

# What to Know About Wildfire & Food Safety

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## INTRODUCTION



In 2011 the Food Safety Modernization Act was signed into law. Of the many rules in this law, the Produce Safety Rule (PSR) was created to address federal food safety requirements at the farm level, specifically for produce crops. This is of special concern because many crops are eaten raw and if contaminated, they can cause illness when consumed. There are three main ways crops can be contaminated on a farm: 1) physical, 2) chemical, and 3) biological.

Generally, there is particular focus on biological contamination because it is often caused by bacteria like E. coli, and viruses. The PSR is focused on reducing and preventing biological contamination on produce, but doesn't enforce specific requirements for chemical or physical contamination, other than requiring that food in market channels to not be adulterated or contaminated.

In recent years, wildfire disasters in the United States have led to many growers asking questions about how to navigate post-wildfire food safety concerns with their crops and livestock. This resource aims to provide guidance about common concerns, how to assess potential impacts, and what remediation and mitigation options are available.

## THE PROBLEM

Although not all fire fallout is toxic, the impacts on livestock and crops from wildfire ash containing contaminants from household products, vehicles, fuel, fertilizers, pesticides, plastics, electrical systems, etc. has not been widely researched, nor have the long term effects on agricultural irrigation sources and soil health.

Of primary concern is how long pollutants, heavy metals, and fire retardants remain in the environment and what effects this has on crop and livestock quality, and organic certification status. There is even less accessible guidance for farmers facing these issues that provides information on what practices and actions can be taken to mitigate, remediate, and alleviate wildfire-derived pollutants.

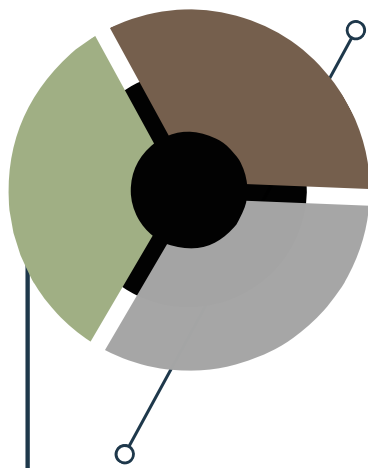


# Background

## ENVIRONMENTAL POLLUTANTS AND WILDFIRE



***Preliminary research suggests that eating trace contaminants on produce does not provide a significant increase in chemical exposure to humans during a single urban wildfire event in the short term.*** Unfortunately, many farmers are facing chronic wildfires that occur over prolonged periods. It is important to acknowledge that some environmental pollutants exist naturally at low levels in the soil, air and water. These “background levels” are important benchmarks for comparing against when contamination is suspected. Many agencies have established minimum thresholds for pollutants of concern to human health, livestock, forage, soil, and water. The top three pollutant classes of concern are detailed below:



### HEAVY METALS

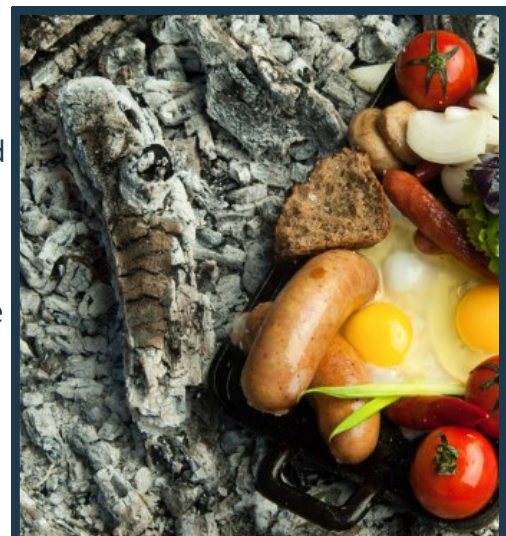
These are individual ions that cannot be broken down. Fire alters the physical and biogeochemical properties of pollutants and heavy metals can persist in the top five inches of soil for at least two years after a fire. Research indicates that overall, heavy metals increase after wildfires, especially the presence of Copper, Iron, Mercury, Lead, Zinc, Arsenic, and Manganese.

