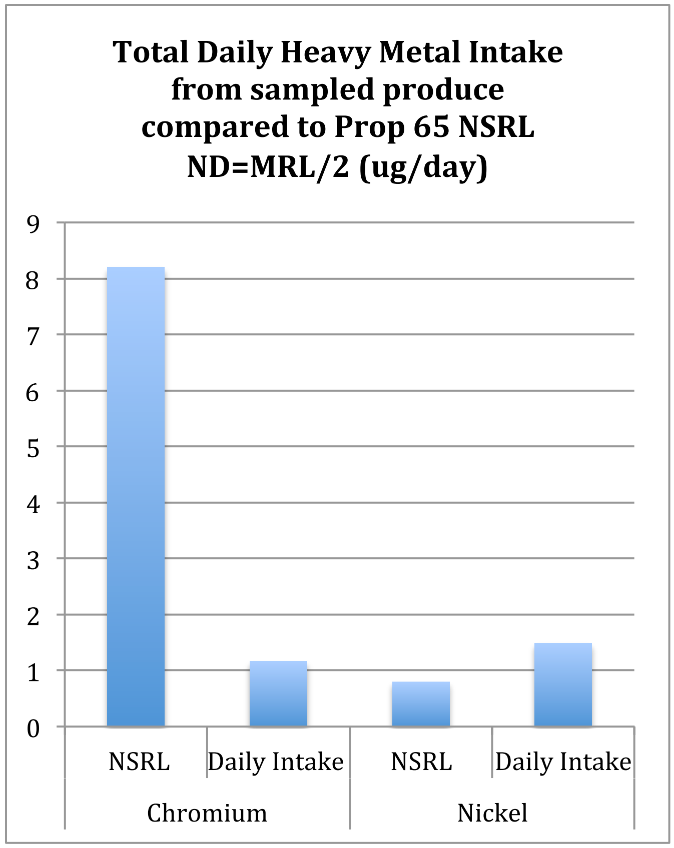
Our tests did not detect lead, arsenic, mercury, which pose some of the greatest public health concern among heavy metals. In our heavy metals test, we did find low levels of Barium, Chromium, Copper, Molybdenum, Nickel, Thalium, and Zinc. Of these, only Chromium and Nickel are both monitored in California under Proposition 65.

We created a "Daily Intake" rate by taking the concentration of these metals found in our samples and multiplying them by the average daily green leafy vegetable consumption determined by the USDA (0.021 kg/day)[x].

For chromium, the concentrations detected on our samples would lead to a daily intake rate that is only a quarter of the Proposition 65 "No Significant Risk Level" threshold (NSRL).

For nickel, the concentrations detected on our plants would lead to daily intake rates that are higher than the Prop 65 NSRL (NSRL= 0.8 ug/day; Estimated Daily Intake from sampled produce = 1.48 ug/day).

Nickel is a naturally occuring metal that is present to some concentration in all soils, and so it may be that this result reflects underlying elevated nickel levels in our area. However, nickel is also commonly used in the manufacture of metal alloys. It's possible that our elevated levels are from nickel that volatilized from the metal in burning buildings or from burning the nickel naturally occuring in soil.



Additionally, there are some forms of nickel that are non-toxic to the human body, such as nickel that is still bound as an alloy, and there are some forms of nickel that are highly toxic, such as unbound Nickel dust. Our current tests cannot confirm which form of nickel are present in our samples.

Last but not least, only two of the eight samples tested for heavy metals contained detectable levels of nickel: unwashed kale from site 1, and unwashed lettuce from site 2. It is worth noting that nickel was only found in unwashed samples.

NEXT STEPS: We will be continuing heavy metals panels that include nickel for all additional sites. If we continue to find elevated levels of nickel, we will seek out additional tests that can assess which type of nickel was present in samples.

