Health Consultation

Wood Debris Fire

Queen Creek, Pinal County, Arizona

Prepared by

Arizona Department of Health Services
Office of Environmental Health
Environmental Health Consultation Services

Under Cooperative Agreement with the Agency for Toxic Substances and Disease Registry (ATSDR)

Introduction

A massive pile of wood debris caught fire and burned from October 27 to October 31, 2001, in northern Pinal County, Arizona. The fire consumed wood debris from citrus trees that had been stored in an approximately 25-acre area in Pinal County near the Queen Creek area. The pile of wood debris was approximately 5 feet deep.

The fire generated a large quantity of smoke. Persons reported smelling the smoke up to 40 miles away from the fire. Meteorological conditions during the fire intermittently created conditions that limited lift, especially at night, causing smoke to settle in residential neighborhoods in the Queen Creek area. The Arizona Department of Health Services issued public health advisories for the evenings of October 29 and 30.

This report summarizes the events that occurred during the fire and analyzes the data collected by the Arizona Department of Health Services and the Arizona Department of Environmental Quality to determine the extent of the public health threat from the fire.

Background

The fire began on the morning of October 27, 2001, at a wood debris storage area on vacant land located south of Empire Blvd and east of Ellsworth Road in Queen Creek, Arizona. The fire consisted of burning debris from citrus trees that had been stored in an approximately 25-acre area at the site. The pile of wood debris was approximately 200 yards wide, 400 yards long, and 5 feet deep.

The Rural Metro Fire Department responded to the fire around noon on October 27, 2001. The firefighters decided that the best strategy was to watch the fire burn itself out and to prevent it from spreading to other areas.

At 8:00 am, on October 29, staff from the Arizona Department of Health Services and the Arizona Department of Environmental Quality began receiving calls from citizens complaining about the smoke. A hazardous materials officer from the Arizona Department of Environmental Quality and staff from the Arizona Department of Health Services arrived at the scene in the morning. A large quantity of smoke was seen rising from the wood, shifting directions, and intermittently settling in nearby neighborhoods.

The Rural Metro Fire Department conceded that the fire was overwhelming their resources at approximately 10 a.m. on October 29. Pinal County then took responsibility for fighting the fire and added additional resources in an attempt to extinguish the fire.

As a result of the levels of respirable particulate matter (PM10) measured and the expectation that there would be higher particulate levels during the evening, the Arizona Department of Health Services issued a health advisory for the Queen Creek area for October 29. The media release recommended that

persons remain indoors during the night and shut their windows. Persons with respiratory problems in the Queen Creek area were urged to see their physicians if they had symptoms. It also suggested that those with respiratory problems in the smoky area should consider finding an alternative place to sleep.

ADHS staff contacted local schools to communicate health risks, provide safety advice and assess the public health impact of the fire. Contact was made with the Queen Creek School District, Ben Franklin Charter School, the Florence School District, the Higley School District and the Chandler School District. School personnel were advised to keep children inside when smoke was present. School personnel reported complaints of haze and odor. Some children with asthma were reportedly sent home.

The firefighting efforts continued into the morning of October 30 with some success. However, additional resources were needed, and that afternoon the Arizona State Land Department, at the request of the Governor, brought more firefighters and resources to fight the fire. While significant progress had been made putting out the fire by the afternoon, there was sufficient smoke in the area. Therefore, the Arizona Department of Health Services to declared another public health advisory for the evening of October 30. The American Red Cross of Arizona activated a shelter for people being impacted by the smoke on Tuesday night, but nobody went there for assistance.

The firefighters worked throughout the night and by the morning of October 31, approximately 60 % of the fire had been contained. It was officially extinguished at 3:30 p.m. on October 31.

Methods

This public health evaluation was prepared using PM-10 air sampling data collected by the Arizona Department of Environmental Quality and observations made by Arizona Department of Health Services staff during the event.

