

Yakama Reservation Air Exposure Investigation

A Summary of Findings

The Yakama Reservation, located in south-central Washington State, is home to many large dairy and beef animal feeding operations (AFOs). Community members, advocates, and the U.S. Environmental Protection Agency (EPA) asked ATSDR to investigate air quality on the Reservation. ATSDR conducted an exposure investigation (EI) near the town of Harrah on the Yakama Reservation to determine the community's exposure to contaminants related to AFOs and review data on the general air quality in the region.

The investigation measured the following harmful contaminants in air: hydrogen sulfide, ammonia and two sizes of dust – that is particulate matter less than 2.5 micrometers ($PM_{2.5}$) and less than 10 micrometers (PM_{10}). See Box 1 for a description of PM.

This is a summary of the ATSDR report. The full report is available online here: <https://www.atsdr.cdc.gov/HAC/PHA/HCPHA.asp?State=WA>.

Community Concerns

Community members asked for air monitoring because they were concerned that air emissions from AFOs on the reservation might pose health risks to the community, especially to children. People also expressed concern about environmental odors and odor-related symptoms.

Exposure Investigation

What did ATSDR do?

ATSDR met with local stakeholders in 2014 and 2015 to decide which pollutants to measure at which locations and when. We set up nine air monitoring locations close to AFOs at residential and commercial locations, and at the Harrah elementary school. We monitored for $PM_{2.5}$ and PM_{10} , hydrogen sulfide, and ammonia over two 8-week time periods – October to December 2014 and June to August 2015. ATSDR also collected weather data to better understand how local weather effects the levels of pollutants in the area. We also reviewed:

- Findings and recommendations from other air monitoring efforts in the area;
- The latest community health outcome data that may be related to exposure to $PM_{2.5}$.

We compared the measured concentrations with health comparison values from ATSDR, the World Health Organization, and the U.S. EPA. When measurements were higher than health comparison values, we compared the measured concentrations to documented health effect levels from scientific literature.



Photo of air monitoring equipment near Harrah.

The Bottom Line:

We found unhealthy levels of dust in the air near the town of Harrah on some days. Levels of ammonia and hydrogen sulfide were below harmful levels, but hydrogen sulfide was above the odor threshold.

Sensitive individuals – children, older adults, and people with heart or lung disease – are at greater risk for health issues from exposure to dust in the area. Health issues could include breathing problems, asthma symptoms that get worse, and increased risk of heart disease including heart attacks.

Odors are not expected to harm people's health in the general population, but some individuals may experience odor-related symptoms.



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What did ATSDR find?



Finding 1 – Daily exposures to air with the maximum concentrations of PM_{2.5} at each sampling location in the Harrah area, could harm people’s health. Sensitive individuals, including children, older adults, people with heart or lung disease, and people with asthma, are most at risk.

We calculated 24-hour averages for PM_{2.5} from the measured data. We used the highest 24-hour value to assess short-term exposure. This value exceeded safe levels according to the known acute comparison value. Across all sites sampled, on 280 of 714 days (39%), PM_{2.5} was measured at levels that could potentially harm some sensitive individuals. On 3 days, levels of PM_{2.5} were high enough to harm the general population. See Box 2 for a description of comparison values.

Short-term exposures to elevated levels of PM_{2.5} can cause irritation to the eyes, nose, and throat; coughing; phlegm; chest tightness and shortness of breath; unusual fatigue; palpitations, and increased risk of heart attacks.

Next Steps

Because of the presence of unhealthy levels of dust in the air on some days, ATSDR recommends the EPA and the Yakama Nation consider long-term efforts to reduce and monitor PM_{2.5} in Harrah and other areas on the Reservation that may have elevated concentrations of PM_{2.5}. This monitoring could help forecast air quality in the future.



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Finding 2 – We need more information to determine whether breathing the average measured concentrations of PM_{2.5} in the Harrah area long term (for one year or more) could harm people’s health.

We used the 24-hour average to assess long-term exposure to PM_{2.5}. The 24-hour average exceeded the chronic comparison value at all sites during the winter sampling.