### NUTRIENTS

Nutrient levels also typically rise after a fire (nitrate and nitrite are often found to be two-four times higher). Some of this could be attributed to washdown from fire retardant products which are typically made from synthetic fertilizers but also when ignition of vegetative fuels releases nitrogen and phosphorus. This not only impacts soil conditions and plant health, but also threatens waterways with resulting algal blooms that can rapidly reduce oxygen levels and negatively affect sensitive fish species.

### PERSISTENT ORGANIC POLLUTANTS (POPS)

POPs are a special subset of toxic chemicals that can readily transport beyond their origin and which persist for long periods of time in the environment. Perhaps more importantly, they can accumulate in the fats and tissues of organisms and become concentrated through the food chain. Dioxins are POPs created through the combustion of plastic products that have been found in soils exposed to intense urban wildfires at levels exceeding the Environmental Protection Agency and Office of Environmental Health Hazard Assessment screening thresholds. Toxic effects include cancer, immune toxicity, developmental, and hormonal effects. Vulnerable populations are at higher risk.



# Key Contamination Concepts Post-wildfire



***There are three types of contamination: physical, chemical, and biological.*** This resource focuses primarily on the last two types and the impacts that agricultural producers are facing post-wildfire. There are several pathways that contaminants can get into production systems: airborne and smoke-borne (wind dispersed), through plant roots (also known as uptake), on plants' parts/leaves, and via bioaccumulation in the food chain. Why is this important? Toxins can inhibit plant growth, cause negative impacts to human and livestock health, interfere with soil processes, and impair water quality.

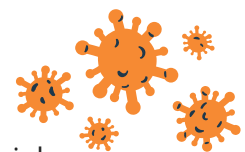
## CHEMICAL



Chemical contaminants may include heavy metals, petroleum products, pesticides, or other agricultural chemicals and fertilizers. Potential sources of chemical contamination vary greatly depending on the severity of fire, proximity to operations using chemicals, and runoff/transport pathways. Airborne and smoke-borne transport of chemical contaminants is of primary concern to human health as wildland fires are a well-known source of polycyclic aromatic hydrocarbons (PAHs).

Many synthetic chemicals are also known to bond to fine particles and travel in both soil and water, which poses a significant threat to farming systems. The length of a chemical's residence time in the environment before breaking down into less dangerous forms, is of special concern to agricultural operators because this can impact planting plans, harvest periods, and safe access for farmworkers. When a compound binds tightly to very fine particles, like clay, it is less likely to move down through the soil. If chemicals of concern are near the soil's surface, they can move across the top of the soil and into surface water systems. Knowing your soil type and the likelihood of chemical transport and bonding with contaminants in the environment after a wildfire will help when making decisions about removal, remediation, and/or mitigation.

## BIOLOGICAL



Pathogens may include bacteria, parasites, and viruses. Sources of microbial contamination to agricultural irrigation sources can come from pathogens originating in upland areas due to damaged septic systems, raw manure, etc. The seasonal timing of wildfires matters because if a strong rain event occurs shortly after a fire, there is a greater probability that contaminants will run off site with little vegetation or soil structure and active biology to capture and treat them naturally.



# Assessing Crop & Livestock Consumption Risk



*After a wildfire there are five main steps you can take to help determine if your crops are safe to eat:*

## #1. OBSERVE

Check to see if there is any visible degradation in plant quality or animal health. Crops may exhibit wilting, spotting, scaring, etc. Livestock may express fatigue, have difficulty breathing, mucous and soot clogging airways, and/or lack of appetite and weight loss (overall decline in body condition).

## #2. TEST

If possible, conduct soil testing in your growing area prior to any wildfire event to establish a baseline you can compare against later on. Make sure to map soil testing locations before sending them to a lab! It is also beneficial to understand the site history- prior fires, flooding, livestock impacts, industrial activities, etc. If sampling post fire, it is advised to sample multiple sites in a burn scar and homogenize to establish if there is a baseline threat, and then conduct more targeted sampling if problem contaminants are identified. Irrigation wells should be tested for benzene.

