

Post-Las Conchas Fire Recommendations: How to Prevent Exposure to Fire-related Contaminants Transported through Floodwater

With monsoon season upon us, many may be wondering about last year's Las Conchas Fire and the potential for exposure to contaminants in soil and sediment transported by flood waters and if there are precautions to take.

The Interagency Flood Risk Assessment Team (IFRAT) looked at a variety of scenarios that could result in exposure to flood waters and flood deposits and consumption of produce and fish including:

- 1) Person consumes produce grown in soil with ash from the fire
- 2) Farmer/rancher works in fields with ash from the fire
- 3) Person walks or hikes in floodplain area with deposited sediment containing ash from the burn area
- 4) Person wades in floodwater which has ash from the fire
- 5) Person eats fish from Cochiti Lake, where ash has settled onto lake-bottom sediments

The IFRAT consists of staff members of the New Mexico Environment Department, the New Mexico Department of Health, Los Alamos National Laboratory, and the City of Santa Fe. Each scenario was assessed for the risk of developing cancer and non-cancer health effects following long-term exposure. Samples were collected in 2011 and 2012 to measure contaminant concentrations in soil, sediment, floodwater, and fish ([see map for sampling locations](#)). Average sample concentrations were used to estimate exposure when possible because they represent the most likely exposure concentrations for people. For scenarios 3 and 4, there were enough samples to calculate average concentrations. For scenarios 1, 2, and 5, maximum concentrations were used to evaluate exposure because there were too few samples representing farm soils or fish tissue concentrations. Using maximum observed concentrations ensures that the potential exposure to contaminants associated with these scenarios represents the highest potential exposure.

Specific recommendations are provided below for scenarios where there is evidence that the potential exposure is higher after the fire than before the fire, thereby indicating possible fire-related impacts. Consequently, recommendations are only provided for scenarios 1, 3, and 5. However, it is important to note that everyone should always avoid rapidly rising water levels in arroyos, canyons, or rivers downstream of recent burn areas and be aware of surrounding weather conditions to prevent potential injuries or even death (scenario 4). The recommendations below assume that conditions will stay the same over time. In reality, exposure will decrease as ash is washed downstream and mixed with clean sediment.

Scenario 1: Person consumes produce grown in soil with ash from the fire.

Findings: Long-term consumption of produce may result in excessive exposure to radioactive strontium (strontium-90) and to thallium. Exposure to strontium-90 at these levels may increase the risk of cancer among people consuming produce grown in soil with ash from the fire. Cancers of concern from

strontium-90 exposure include bone tumors or leukemia. Specifically, it is estimated that during a lifetime of exposure at these levels, there would be 5 additional cases of cancer among 100,000 people. Potential health effects from long-term (30 years) exposure to thallium at the levels detected may include hair loss and gastrointestinal and neurological symptoms. However, effects can vary from person to person depending on the amount of produce consumed from the contaminated source, individual body weight, other dietary habits, and individual sensitivities such as preexisting kidney disease and other factors.

Many heavy metals contained in flood deposits from both natural sources and wildfire-ash have the potential to be taken up from the soil and assimilated by plants/crops through root absorption. For example, thallium can be readily taken up and absorbed by the roots of most plants and home-grown fruits such as apples, blackberries, cucumber, black currant, pear, strawberry, tomatoes and green vegetables. Green vegetables and especially brussels sprouts, green cabbage, broccoli, cauliflower, cress, bok choy, celery, parsley, cilantro, and carrots appear to concentrate much higher thallium levels than other plants. Strontium-90 can also be readily taken up and absorbed by the roots of most plants. Radishes, snapbeans, cucumbers, hot peppers, and celery appear to concentrate much higher strontium-90 levels than tomatoes or cauliflower, for example. Animals eating these plants can then accumulate metals in their organs (such as the liver) and/or muscle tissue. Consequently, people could be exposed to heavy metals such as thallium and strontium-90 through ingestion of plants as well as through the meat from animals eating the plants.

Recommendation: Using post-fire ash directly on gardens or farm fields is not recommended because plants could concentrate ash contaminants to levels potentially unhealthy for long-term human consumption.

Scenario 3: Person walks or hikes in floodplain area with deposited sediment containing ash from the burn area.

Findings: Frequent walking or hiking (2 hours per day, 200 days per year) in areas with ash from the burn area may result in excessive exposure to cesium-137. It is common for cesium-137 to occur in surface soils and forests due to global fallout from past nuclear testing. As a result of fires, cesium-137 can concentrate in ash. Exposure to cesium-137 at these levels may increase the risk of cancer among people who frequently walk or hike in floodplain areas with deposited sediment containing ash from the burn area. Although no specific cancers have yet been attributed to cesium-137 itself, the radioactive decay associated with cesium-137 has been associated with leukemia, breast cancer, and tumors of the testes and thyroid. Specifically, it is estimated that during a lifetime of exposure at these levels, there would be 2 additional cases of cancer among 100,000 people.

Recommendation: Limit the amount of time walking or hiking in a floodplain area where deposits containing ash from burn-area runoff is present at the surface to less than 2 hours per day, 200 days per year (or less than 400 hours per year).

Scenario 5: Person eats fish from Cochiti Lake, where ash has settled onto lake-bottom sediments.

Findings: Long-term consumption of fish from Cochiti Lake may result in excessive exposure to mercury. Although arsenic levels were higher post-fire, the form of arsenic that is normally present in fish is not

expected to result in health problems at the levels of arsenic measured in fish tissue. In contrast, potential health effects from exposure to the form of mercury in fish at the levels detected may include neurological effects in newborns and children. Both arsenic and mercury are known to occur in the Cochiti basin. Fish samples taken shortly after the fire by Los Alamos National Laboratory indicated that arsenic and mercury concentrations increased. There are already advisories for consuming a variety of fish in Cochiti Lake based on data from 2006 and older. The results of the fish samples taken after the fire do not change the fish consumption guidelines in the advisory for Cochiti Lake. However, over time the concentration of mercury can increase in fish which may affect future fish consumption guidelines for Cochiti Lake. For more information about limits on fish consumption, please see:

<http://www.nmenv.state.nm.us/swqb/advisories/> and

https://nmtracking.unm.edu/environ_exposure/fish/

Recommendation: Follow the fish consumption advisories currently in place for Cochiti Lake.