Dioxins and Furans: *SOME CONCERN: ABOVE BACKGROUND LEVELS, BELOW NSRL*

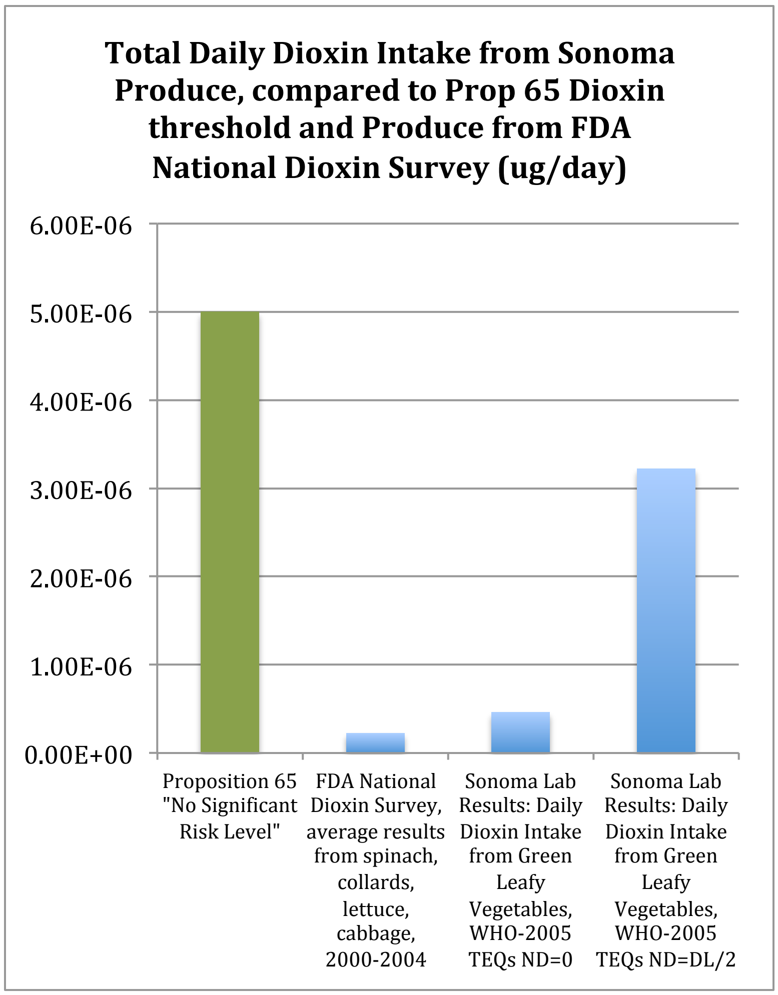
Our tests did detect concentrations of dioxins and furans. Of those found, the most common were OCDD (found in all 10 samples), 1,2,3,4,7,8-HxCDD (8 samples), OCDF (7 samples), and 1,2,3,7,8,9-HxCDF (5 samples). All others were detected in 2 or fewer samples.

We created a "Total Dioxin Concentration" for each sample by scaling the concentration of each dioxin found by its relative toxicity (this is called a "Toxicity Equivalent Quotient") and then adding up the TEQs. For instance, although OCDD occurred with the most frequency and highest levels, it has been found to have only 0.0003x the toxicity of TCDD, the most toxic dioxin, which was not detected in our samples.

To get an estimated Daily Intake, we then calculated the average total dioxins across our samples and multiplied this number by the average green leafy vegetable consumption determined by the USDA. We created two different Daily Intake estimates, one where we assumed that all of the non-detected dioxins had a concentration of zero in our samples (ND=0), and another where we assumed that the samples still had some small levels of dioxins that were around half of our method detection limit (ND=DL/2).

We also compared the values found in our samples to the dioxin concentrations found in the Food and Drug Administration (FDA)'s National Dioxin Monitoring Program. From 2000-2004, the FDA analyzed hundreds of different food types collected under its Total Diet Study (TDS) in order to obtain a baseline data for dioxins in food, and to find opportunities to reduce contamination and dietary exposure[xi]. From their list of analyzed foods, we found the average of all samples for the foods most similar to our study: spinach, collards, lettuce, and cabbage (TDS# 107-110).

Using this method, we found that the daily dioxins intake from eating produce from these two sites was far below Prop 65 NSRL. However, they are still above the average background dioxin concentrations found in green leafy vegetables by the FDA's study.



NEXT STEPS: We will be continuing to test samples for dioxins in all upcoming sites.

PRELIMINARY CONCLUSIONS AND LIMITATIONS

Overall, our results from these first two priority sites indicate that some chemical contaminants are present, but that they are generally present at low levels that do not present an extreme concern for human health. We hypothesize that smoke from the fire did not deposit toxic heavy metals, PAHs, or dioxins at levels above Proposition 65 No Significant Risk Level, which would mandate the notification of consumers.

There are a number of significant limitations from our method, which we aim to address in our next steps. These include: low sample number, lack of replicates in many samples, lack of an adequate control sample for comparison, and a risk assessment approach that assumes chronic exposures.

