



WILDFIRE IMPACTS ON SURFACE WATER QUALITY FREQUENTLY ASKED QUESTIONS

Past experience from major wildfires provides a clear pattern of water quality changes that result from wildfire in ponderosa pine and higher elevation conifer forest fires in New Mexico. Based on our experience with these fires we provide the following responses to frequently asked questions.

WHAT WILL HAPPEN WHEN IT DOES RAIN?

Some of the biggest concerns after a fire are erosion, landslides, and flooding in areas where the vegetation that once stabilized the soil has been destroyed by fire. The U.S. Forest Service and other state and federal agencies typically evaluate the conditions and stability of watersheds and implement measures to reduce the immediate harmful impacts of landslides, flooding, water pollution, and other hazards.

WHAT KINDS OF CONTAMINANTS OCCUR IN ASHY WATER?

Runoff from areas burned by wildfire contains mostly natural sources of contaminants that were present in the forest overstory, understory, and litter before the fire. Fires function to concentrate these contaminants in the ash. In areas impacted by wildfire these contaminants become more mobile and as a result their concentrations in the stream increase. This includes sediment from unprotected soils, metals, radionuclides originating from historic above-ground nuclear testing, and nutrients in ash from burned vegetation. Pulses of alkaline ash slurry with high levels of ammonia have been known to result in fish kills. The increase in sediment may be accompanied by increased levels of metals contained naturally within the soil. Radionuclides (gross alpha emitters) found naturally in soils as well as throughout the west as a result of fallout of cesium-137 and strontium-90 from nuclear testing in the 1950's and 60's may be released with eroded soils and from burned above-ground biomass. Another significant human source of contaminants is phosphate-based fire-retardant chemicals used to fight wildfires. The use of fire-retardant chemicals typically produces localized and temporary increases in phosphorus, nitrogen (including ammonia), carbon, and sulfur, which can be toxic to fish and other aquatic life and fertilize noxious weeds and aquatic plants.

HOW WILL THE CHANGES IN WATER QUALITY IMPACT HUMAN HEALTH?

The Interagency Flood Risk Assessment Team (IFRAT) collected environmental samples following the 2000 Cerro Grande Fire and the 2011 Las Conchas Fire, had them analyzed for contaminants, validated and analyzed the data, then conducted a risk assessment using both average and maximum values to determine impacts to human health. In general, the results indicated that ash from forest fires tend to concentrate metals and nuclear fallout contaminants (radionuclides); however ash and contaminants in ash are expected to be flushed from the affected areas within two years' time. During the time immediately following a wildfire, it is best to limit your exposure to soil, sediments, and water containing ash. After the first few runoff events from a burned area following a fire, there is relatively minor risk of exposure to contaminants from activities such as irrigation, swimming, wading, or hiking in the floodplain. The one significant exception is using ash as a soil amendment which, because of the concentrated levels of ash exposure, may lead to an unacceptable human health risk (see answer to next question for more information).

CAN I IRRIGATE MY CROPS WITH THE BLACK ASHY WATER?

Yes. Following the Las Conchas Fire, NMED sampled soil in alfalfa fields that were irrigated with "black water" (ash laden) and observed measured concentrations of most constituents to be within the range

of previously measured values. In other words, the soils irrigated with ash water were not distinguishable from soils irrigated with normal, non-ashy water. Risk assessment studies found no measurable increase in human health risk caused by irrigation with ashy water. However, it should be cautioned that the risk assessment studies did find that directly applying ash or muck to soils, for example as a garden or soil amendment, increased human health risk over acceptable levels (1 cancer in 100,000 people) due to elevated strontium-90; therefore 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.

CAN LIVESTOCK DRINK ASHY WATER?

Based on the information NMED has, livestock consuming ash laden water does not appear to be a health risk to either the animals or subsequently to humans (after consumption).

CAN CHILDREN SWIM IN THE ASHY WATER?