Since EIs are not designed to be long-term studies, we could not evaluate health effects related to long term exposure (exposure more than 1 year) because our air sampling was only for 16 weeks. But if the existing data represent chronic conditions in the Harrah area, long-term exposure to the average PM_{2.5} concentrations at each sampling location could harm people’s health.

Next Steps

Because more information is needed to determine risk from long term exposure to PM_{2.5}, ATSDR recommends the EPA and the Yakama Nation consider long-term efforts to reduce and monitor PM_{2.5} in Harrah and other areas on the Reservation that may have elevated concentrations of PM_{2.5}.



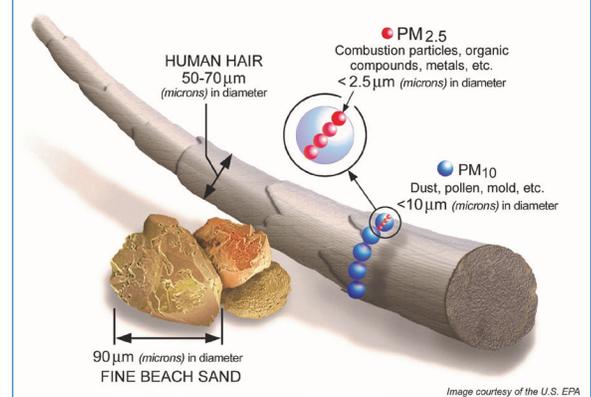
NO HEALTH
HAZARD

Finding 3 – Breathing PM₁₀ in the Harrah area is not expected to harm most people in the general population. However, some sensitive individuals may experience respiratory effects or aggravation of existing heart-lung disease when breathing the highest measured concentrations of PM₁₀ dust in the Harrah area.

Box 1. What is PM?

PM stands for *particulate matter*, another term meaning dust. Particulate matter is described by the size of the particles in units called *microns*, also called *micrometers*. The abbreviation is μm . In this investigation, we measured PM_{2.5} and PM₁₀. These particles are 2.5 microns and smaller, or 10 microns or smaller. For comparison, a human hair is 50 – 70 microns across.

The size of the particles is directly linked to their potential for causing health problems. PM₁₀ can pass through the throat and nose to enter the lungs, but PM_{2.5} can penetrate more deeply in the lungs and lead to higher toxicity.



We calculated 24-hour PM₁₀ averages from the measured data. The highest 24-hour value was used to assess short-term exposure. The highest day measured was below the most relevant acute comparison value, thus PM₁₀ concentrations are not expected to harm the general public.

The average 24-hour value was used to assess long-term exposure. The 24-hour average was nearly equal to the chronic comparison value which is a concentration in air that is unlikely to cause harmful health effects in people. Thus, PM₁₀ exposure is not expected to harm the general population.



**NO HEALTH
HAZARD**

Finding 4 – Breathing ammonia in the Harrah area is not expected to harm people’s health.

We calculated 30-minute ammonia averages based on measured data and compared them to an acute exposure comparison value for ammonia. None of the measurements were higher than the comparison value for short-term exposures (up to two weeks long).

We estimated chronic exposure based on the average measured at each site over the entire EI. None of the measured averages were higher than our comparison value for long-term exposures (greater than one year).

Thus, we do not expect adverse health effects from short- or long-term exposures to ammonia.



**NO HEALTH
HAZARD**

Finding 5 – Breathing hydrogen sulfide in the Harrah area is not expected to harm people’s Health.

We calculated 30-minute hydrogen sulfide averages from the measured data and compared them to an acute exposure comparison value for hydrogen sulfide. None of the measurements were higher than the comparison value for short-term exposures (up to two weeks long).

We detected hydrogen sulfide in half of the samples. The average measured at three locations exceeded the comparison value (1.4 ppb) for long-term exposures (greater than one year). The averages at these sites ranged from 1.50 to 1.61 parts per billion (ppb). These averages were nearly equal to the long-term comparison value, which is set at a level that is unlikely to cause harmful health effects. Thus, we do not expect adverse health effects from short-or long-term exposure to hydrogen sulfide.



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Finding 6 – Odors in the Harrah area are not expected to harm people’s health in the general population, but some individuals may experience odor-related symptoms.

ATSDR recognizes that community members are concerned about environmental odors in the area and whether odors could lead to health effects.