The proposition 65 method that we have been using in this preliminary report assumes a lifetime of exposure at the daily intake rate. In our study, we are assuming that consuming local produce following the fire would result in an acute or sub-chronic exposure due to the wildfire incident[xii], and these concentrations do not reflect lifetime intake rates.

"Acute, Chronic & Subchronic"
The length of the exposure can make a significant difference in whether or not an exposure has health consequences.

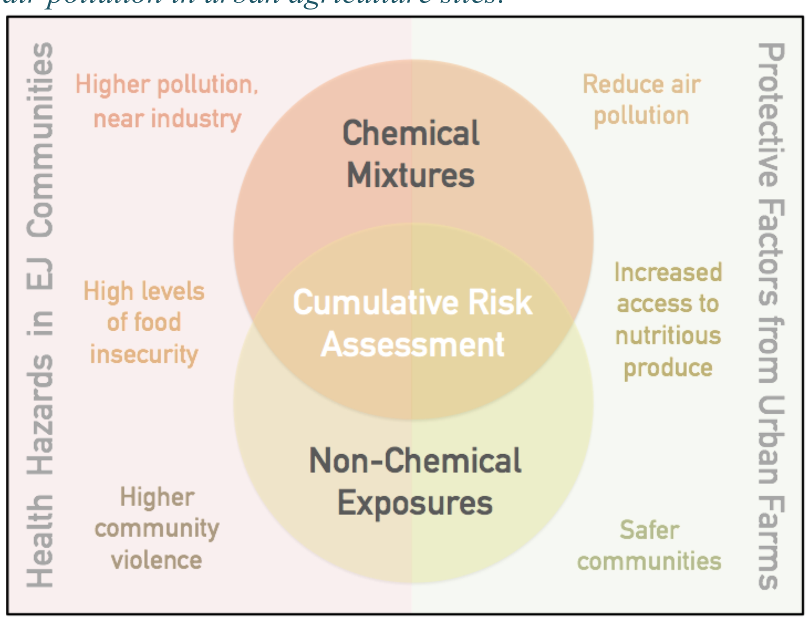
Acute *= exposure for under 24 hours*
Subchronic *= repeated exposure for more than 30 days, up to 10% of the lifespan*
Chronic *= repeated exposure for more than 10% of the life span in humans (90 days to 2 years is typically used in lab animal studies)*

Additionally, this preliminary report does not account for the increased vulnerability of certain populations, such as children, food insecure communities, and communities experiencing a higher level of chemical and non-chemical exposures.[xiii]

Nor does this preliminary report provided a comparative assessment of the health benefits associated with eating produce[xiv] [xv], or the benefits for community resilience from having a thriving local food movement.

We strive to move towards this cumulative health risk assessment approach[xvi] [xvii] in our final report.

"Cumulative Risk Assessment"
Cumulative Risk Assessments are a framework for considering the aggregated risk from multiple stressors and protective factors from chemical and non-chemical sources, such as this framework for understanding cumulative risk of air pollution in urban agriculture sites.



SUMMARY OF NEXT STEPS

Additional Foliar Testing
We are creating a testing strategy to verify whether our preliminary results hold true across our other sites in order to feel confident reaching these conclusion that produce safety was not highly impacted by the North Bay fires. For our next set of testing, we are considering:

- Testing three additional sites for PAHs, Heavy Metals, and Dioxins
- Seeking a different laboratory or analysis method to detect PAHs at lower concentrations
- Identify other heavy metals tests that could determine what form of Nickel is present

Soil Sampling and Testing
We are launching the soil sampling component of this project this month. Soil contamination with persistent pollutants could lead to chronic exposures, especially for kids who are more likely to put contaminated soil in their mouths[xviii].

We aim to collect soil samples at the two high priority sites we have already tested, as well as the three additional sites. We will test these soil samples for dioxins and heavy metals.

Comparisons
Using air pollution data from emergency monitors that were set-up in Santa Rosa by the California Air Resources Board in the days following the fire, we are spatially analyzing the data from these monitors and will evaluate the chronic health risk associated with inhalation of the smoke as a comparison to the risk from ingesting produce.

We will also continue our background research to find other air pollution and agriculture studies in order to draw comparisons between what we are finding in Sonoma County and the findings from these other contexts.

Additional Analysis Methods
The proposition 65 method that we have been using in this preliminary report assumes a lifetime of exposure at the daily intake rate. We will be exploring other risk assessment methods that can better assess the risk associated with shorter-term exposures.