## #3. IMPLEMENT

When conducting activities around hazardous materials, take precautions to minimize offsite movement of toxins and to protect yourself from unnecessary exposure. Practice good hygiene by washing hands frequently, wear gloves, respiratory masks, eye protection, and even consider using a Tyvek suit or equivalent, as well as clean footwear before/after site access, etc. Be careful not to touch your mouth or face during sampling or debris removal!

## #4. MONITOR

Are there any visual changes observable with the human eye since remediation methods or practices were implemented?

## #5. TEST-AGAIN!

Verify observations or test for factors that cannot be directly observed, such as soil microbial activity. Sampling ash directly is also advised in order to characterize contaminants and determine if there are toxins located within 50 feet of a natural waterway or drainage, or are present above established safe levels.





# Livestock Protection, Handling & Processing During Wildfire

*In general, small grazing and ranching operations have difficulty accessing federally inspected meat processing and packing facilities, largely because of burdensome regulations and scarcity. Local custom butchers are often operating at capacity or are not cost-effective. These challenges are compounded by disasters such as wildfires, which can lead to unwanted or untimely culling of herds and flocks. The need to transport livestock on short notice to hard to find alternative holding/grazing sites can also place additional stress on animals, and the meat processing chain.*

## FIRE-INDUCED HEALTH IMPACTS & MITIGATION OPTIONS

Emerging research on impacts to livestock from wildfires, including prolonged exposure to smoke, indicates that respiratory conditions such as pneumonia, increase during these types of events. Poultry have an air intake system which makes them even more vulnerable to wildfire smoke. Of the common commercial ruminants, goats appeared most likely to suffer from respiratory disease, although beef cattle and sheep producers also reported similar health concerns. When possible, it is best to move livestock to areas with good ventilation, or to locations with better air quality to help reduce health complications, such as low birth weights and reduced milk productivity.



All types of operators reported being negatively impacted by evacuations (and livestock transport) and pasture loss or damage. The stress of evacuation combined with higher density holding and commingling with other herds or species, and higher potential for handling by outsiders, contributes to increased observations of respiratory disease. There is overwhelming evidence that ovine smoke inhalation compounds the negative effects of stress and associated immune suppression. Some methods for mitigating these known stressors include ensuring access to clean and abundant water because it is important to keep animal airways moist, which helps flush out particulate matter that can lead to bacteria-caused infections. Residual particles in the lungs can potentially worsen the symptoms of smoke exposure, so provide low-dust animal feed and misters in holding areas whenever possible. Adding more shade options and minimizing livestock exercise can also help.



# Livestock Protection, Handling & Processing During Wildfire

## MEAT PROCESSING & STORAGE DURING DISASTER

Food safety is threatened by livestock health because meat processing workers are exposed to biological agents during slaughter when handling affected meat and through exposure to sick animals. Foodborne illnesses are demonstrated to be more prevalent when livestock are processed too quickly, or are immunocompromised. It is well established that missteps in the handling, slaughter, dressing, and dissection of these ruminants can cause food safety concerns.

Wildfires are significantly impacting the stability of the electrical grid, which is of concern in terms of reliable refrigeration for animal products. The majority of electrical outages are caused by extreme weather scenarios or natural disasters, and are unpredictable and sometimes last for weeks. Without proper backup systems, Meat and Poultry Processing (MPP) plants are at increased risk of contributing to potential food contamination. These facilities are also known to pollute public surface waters and water treatment plants, primarily with nitrogen and phosphorus. As a result, the EPA is considering tougher effluent regulations for MPPs, so the cost of processing is bound to increase to reflect the price of compliance activities and reporting.

## POLICY RESPONSES AND PROGRAMS



In response to these chokepoints and concerns, California passed Assembly Bill 888 in 2021 to support expansion of on-farm slaughter by removing restrictions on the number of animals that could be harvested per month, and streamlining some of the requirements for ranchers and Mobile Slaughter Operators (MSOs). Selling livestock "on the hoof" is another approach whereby producers sell whole animals or portions of live whole animals to individuals so that they can process it themselves as their customs prefer. The Federal Meat Inspection (FMI) Act considers this type of slaughter and processing activity exempt so long as it is exclusively for the owner's household use, and any non-paying guests or employees.