Hydrogen sulfide was measured at levels much lower than levels shown to cause harmful health effects such as irritation of the eyes, nose, or throat. However, the odor of hydrogen sulfide can be detected by people at levels below health effect guidelines. In the Harrah area hydrogen sulfide was regularly measured at levels

Box 2. Comparison Values

For this EI, *comparison values (CVs)* are concentrations of a substance – like ammonia – in air that is unlikely to cause harmful health effects in people who have been exposed to it. Health assessors compare measured amounts of a substance in the environment, or estimates based on measured amounts in the environment, to comparison values. If the amount in the environment is higher than the comparison value, then the health assessor will recommend that the substance be looked at more carefully in the public health assessment process.

CVs are intended to protect the general public from adverse health effects for specific durations of exposure. The maximum measured concentrations are compared to acute CVs, which are designed to protect the public from short-term exposures. The average concentrations are compared to chronic CVs, which protect the public from long-term exposures.

we expect people will be able to smell, that is, it was regularly measured above its odor threshold.

Odor-related symptoms from hydrogen sulfide can include headaches, nausea, and stress in some sensitive individuals. See Box 3 for more information about odor-related symptoms

Next Steps

The EPA and the Yakama Nation may want to consider taking steps to reduce odors from animal feeding operations that affect community members and residents on the Yakama Reservation.

Community members can reduce exposure to odors by:

- Exercising indoors during days with more environmental odors;
- Staying indoors when your allergies, asthma, and/or chronic lung problems are acting up;
- Leaving the area for a few hours if possible.

Is there a relationship between air quality and health outcomes in Harrah?

As part of the public health evaluation process, ATSDR analyzed health outcome data from the Washington State Department of Health's Washington Tracking Network to identify potential health issues in Harrah associated with PM_{2.5} exposures (asthma hospitalizations and mortality due to cardiovascular disease). The 2014 data (most recent) show rates of asthma hospitalizations (in the zip code containing Harrah 98933) and heart disease mortality (in the census tract containing Harrah) are significantly greater than rates in the state of Washington as a whole.

Although these data can give us an overall understanding of the health status in the community, they cannot provide any information on the cause of the health outcomes. The health effects of PM_{2.5} are associated with various other factors that can occur over a person's lifetime, and ATSDR cannot determine if PM_{2.5} was the cause of any specific health outcome. While we cannot ascribe a causal association, PM_{2.5} exposure may be a potential risk factor in your area for the development of certain respiratory health conditions, including the development of asthma.

Next Steps

ATSDR will share the findings of this report with the Yakama Tribal Council, the EPA, the exposure assessment participants, the Indian Health Service and other community members as requested. ATSDR can work with EPA and the Yakama Nation if requested to consider options for reducing exposures in the Harrah area.

How can I learn more about the Yakama Reservation Air Exposure Investigation?

For more details about ATSDR's findings, see our full report "*Health Consultation – Exposure Investigation: Evaluation of Hydrogen Sulfide, Ammonia, Particulate Matter, and Meteorological Measurements Collected During ATSDR's Ambient Air Monitoring/Sampling Program on the Yakama Reservation, Harrah, Washington.*" The full report is available online here: <https://www.atsdr.cdc.gov/HAC/PHA/HCPHA.asp?State=WA>.

If you have questions or comments, call ATSDR's Debra Gable, environmental health scientist, at 206-553-1796 or our toll-free number at 1-800-CDC-INFO.

About ATSDR

The Agency for Toxic Substances and Disease Registry (ATSDR) is a federal public health agency of the U.S. Department of Health and Human Services (HHS). ATSDR works with other agencies and tribal, state, and local governments to study possible health risks in communities where people could come in contact with dangerous chemicals. For more information about ATSDR, visit our website at <https://www.atsdr.cdc.gov/>.

Box 3. Odors and your health

You may have symptoms when exposed to environmental odors, but the symptoms usually go away when the odor is gone.

Not everyone reacts to environmental odors the same way. Some individuals may experience odor related symptoms such as headache, nausea, and stress, which can affect people's sense of wellbeing and reduce their quality of life. See more information at: <https://www.atsdr.cdc.gov/odors/index.html>