Based on our past experience and studies of the Cerro Grande and Viveash Fires – which is considerable – the answer is “yes.” The risk assessment effort the Department led after Cerro Grande found swimming in fire-impacted waters did not increase human health risk over acceptable levels (1 cancer in 100,000 people). With that said, NMED recommends caution when swimming in any waterbody when it contains stormwater runoff. *E. coli* bacteria tend to be highest during storm events (when ash is also likely to be present). Water quality data indicate that many waters in New Mexico have elevated levels of *E. coli* bacteria during periods of stormwater runoff. Because of this the “primary contact” use (e.g. swimming or any other activity with significant risk of ingestion) should be considered “impaired” during these periods indicating an increased risk for illness if ingestion of this water occurs.

IS THERE ANY DANGER FROM THE SMOKE AND ASH TO FISH AND WILDLIFE?

The primary impacts to fish and wildlife will be from stormwater runoff entering streams and lakes from burned areas. The runoff may carry extra sediment and ash, which can kill aquatic life by robbing the streams of oxygen, damaging gills, and smothering habitat. Fires also release pollutants that are normally found in soil and in living and decaying plants that are washed into streams and lakes either through runoff or transported through the air in smoke and ash.

WHAT EFFECT WILL THE FIRE (ASH AND SMOKE) HAVE ON THE LAKES AND STREAMS?

After a fire there are concerns about streams flooding when burned areas receive heavy rainfall because vegetation and forest litter that once slowed runoff are gone. Soil surfaces that get very hot can also become water-repellant. Peak flows downstream of burned areas can increase by one to two orders of magnitude as a result, while the watershed recovers. This effect is most pronounced within about ten miles downstream of a burned area, and is attenuated with distance downstream. Sediment and ash from burned slopes end up in streams, rivers, and lakes, and stream channels that developed under a less intense flood regime will erode to accommodate the new peak flows, contributing still more sediment downstream. Where valley slopes become more gentle, sediment may settle and pile up, causing the stream to change course and damage infrastructure. Watershed erosion processes generally return to background levels within three to five years after the fire, but the accumulated sediment can take substantially longer to export.

CAN I EAT THE FISH IN WATERS IMPACTED BY WILDFIRE?

Fish absorb contaminants slowly throughout their lives and not rapidly under acute, adverse conditions such as wildfires. As such, the impact of the fire will have no direct impact on whether a fish taken from ash laden water might be hazardous to your health. Following the established fish consumption advisories for the waterbody is highly recommended. For more information on fish

consumption advisories in New Mexico (not related to wildfires), please visit SWQB's website: <https://www.env.nm.gov/surface-water-quality/fish-consumption-advisories>.

IS THERE ANY DANGER TO AQUATIC ENVIRONMENTS FROM THE FIRE RETARDANTS?

Fire retardant chemicals can have adverse impacts on water quality and ultimately on fish and other aquatic life. The retardants can cause fish kills if applied directly over lakes and streams. This is because ammonia is in many of the retardants and is very toxic to aquatic life. Retardants may also contain large quantities of nitrogen and phosphorus which if flushed into a stream or lake can cause algal growth that uses up all the oxygen in the waterbody. If the retardant has not been sprayed directly over lakes and streams, the possibility of runoff will depend largely on the amount of rainfall, the steepness of the terrain, and the size of the receiving stream or lake. In light of these potential adverse effects, the U.S. Forest Service has published an *Implementation Guide for Aerial Application of Fire Retardant* available at <https://www.fs.usda.gov/managing-land/fire/chemicals>. The *Guide* includes directions for the development of aerial fire retardant avoidance maps for each National Forest, available at https://ftp.nifc.gov/public/base_info/retardant_avoidance_areas/Maps.

IS THERE ANY DANGER TO HUMANS OR ANIMALS FROM THE FIRE RETARDANTS?

Fire retardants are fire-suppression chemicals used to slow or smother wildfires. Most of the ingredients in these products are common chemicals found in fertilizers (ammonia, nitrate and phosphate), household cleansers, soaps, cosmetics and paints. Generally, exposure to retardants results in minimal problems for humans. The usual complaints are of mild skin and eye irritation. These chemicals also have limited direct impacts on wildlife, but like any fertilizer applied to the landscape, fire retardants can encourage the growth of undesirable noxious weeds and shrubs and may contaminate ground and surface water.