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**MEDICAL ADVISORY: MAUI FIRES – UPDATED INFORMATION FOR PROVIDERS  
TOXIC CONTAMINANTS IN THE ASH AND BIOMONITORING**

The devastating fires on Maui have caused tragic loss of life, injuries, and taken a severe emotional toll. The ash from the fire contains multiple toxic contaminants that may present an ongoing environmental health risk after high dose exposure. Below is new, more specific information clinicians need to know to assess the environmental health impacts of exposure to the ash and information on specialized toxicological testing, also known as biomonitoring, for the most concerning contaminants.

- Preliminary results from ash sampling in Kula shows extremely high levels of arsenic and high levels of lead and cobalt.
- People interacting with and disturbing the ash are at high risk of arsenic exposure causing health effects. People living in areas near the impacted areas are also at risk of exposure if ash is transported to their home or property by winds or other ash disturbances.
- Unintentional ingestion by children is of the highest concern for exposure. However, inhalational exposure may pose a hazard, especially for people working in the ash or doing clean-up activities without adherence to recommended prevention measures including personal protective equipment (PPE).
- People with chronic kidney disease are at higher risk for toxicity from arsenic because of reduced renal elimination.
- Biomonitoring is possible for some of the toxic contaminants; although, blood and urine testing cannot predict if people will become ill from their exposure.
  - Biomonitoring must be done with a clear understanding of the limitations of the test results and the awareness of common confounders which may include exposure unrelated to the fires from other environmental or occupational sources.
  - These tests are often send-out tests that may have long turn-around times and interpretations of the results may be difficult due to variations in reference ranges.
- Behavioral Health and Infectious Hazards remain present in communities impacted by the fires. Please see [DOH's medical advisory from August 24, 2023](#) for more information.

Dear Healthcare Provider,  
The Hawai'i Department of Health (DOH) continues to provide services to Maui residents impacted by the August 2023 Maui wildfires.

DOH would like to thank medical providers from across the state who are supporting our Maui community. This medical advisory provides additional guidance with special attention to the environmental health risks posed by toxic contaminants in the ash and dust of the impacted areas. DOH will continue to coordinate closely with community, county, state, and federal partners and is committed to its mission to protect the health and environment for all people in Hawai'i.

#### **ASH HAZARDS:**

Ash from the fires presents environmental hazards that may endanger people who return to the burned areas in Kula and Lāhainā as well as people living in neighboring areas. Ash from burned buildings contains toxic contaminants including asbestos, lead, arsenic and other heavy metals and organic chemicals. In addition to the toxic contaminants, exposure to ash can cause irritation to eyes, nose, throat and lungs.

DOH has been working with Maui County and federal, local and state partners to inform the public of the risks of the ash including the importance of avoiding burn area entry where possible and adhering to all prevention measures when one does enter including the use of personal protective equipment (PPE).

To understand the exact constituents of the ash and be able to further advise people on the risks, samples were collected on September 21 from eight burned homes in Kula, which had been constructed from the 1930s to the 2000s. Ash testing will be performed in Lāhainā in the near future as EPA completes the hazardous materials removal process (Phase 1). These results will also be publicly released once available. Since homes in the impacted area of Lāhainā were constructed during the same time period, DOH expects that the ash in Lāhainā will have a similar contaminant profile.

Preliminary results from the ash sampling show extremely high levels of arsenic and also high levels of lead and cobalt.

Parameter	Unit	Lab Report #1	Lab Report #2	Lab Report #3	Mean Lab Reports	Soil Environmental Action Level
Arsenic	mg/kg	3,240	3,260	3,080	3,193	23
Cobalt	mg/kg	86	81	89	85	4.7
Lead	mg/kg	640	769	655	688	200

Note that the above results represent testing of concentrated ash and may not be reflective of the exposure to most people due to inhalation or ingestion.

The arsenic levels in the ash are 140-fold higher than DOH's environmental action level for soil and pose a risk to people exposed to it. Of most concern is the possibility of **unintentional ingestion by children** who may get contaminated dust or ash on their hands and then put their hands in their mouths. Inhalational exposure is also possible if the ash is disturbed as transport of the ash outside of the impacted areas may lead to exposure to the contaminated ash in nearby communities.

Contaminants of concern, such as metals like lead or arsenic, adhere to ash and dust that register as particulate matter (PM 2.5). Because of this, air monitoring for PM 2.5 can be used as an indicator for contaminant monitoring. If PM 2.5 measurements are not above typical

baseline levels (remain in the green zone), then potentially toxic ash and dust are very unlikely to be in the air in any measurable amount that would be considered harmful.

Air monitoring is indicative of the general air quality. Cleanup or other activities that disrupt the ash could cause hazardous dust and ash to become airborne in that localized area, creating a hazard. It is important to understand and communicate ash and dust exposure risk and mitigation strategies prior to debris removal (EPA phase 2).