Cumulative Risk Assessment
Using a cumulative risk analysis framework, we will specifically address the context of environmental justice and food insecure communities, and include a balanced analysis that weighs the health benefits of open green spaces, access to nutritious produce, and support of the local farming economy.

Community Education
Upon completion of these above steps, and within the next year, we will be leading workshops in the community to share our results, answer community questions regarding environmental health, and provide tangible steps that farmers and gardeners can do to mitigate any risks that are associated with fire-related contamination and typical regional air pollution.

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Produce Safety after Urban Wildfire Citizen Science Initiative

PRELIMINARY ANALYSIS, JUNE 2018

PAH Lab Results: TestAmerica ND = MRL/2

Lab	TestAmerica							
Site	LKW01				SRO09			
Variety	Lettuce		Kale		Lettuce		Kale	
Wash Condition	Unwashed	Washed	Unwashed	Washed	Unwashed	Washed	Unwashed	Washed
Acenaphthene	43.5	22.5	50	55	21.5	19.5	43	39
Acenaphylene	39.5	20.5	46	48.5	19.5	18	39	36
Anthracene	43.5	22.5	50	55	21.5	19.5	43	39
Benzo(a)anthracene	120	60	140	150	60	55	120	110
Benzo(a)pyrene	85	43	95	100	41	37.5	80	75
Benzo(b)fluoranthene	120	60	140	150	60	55	120	110
Benzo (g,h,i)perylene	70	35	80	85	33.5	30.5	65	60
Benzo(k)fluoranthene	120	65	145	150	60	55	120	110
Chrysene	105	55	75	130	55	48.5	105	95
Dibenzo(a,h)anthracene	90	46	105	110	44	40	90	80
Flyoranthene	90	46	105	110	44	40	90	80
Fluorene	50	26.5	60	65	25	23	50	46
Indeno(1,2,3-cd)pyrene	90	47	105	110	45	41	90	80
Napthalene	37.5	19.5	44	46.5	18.5	17	37	34
Phenanthrene	32	16.5	37.5	39.5	16	14.5	31.5	29
Pyrene	85	44	100	105	42	38.5	85	75
Key: ***All data are MRL/2, no true measurements								

PAH Lab Results: Enthalpy ND= RL/2 (ug/kg)

Lab	Enthalpy			
Site	LKW01		SRO09	
Variety	Chard		Chard	
Wash Condition	Unwashed	Washed	Unwashed	Washed
Acenaphthene	32.5	60	38	43
Acenaphylene	32.5	60	38	43
Anthracene	32.5	60	38	43
Benzo(a)anthracene	32.5	60	38	43
Benzo(a)pyrene	32.5	60	38	43
Benzo(b)fluoranthene	32.5	60	38	43
Benzo (g,h,i)perylene	32.5	60	38	43
Benzo(k)fluoranthene	32.5	60	38	43
Chrysene	32.5	60	38	43
Dibenzo(a,h)anthracene	32.5	60	38	43
Flyoranthene	32.5	60	38	43
Fluorene	32.5	60	38	43
Indeno(1,2,3-cd)pyrene	32.5	60	38	43
Napthalene	32.5	60	38	43
Phenanthrene	32.5	60	38	43
Pyrene	32.5	60	38	43
Key:	***All data are RL/2, no true measurements			

Produce Safety after Urban Wildfire Citizen Science Initiative

PRELIMINARY ANALYSIS, JUNE 2018

Heavy Metals Lab Results: TestAmerica ND=MDL/2 (mg/kg)