Unfortunately, this option is only feasible for low volume scenarios and generally requires that those channels and relationships exist in advance of a disaster situation. It also forces small ranchers into a pipeline of choosing scale or conventional methods over practices that support the land and soil health through mindful movement of animals.

# Navigating Regulations & Government Assistance



***Disasters are scary, and many programs and services designed to support impacted parties can be confusing or complicated. Two main considerations to make about hazardous sites are if you qualify for debris removal, and how toxins can affect organic certification status.***

## CALIFORNIA OFFICE OF EMERGENCY SERVICES (CAL OES)

Debris removal programs through Cal OES typically subcontract with external hazardous waste services and require them to remove soil from the ash-footprint until no contamination is found. This approach does not account for the spread of toxins post-fire by wind and rain. Other burned debris and small structures under 120 square feet fall outside the scope of standard cleanup covered by this program. For eligibility information, contact the Dept. of Toxic Substance Control.

## IMPACTS ON ORGANIC CERTIFICATION

In certified organic production systems, synthetic materials are prohibited substances and are not permitted. Most commercial fire retardants are made with active ingredients like aluminum phosphate, which is a synthetic material that is not included on the National List.

When crops and/or land are contaminated by prohibited substances, the National Organic Program (NOP) standards require a new (standard) three year transition period. If wildfire retardant drifts onto crops or land, removal of the current crop can sometimes be sufficient to avoid full certification suspension. Certifiers may request additional information, especially in potential drift events, in order to determine impacts. Direct exposure (ex: anything in the flight path) will also require three years for organic certification recovery. It is advised that farmers document impacts to the best of their ability and report them right away.

Currently, there are no exemptions for wildfire retardant exposures, even if applied during a declared emergency. However, an exemption outlined in Section 205.672 of the NOP standards for emergency pest or disease treatment conducted by Federal or State programs, provides guidance that could be adopted. The clause protects organic status so long as any harvested crop or plant parts that have contact with the substance is not sold, labeled, or represented as organically produced. Any exposed livestock, including livestock products such as eggs, cannot be sold, labeled, or represented as organically produced, except for milk or milk products produced at least 12 months after exposure. However, exposed offspring of mammalian breeder stock in the first 2/3rds of gestation *may* still be considered organic. Check with your certifier for specifics.



CAFF is advocating for an exemption through the NOP to see if they will consider aligning the emergency application of fire retardant with existing emergency pest treatments. In the meantime, some private companies, like [Fortress](#), have approved use through the U.S Forest Service for their “green” retardants containing magnesium chloride as the main active ingredient. This is preferable because of its superior fire suppression capabilities, its eco-friendly properties, and because it can be produced at scale.

# Mitigation Methods



***WHENEVER POSSIBLE, PREPARING IN ADVANCE OF WILDFIRE CAN AVOID A LOT OF TROUBLE AND EFFORT LATER ON***

## **DEFENSIBLE SPACE**

Use targeted/prescribed grazing, beneficial fire, and mechanical methods to maintain vegetation buffers around sensitive structures, access roads, and containment areas. Protect farm infrastructure (water, electrical, mechanical) through materials hardening to ensure proper functioning and access during fire events. Consider additional water storage options like above ground tanks or swimming pools and invest in backup power sources like gas/propane generators or batteries.

## **DESIGNATED CONTAINMENT AREAS**

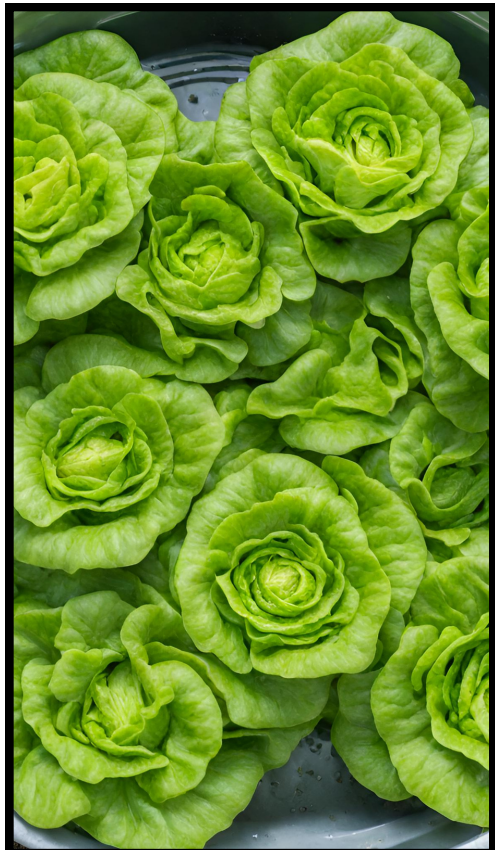
Keep pesticides/fertilizers, etc. in a non-flammable containment area (metal containers) to reduce the likelihood of contact with fire and heat sources. Keep flammables away from cultivation and livestock holding areas as well as from freshwater and/or irrigation sources to minimize the potential for drift.