People can monitor real-time air quality at [fire.airnow.gov](https://www.airnow.gov) or by downloading the [AirNow mobile app](#). Additional apps such as [Local Haze](#), [IQAir](#), and [Paku](#) use the same data sources and allow for real-time alerts.

If real-time air monitors in Lāhainā or Kula are yellow, orange, red, or purple (Air Quality Index - AQI above 50), DOH recommends the following to minimize exposure:

- Avoid outdoor activities to reduce exposure and minimize health risks. This is particularly important for children, pregnant people, people with chronic kidney disease and those with chronic respiratory disease like asthma or COPD.
- Stay indoors and close all windows and doors. If an air conditioner is used, set it to the recirculate option.
- If you need to leave the affected area, turn on your vehicle's air conditioner and set it to the recirculate option.

Increases of particulate matter and deterioration of air quality will likely be episodic and short-lived and staying aware of current conditions is important.

DOH, in conjunction with Maui County, DOE, and other state, local and federal partners continues to work to minimize the risk of exposure to the ash. For more details on these efforts, please see [DOH's news release](#) on the ash sampling results from October 15, 2023.

### **PRIMARY CONTAMINANTS:**

**Arsenic** is a metal found in soils in Hawaii due to volcanic geology and arsenic's use as an herbicide in the early 1900s. It is also found in building materials made of sugar cane (Canec) and wood treated for termite control (CCA treated wood). Arsenic can also be found in food such as rice, meats, fish and seaweed and has also been found to be naturally occurring in well water around the world. Long-term, environmental exposure to inorganic arsenic can cause malignant and non-malignant skin lesions and has been associated with cardiovascular disease such as hypertension, peripheral vascular disease (PVD), and diabetes, neuropathy, hepatic fibrosis, anemia, chronic kidney disease and cancers of the skin, bladder and lungs. Levels of arsenic in the ash were very high and pose a potential health risk to people with prolonged exposure to the ash.

**Lead** is a metal that is present in ash due its use in paint on houses built before 1978. Lead is particularly toxic for young children and fetuses as it hinders the development of the brain. Babies and children exposed to lead have trouble with learning, school performance, attention, and other neurocognitive problems. Lead levels in the ash were high and pose a health risk to children and pregnant women who are exposed to ash and dust from the burned areas.

**Cobalt** is a naturally occurring element that is essential for certain functions of the body including the generation of red blood cells. People are exposed to small amounts of cobalt in

food, industrial air pollution, and many cosmetics. Cobalt is also a component in paint, ceramics and many building materials. Excessive and long-term exposure to cobalt can lead to anemia, cardiomyopathy, pulmonary disease and rashes. Cobalt has been evaluated as a possible carcinogen by the International Agency for Research on Cancer (IARC).

**Organochlorine pesticides** were used historically in Hawaii such as chlordane, DDT, dieldrin, and heptachlor. These chemicals were not detected in the ash.

DOH continues to analyze the ash sampling results to assess any potential risks from other contaminants such as polycyclic aromatic hydrocarbons (PAHs), Dioxins, and others.

## **GROUPS AT RISK FOR EXPOSURE TO THE CONTAMINANTS:**

### **People undergoing Re-Entry Visits:**

People disturbing the ash during clean-up activities or “sifting” during re-entry are at highest risk for significant exposure to the toxic contaminants in the ash. DOH strongly recommends:

- People do not use sifters in areas next to inhabited areas during Lāhainā re-entry visits, as the sifters cause ash to become airborne.
- The use of DOH recommended personal protective equipment when in impacted areas and adherence to DOH recommended removal and disposal procedures. Please see [DOH's Re-entry Guidance Fact Sheet](#) for more information on PPE and other ways to mitigate hazards during re-entry.
- Children and pregnant people **absolutely should not** enter impacted areas.
- People with chronic kidney disease and chronic respiratory illness are also at higher risk of health impacts from exposure to the ash and should not enter impacted areas. People who are unable to properly don or wear PPE should also not enter impacted areas.
- People should not eat in impacted areas. Ensure that the spout or top of water bottles are covered and protected from dust.
- Any objects removed from the impacted area must be immediately washed with soap and water.
- People consider the risk of re-entry and thoughtfully decide if the risk of exposure to these contaminants is worth the benefit for them.
- People limit their time in the re-entry zone as much as possible.
- Upon leaving the impacted areas, people should shower and change clothes as soon as feasible to prevent bringing contaminated ash into their homes.

### **Communities Adjacent to Impacted Areas**

Many people remain living in intact homes near the impacted areas. It is possible that the contaminants may have been transported with the ash into their yards and homes. Young children in these communities are at highest risk of exposure due to hand-to-mouth behavior.

Residents in areas near the impacted areas can reduce their exposure by taking precautions such as daily mopping and wet wiping to keep household surfaces free of dust or ash. Residents should pay close attention to the air quality and follow the guidance listed above, especially when winds are high or there is significant ash disruption. Children should not play outside in areas that contain visible ash.