Site	LKW01				SRO09					
Variety	Lettuce		Kale		Lettuce		Kale			
Wash Condition	Unwashed	Washed	Unwashed	Washed	Unwashed	Washed	Unwashed	Washed	BLANK	AVG
Antimony	0.05	0.0475	0.0475	0.0475	0.05	0.05	0.05	0.05	0.05	0.049063
Arsenic	0.075	0.07	0.07	0.07	0.08	0.075	0.075	0.075	0.075	0.07375
Barium	**1.2**	**1.4**	**3.2**	**3.6**	**0.95**	**0.78**	**3.1**	**2.6**	0.045	2.10375
Beryllium	0.005	0.00475	0.00475	0.00475	0.005	0.005	0.005	0.005	0.005	0.004906
Cadmium	0.0255	0.024	0.024	0.024	0.026	0.0255	0.026	0.052	0.025	0.028375
Chromium	0.05	0.0475	0.0475	0.0475	**0.1**	0.05	0.05	0.05	0.05	0.055313
Cobalt	0.005	0.00475	0.00475	**0.0096**	0.005	0.005	0.005	0.005	0.005	0.005513
Copper	**0.45**	**0.38**	**0.52**	**0.31**	**0.34**	**0.23**	**0.35**	**0.41**	0.005	0.37375
Lead	0.0305	0.0285	0.0285	0.0285	0.0315	0.0305	0.031	0.031	0.03	0.03
Mercury	0.0165	0.0195	0.0165	0.0195	0.0165	0.017	0.0175	0.155	.02/2	0.03475
Molybdenum	0.0475	0.0475	**0.43**	**0.22**	0.05	0.05	**0.46**	**0.54**	0.05	0.230625
Nickel	0.05	0.0475	**0.17**	0.0475	**0.1**	0.05	0.05	0.05	0.05	0.070625
Selenium	0.05	0.0475	0.0475	0.0475	0.05	0.05	0.05	0.05	0.05	0.049063
Silver	0.015	0.0145	0.0145	0.0145	0.0155	0.0155	0.0155	0.0155	0.015	0.015063
Thallium	0.024	0.024	**0.085**	0.024	0.026	0.0255	0.026	0.026	0.025	0.032563
Vanadium	0.15	0.145	0.145	0.145	0.155	0.155	0.155	0.155	0.15	0.150625
Zinc	**2.7**	**2.8**	**5.3**	**2.6**	**3**	**1.9**	**4.3**	**4.2**	0.3	3.35

Key: * Bolded values Indicate a laboratory measurement

** Non-bolded values indicate the estimated detection limit divided by two

Produce Safety after Urban Wildfire Citizen Science Initiative
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Dioxin Lab Results: TestAmerica ND=EDL/2 (pg/g)

Site	LKW01				SRO09					
Variety	Lettuce		Kale		Lettuce		Kale			
Wash Condition	Unwashed	Washed	Unwashed	Washed	Unwashed	Washed	Unwashed	Washed	BLANK	AVG
2,3,7,8-TCDD	0.06	0.0315	0.032	0.0255	0.0395	0.0495	0.036	0.0315	0.013	0.0381875
1,2,3,7,8-PeCDD	0.065	0.0335	0.031	0.032	0.0425	0.0445	0.041	0.041	0.0125	0.0413125
1,2,3,4,7,8-HxCDD	**0.28**	**0.41**	**0.26**	**0.47**	**0.43**	**0.3**	**0.29**	**0.26**	**0.134**	0.3375
1,2,3,6,7,8-HxCDD	0.031	0.0255	0.019	0.0255	0.0215	0.025	0.0195	0.0175	0.0075	0.0230625
1,2,3,7,8,9-HxCDD	0.0305	0.025	0.0185	0.025	**0.2**	0.0245	0.019	**0.11**	0.0075	0.0565625
1,2,3,4,6,7,8-HpCDD	0.21	0.17	0.265	0.16	0.42	**1.8**	0.18	0.18	**0.0703**	0.423125
OCDD	**1.9**	**0.84**	**6.3**	**0.77**	**4.9**	**2.8**	**1.5**	**1.3**	**0.353**	2.53875
2,3,7,8-TCDF	0.045	0.019	0.0205	0.0245	0.0275	0.032	**0.15**	0.026	0.009	0.0430625
1,2,3,7,8-PeCDF	0.065	0.0225	0.023	0.0245	0.0285	0.026	0.024	0.0195	0.0095	0.029125
2,3,4,7,8-PeCDF	0.041	0.023	0.0235	0.0255	0.0295	0.027	0.025	0.0205	0.0095	0.026875
1,2,3,4,7,8-HxCDF	0.07	0.027	0.0455	0.033	0.05	0.0415	0.0455	0.0375	0.0115	0.04375
1,2,3,6,7,8-HxCDF	0.065	0.047	0.0395	0.029	0.0455	0.036	0.0395	0.0325	0.01	0.04175
1,2,3,7,8,9-HxCDF	**0.19**	0.027	0.0455	**0.15**	**0.21**	**0.14**	0.0455	**0.16**	**0.0301**	0.121
2,3,4,6,7,8-HxCDF	0.07	0.0255	0.043	0.0315	0.0495	0.039	0.043	0.0355	0.011	0.042125
1,2,3,4,6,7,8-HpCDF	0.34	0.415	0.7	0.7	0.455	**2**	0.95	0.6	0.0175	0.77
1,2,3,4,7,8,9-HpCDF	0.41	0.5	0.85	0.8	0.55	0.65	1.15	0.75	0.021	0.7075
OCDF	**1.1**	0.0355	**0.62**	**0.3**	**0.72**	**0.46**	**0.37**	**0.27**	0.0145	0.4844375