## **DOWNSTREAM CATCHMENT BASINS**

Build swales (depressions on contour) to capture contaminated runoff and eroded soils. Consider seeding with grasses and other plants known for their phytoremediation abilities (see next page for more details).

## **WASH/RINSE PRODUCE**

Prior to selling or consumption of agricultural products, make sure to thoroughly clean and/or remove the outer skin/peel if exposed to wildfire smoke or ash.





# Remediation Methods



**IF YOU HAVE BEEN IMPACTED BY A WILDFIRE AND NEED TO TAKE ACTION TO ADDRESS TOXINS, THERE ARE SOME GREAT TOOLS OUTLINED BELOW THAT CAN HELP!**

## FUNGAL

Fungi (mushrooms) are the only organisms that possess enzymes capable of breaking down the complex and resistant molecules in wood, specifically lignin. This same mechanism is used to break down POPs and toxic chemicals in the environment including benzene and polycyclic aromatic compounds, chlorinated aromatic compounds, and dioxins. Fungi use chelation to absorb heavy metal ions from the environment. Fungi utilized in this manner *are not safe to consume!* The pH of soils can also influence the ability of fungi to capture heavy metals, and generally speaking, more neutral soils will facilitate greater absorption. Fungal treatments are most effective when contamination rates are at their highest (most recent), so using this method of remediation on sites with impact over 2 years old may not yield significant results.



## MICROBIAL

Use inputs from trusted/tested sources like the Organic Materials Review Institute (OMRI) approved products. If possible, grow crops off the ground and dilute contaminants by importing clean soils for sensitive crops like leafy greens. Amending with compost to bind soil contaminants may help break down organic chemicals (like dioxins) in soils, and would be appropriate for low-level contamination. Composts high in phosphorus may also help bind lead and cadmium in soils.

## VEGETATIVE

Phytoremediation is the natural capability of certain plants to repair and regenerate toxic soils, and clean groundwater and surface water. Plants can help bind, extract, transform and clean up many kinds of pollution including metals, pesticides, chlorinated solvents, polychlorinated biphenyls (PCBs), explosives, radionuclides, and petroleum hydrocarbons. Plants clean up these forms of pollution as far down as their roots can grow. Plants also help prevent wind and rain from carrying pollution away from the site to other areas. Cover cropping is another type of phytoremediation.

## FAUNAL

Targeted grazing can also be used to gently open up hydrophilic soils 1-2 years after intense fires, and can improve root distribution as well as stimulate microbes in the soil which are often sterilized during extreme heat. The timing of this method is very important as post-fire soils can be fragile, but also tend to host annual or invasive grass and weedy species in the first few months after a burn.

## GENERAL

Mulch to prevent airborne soil dust and prevent up-splash onto crops. Use subsurface irrigation to prevent spreading contaminants. Consider installing windbreaks and hedgerows to help block airborne particles before they reach crops.

# Summary

Whether you are a row crop farmer, rancher, or diversified operator, there are a number of actions you can take to help protect your operation from contaminants and also address food safety risks. Please use the QR codes below codes to learn more about specific practices outlined in this booklet.

## REFERENCES

Scan this QR Code to review the sources used in the creation of this booklet.



## ADDITIONAL RESOURCES

Use the QR code below to access our Linktree site with a suite of wildfire resilience related content including our library, blog-posts, podcast sessions, short films, legislative calls to action, and more!



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Reach out if you have any questions or feedback, we are here to listen!

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