This report evaluates environmental sampling data by comparing the PM-10 analytical results to established screening levels and data in the scientific literature to determine the magnitude of the public health threat from the fire. The primary screening values used to evaluate the particulate matter were the United States Environmental Protection Agency Ambient Air Quality Standards and Emergency Episode Levels and the World Health Organization Health Guidelines for Vegetation Fire Episodes.[1]

Air Sampling Data

The Arizona Department of Environmental Quality, Hazardous Air Response Team arrived at the scene at approximately noon on October 29. The team set up monitors to quantify respirable particulate matter (PM-10) levels at several locations in the area. Afternoon PM-10 readings in residential areas 1 mile from the fire ranged from 70 micrograms per cubic meter ($\mu g/m^3$) to 176 $\mu g/m^3$.

Daytime transient PM-10 levels were exceeding the United States Environmental Protection Agency 24 hour standard for PM-10 of 150 $\mu g/m^3$ and the World Health Organization Health Guidelines for Vegetation Fire Episodes. Meteorologists at the scene suggested that they expected winds to calm in the evening, increasing PM-10 levels in the neighborhoods within a 3-mile area of the fire.

Consistent with the meteorological predictions, smoke from the fire settled in neighborhoods in the Queen Creek area during the evening of October 29. The sampling team observed that PM-10 concentrations frequently changed by several hundred ug/m^3 within minutes. A reading in the Orchard Lane neighborhood (located about one-half to three-fourths of a mile north of the fire) at 12:30 am was 70 $\mu g/m^3$. The concentration at the same location 15 minutes later was 251 $\mu g/m^3$. Readings along Achilles Way ranged from 348 $\mu g/m^3$ to 418 $\mu g/m^3$ in a five-minute period at approximately 12:50 am. Readings at the corner of Achilles Way and Empire Boulevard ranged from 1,698 $\mu g/m^3$ to 2,156 $\mu g/m^3$ in a 5-minute span at approximately 1:10 am. PM-10 concentrations in these ranges were consistent throughout the night.

The concentrations of PM-10 in the neighborhoods near the fire fell as wind picked up and atmospheric mixing increased on the morning of October 30. PM-10 concentrations in Queen Creek were generally in the 100 to 200 $\mu g/m^3$ range throughout the day on October 30.

Queen Creek PM-10 Levels - October 29th and 30th, 2001

	Measured PM-10 Range ($\mu g/m^3$)	24-Hour USEPA Standard ($\mu g/m^3$)	24-Hour USEPA Alert ($\mu g/m^3$)	1-Hour WHO Alert Stage Guideline ($\mu g/m^3$)
Transient Daytime PM-10	70 – 176	150	350	400
Transient Nighttime PM-10	70 – 2,156	150	350	400

Discussion

Wood smoke is a complex mixture of substances produced during the burning of wood. The major emissions from burning wood are particulate matter, carbon monoxide, and organic gases. Because the particles in wood smoke are too small to be filtered by the nose and upper respiratory system they wind up deep in the lungs where they can remain for days, potentially causing tissue damage and respiratory health effects.

Exposure to wood smoke is well recognized to cause a decrease in lung function. The occurrence of

respiratory illness in children has been shown to increased with increased exposure to wood smoke. Symptoms include lower respiratory infections and bronchitis. Wood smoke also aggravates asthma, emphysema, and bronchitis. It can also irritate the eyes and can trigger headaches and allergies.

Epidemiological studies have consistently found that prolonged exposure to PM-10 may cause shortness of breath, increases in coughs, aggravation of asthma, decreases in lung function and lung defense mechanisms, chronic obstructive pulmonary disease, and increased rates of hospitalization for respiratory and cardiovascular illnesses.[2-13]

Wood smoke containing particulate matter was intermittently present in the residential neighborhoods within a 3-mile radius of the fire. The concentrations of PM-10 changed by several hundred $\mu g/m^3$ in minutes. Measurements on residential neighborhoods approximately 1 mile from the fire at night ranged from 70 $\mu g/m^3$ to 2,156 $\mu g/m^3$. Readings in the 200 to 300 $\mu g/m^3$ range were common at night when atmospheric mixing was at a minimum. People in the neighborhoods were generally in their homes during this time.