Key: * Bolded values Indicate a laboratory measurement
** Non-bolded values indicate the estimated detection limit divided by two

Dioxin Lab Results: Enthalpy ND=DL/2 (pg/g)

Site	LKW01									
Wash Condition	Washed				Unwashed					
Replicate	1	2	3	AVG	1	2	3	AVG	BLANK	AVG
2,3,7,8-TCDD	0.0201	0.0156	0.0136	0.01643	0.0301	0.0148	0.01725	0.02072	0.01955	0.018575
1,2,3,7,8-PeCDD	0.0361	0.02645	0.02245	0.02833	0.02755	0.02685	0.0336	0.02933	0.03085	0.0288333
1,2,3,4,7,8-HxCDD	0.02085	0.0174	0.01905	0.01910	0.01535	0.01205	0.0125	0.01330	0.02155	0.0162
1,2,3,6,7,8-HxCDD	0.02345	0.0176	0.0195	0.02018	0.0159	0.01305	0.0129	0.01395	0.02295	0.0170667
1,2,3,7,8,9-HxCDD	0.0244	0.01845	0.0201	0.02098	0.01675	0.0125	0.01375	0.01433	0.0255	0.0176583
1,2,3,4,6,7,8-HpCDD	0.03405	0.0235	0.02425	0.02727	**0.339**	0.02575	**0.475**	0.27992	0.0309	0.1535917
OCDD	0.358	0.309	**0.473**	0.38000	**1.22**	**1.56**	**2.26**	1.68000	0.0348	1.03
2,3,7,8-TCDF	0.01275	0.0104	0.01035	0.01117	0.0113	0.0097	0.0151	0.01203	0.01255	0.0116
1,2,3,7,8-PeCDF	0.0155	0.00935	0.00855	0.01113	0.0105	0.00885	0.01	0.00978	0.0194	0.0104583
2,3,4,7,8-PeCDF	0.01475	0.0087	0.00865	0.01070	0.0104	0.00925	0.0099	0.00985	0.01925	0.010275
1,2,3,4,7,8-HxCDF	0.01845	0.01315	0.01425	0.01528	0.0105	0.011	0.01415	0.01188	0.02385	0.0135833
1,2,3,6,7,8-HxCDF	0.0169	0.0126	0.01345	0.01432	0.0096	0.0098	0.01355	0.01098	0.0238	0.01265
1,2,3,7,8,9-HxCDF	0.02095	0.01495	0.0164	0.01743	0.0124	0.0118	0.016	0.01340	0.02795	0.0154167
2,3,4,6,7,8-HxCDF	0.01885	0.01295	0.014	0.01527	0.00975	0.0106	0.01375	0.01137	0.0255	0.0133167
1,2,3,4,6,7,8-HpCDF	0.0121	0.00865	0.0123	0.01102	0.0091	0.0074	0.01205	0.00952	0.0134	0.0102667
1,2,3,4,7,8,9-HpCDF	0.0158	0.01315	0.01695	0.01530	0.0124	0.0105	0.0187	0.01387	0.02035	0.0145833
OCDF	0.02255	0.01425	0.01285	0.01655	0.01965	0.01885	0.019	0.01917	0.0272	0.0178583

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PROJECT GOALS

Goal 1:

Address community concerns regarding the impact of air pollution generated by the wildfires on local produce

Goal 2:

Build a body of knowledge about the impact of air pollution on produce, a critical and emerging public health topic that has little research data available

Goal 3:

Increase the air pollution and environmental health knowledge of communities engaged in local food and promote awareness of air pollution mitigation strategies

CONNECT WITH US

GOOGLE GROUP

Monthly email updates and forum discussions

groups.google.com/forum/#!forum/produce-safety-after-urban-wildfire

FACEBOOK

Upcoming events and updates that can be easily shared

www.facebook.com/Producesafetyafterurbanwildfire/

WEBSITE

Reports and resources for community and researchers

cesonoma.ucanr.edu/Produce_Safety_after_Urban_Wildfire/

University of California
Agriculture and Natural Resources

Master Gardener UCCE

Bay Area Air Quality Management District

The Pollination Project

#GIVING TUESDAY

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