### **CLINICAL EVALUATION:**

Acute toxicity from ash contaminants is unlikely to occur unless there is an extreme exposure, such as someone ingesting spoonfuls of ash. Skin and mucous membrane irritation or rash on areas of direct ash contact may occur. Prolonged exposures to ash contaminants, however, can lead to health impacts at a later date.

For patients that have visible ash and/or other debris on them, they should receive decontamination or be provided with instructions on how to self-decontaminate by showering using soap and putting on clean clothes.

Perform a thorough history including details of a person's exposure to the ash (location and duration), any use of PPE and any current symptoms. Perform a physical exam that includes respiratory and skin evaluation as well as any other body systems that pertain to their symptoms.

If you are concerned about a person's exposure to the ash and its contaminants, the following laboratory tests may be useful for clinical management:

- Complete Blood Count to evaluate for anemia
- Chemistry panel to evaluate kidney function and glucose
- Hepatic panel to evaluate for liver injury.

You may also consider biomonitoring for the potential contaminants of concern (arsenic, lead, and cobalt); however, it is VERY important to understand the limitations of the testing and potential confounders that may lead to a false positive result.

### **BIOMONITORING:**

**ARSENIC:** Arsenic biomonitoring is possible but can be difficult to interpret.

Blood arsenic levels reflect recent exposure (days) and are not useful in a chronic and episodic environmental exposure scenario such as this. Urinary arsenic can reflect a longer-term exposure and may be the most useful for this exposure scenario. Generally, samples from a 24-hour urine collection are the most accurate. However, these samples are difficult to obtain and are subject to environmental contamination. Because of this, a spot or single urine sample with creatinine correction can be useful. A urine creatinine must be ordered with the spot urine arsenic test to allow for the creatinine correction.

**It is important to note** that people may have some arsenic in their urine normally from eating fish and seafood (organic arsenic) and rice and seaweed (inorganic arsenic) or other exposures. These forms of arsenic will confound the results and cannot be distinguished from their exposures to contaminated ash. To help interpret the results, **order an arsenic speciation** on the urine sample. This will tell you how much of the arsenic present in the urine is organic (from fish and seafood) and how much is inorganic (from rice, seaweed and possible ash exposure). If possible, have the patient avoid eating rice, seaweed, fish and seafood for a week prior to the sample collection.

**LEAD:** Blood lead testing is readily available and can be used in all ages to determine lead exposure. Urine lead testing has limited reference ranges, is highly variable and is not recommended. It is important to recognize that lead remains in the body for many years and that there are many sources of exposure in Hawaii. An elevated blood lead level may reflect remote exposure and not recent exposure from the ash. Capillary testing can be used for

screening but false positives are common so elevated capillary lead tests must be confirmed with a venous test. Lead testing in children under 6 years who may have been exposed to ash is recommended based on current CDC recommendations to screen children with a potential lead exposure.

**COBALT:** Cobalt can be measured in the urine however interpretation is difficult and normal reference values are poorly defined. A very high level will indicate significant exposure but correlation with symptoms or illness is poor. A urine cobalt in the “normal range” may reassure some patients but an elevated level could also reflect exposure to other sources of cobalt such as artificial hip prosthesis.

Biomonitoring results can be compared to reference ranges from the CDC’s National Health and Nutrition Examination Survey (NHANES). Repeat testing and ongoing monitoring after behavioral, dietary or exposure changes may be needed.

The body will eliminate these metals over time. Arsenic is eliminated by the kidneys fairly rapidly (most within 5 days and the rest by a month post exposure) although elimination will be delayed in people with chronic kidney disease (CKD), increasing the risk of toxicity. People with CKD or who are on hemodialysis should pay extra attention to avoiding exposure. Lead and cobalt take longer for the body to eliminate.

**MANAGEMENT:**

Overall medical management should be based on the clinical evaluation. Because acute symptoms are less likely from environmental exposure, current signs and symptoms should be evaluated thoroughly to rule out other possible etiologies.

Avoiding any further exposure is the primary method of treatment for people with environmental exposure to these heavy metals. Chelation for lead is available but is only recommended for children with very high blood lead levels (above 45 ug/dL) and adults with even higher levels (>80 ug/dL) and significant neurologic symptoms. Chelation for arsenic is used primarily in acute arsenic toxicity and is unlikely to be useful for patients with chronic environmental arsenic exposure.

Maximizing nutritional status with adequate intake of calcium and iron will help decrease absorption of these metals and enhance elimination.

For additional questions about environmental or toxic exposures related to the Maui Fires, you or your patients can call the Hawaii Poison Center 24/7 at 800-222-1222.

The Hawaii Childhood Lead Poisoning Prevention Program (HI-CLPPP) is also available to answer questions about lead exposure in children at 808-733-9012 or <https://lead.hawaii.gov>.

Sincerely,



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