Particulate matter infiltrates into the indoor air of homes even when doors and windows are shut. The amount of PM-10 infiltrating indoors depends on how air-tight the home is and the average outdoor particle concentration. Particle size also influences infiltration rates since larger particles stick to surfaces more readily than smaller particles. Since average PM-10 concentrations are not known, and because of the variability in the infiltration rate of homes depending on their structure and operation, it is impossible to determine what the concentrations of particulate matter may have been in area homes during the fire.

The outdoor PM-10 concentrations at night were sufficient to result in a transient decrease in lung function. Plausible symptoms in area residents include cough, other lower respiratory symptoms, and possibly aggravated asthma symptoms.

The concentration of PM-10 was lower during the day than at night on October 29 and 30, however, human activity and outdoor exposure to the particulate matter increased during the day. These factors increase exposure and the potential for health effects.

The data collected during the investigation suggest that the smoke likely caused an increase in respiratory problems in some area residents of Queen Creek consistent with wood smoke inhalation, suggesting that the fire represented an acute (short-term) public health hazard.

Child Health Initiative

ATSDR=s Child Health Initiative recognizes that the unique vulnerabilities of infants and children demand special emphasis in communities faced with contaminants in air. Children are

more likely to be exposed because they play outdoors. Their developing body systems of children can sustain permanent damage if toxic exposures occur during critical growth stages.

Furthermore, children, even those without pre-existing illness or chronic conditions, are susceptible to air pollution because their lungs are still developing, and they are often engaged in vigorous outdoor activities, making them more sensitive to pollution than healthy adults. Studies have shown that in children, particulate pollution is associated with increased episodes of coughing and difficulty breathing, and decreased lung function.

Children, particularly those with asthma, were likely among the most affected persons during the wood debris fire.

Conclusions

The ADHS finds that the smoke likely caused an increase in respiratory problems in some Queen Creek area residents, consistent with wood smoke inhalation, suggesting that the fire represented an acute (short-term) public health hazard.

Recommendations

No further recommendations are indicated at this time.

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Certification

This Wood Debris Fire Health Consultation was prepared by the Arizona Department of Health Services under cooperative agreement with the Agency for Toxic Substances and Disease Registry. It is in accordance with approved methodology and procedures existing at the time the health consultation was initiated.

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The Division of Health Assessment and Consultation (DHAC), ATSDR, has reviewed this health consultation and concurs with its findings.

Chief, SSAB, DHAC, ATSDR

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NEWS RELEASE

FOR IMMEDIATE RELEASE – October 30, 2001

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Health Advisory for Queen Creek Area Remains In Effect

The Arizona Department of Health Services is issuing a public health advisory for the Queen Creek area today due to overnight air quality readings that indicate the potential for adverse health effects due to smoke from a large wood chip fire in the area that erupted Saturday.

A public health advisory is triggered when particulate levels reach 350 micrograms per cubic meter (ug/m^3). The particulate matter levels measured last night by the Arizona Department of Environmental Quality were consistently above 350 ug/m^3.

"We anticipate that wood smoke and particulate matter from the fire will increase again tonight due to forecasted calm winds and cool temperatures. Last night's readings were high enough to potentially cause health problems in people, particularly those with pre-existing conditions such as asthma," said Will Humble, office chief of the ADHS Environmental Health program. "People that live in the smoky area should stay indoors and close their windows to reduce exposure, or find an alternative place to stay tonight. "

The Department has contacted schools in the affected area and advised them to restrict students' time outdoors until the smoke clears.

Itchy eyes, cough, runny nose and upper airway irritation are typical symptoms of short-term exposure to smoke. Other potential health effects include headache, dizziness and nausea. The Department advises residents to consult a physician if physical symptoms are severe or continue beyond several days.

The smoke in the area is originating from a 25 acre pile of wood chips that is burning at the corner of Ellsworth Rd. and the Hunt Highway.

For more information, contact the ADHS Office of Environmental Health at (602)230-5830.

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