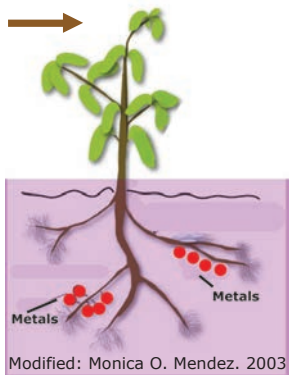


What can be done to **Reduce Exposure** to dust from mine tailings?

- Restrict public access to the mine tailings to reduce entry, and prohibit use of the mine site for recreational purposes (bicycles, motorcycles, and ATVs).

- Implement dust control measures to reduce emissions from mine tailings through:

- watering
- chemical stabilization
- synthetic covers
- phytostabilization*
- vegetative covers and wind breaks



*Phytostabilization is the use of plants to immobilize contaminants like metals in the soil.

- People living in the vicinity of mine tailings can also follow dust control measures:

- use wet mops instead of brooms to clean floors
- dust with a damp cloth
- wash hands after contacting dust (especially children after playing outdoors)
- avoid direct contact with tailings



Want more **Information?**

Arizona Department of Environmental Quality
<http://www.azdeq.gov/>

Agency for Toxic Substances and Disease Registry
<http://www.atsdr.cdc.gov/>

US Environmental Protection Agency
<http://www.epa.gov/ebtpages/airairpollutantsparticulatematterpm.html>
<http://epa.gov/oar/particlepollution/basic.html>
<http://epa.gov/oar/particlepollution/>

National Institute of Environmental Health, Superfund Research Program
<http://www.niehs.nih.gov/research/supported/srp/>

Research Priorities for Airborne Particulate Matter: IV. Continuing Research Progress. Committee on Research Priorities for Airborne Particulate Matter, National Research Council
http://www.nap.edu/catalog.php?record_id=10957

Brought to you by:

The mission of the Binational Center is to resolve environmental and human health challenges along the US – Mexico Border by:

- Providing and supporting environmental science and toxicology training, research, and policy development.

- Facilitating a binational dialogue between investigators and stakeholders concerning risk assessment and remediation problems.

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What are **Mine Tailings?**

Mine tailings are large piles of crushed rock that are left over after metals of interest such as lead, zinc, copper, silver, gold, etc., have been extracted from the rocks that contained them.

The extraction process is only partially efficient and, as a result, a percentage of the desired minerals are left behind in the mine tailings. The extraction process may also concentrate unwanted minerals in the tailings. As a result of the crushing and grinding (milling) processes, the large pieces of rocks are turned into small particles. These fine particles (silty sand-like material) can now easily become suspended in the atmosphere by wind and dispersed throughout the environment as dust particles, which may contain high concentrations of potentially toxic material.

What is **Dust?**

Dust is a generic term used to describe dry particulate matter (PM) suspended in the atmosphere. Dust is formed when fine particles are taken up into the atmosphere by wind or other physical disturbances.



Wind erosion of a mine tailings pile in a typical dry environment. The grey dots are the coarse particles, the smaller purple dots are the fine particles.

Dust continued...

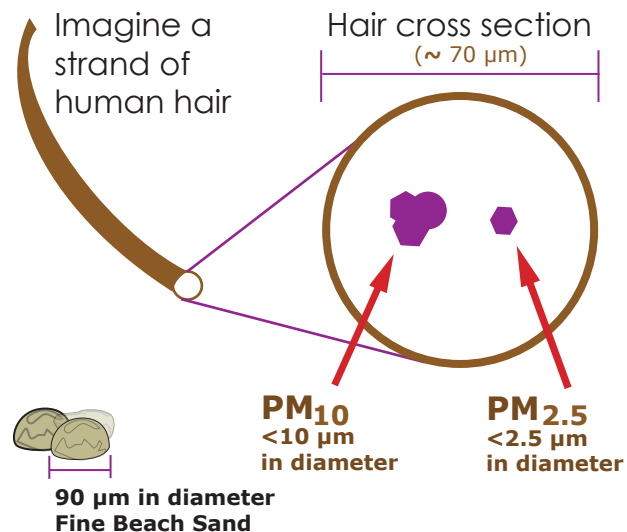
In addition to wind blowing on mine tailings many other mining activities can generate dust, such as the removal of vegetation and topsoil, on-site blasting and drilling operations, use of crushing and screening equipment, construction activities and the driving of vehicles on access and haul roads.

Dust levels are significantly influenced by climatic factors such as rainfall, temperature, and wind. Hot and dry environmental conditions generally result in more dust.

Dust is typically classified according to its particle size:

- **PM₁₀** refers to particles 10 micrometers (μm) in diameter or less (coarse particles).
- **PM_{2.5}** refers to particles 2.5 μm in diameter or less (fine particles).

How small is PM?



Particle size is an important factor influencing the dispersion and transport of dust in the atmosphere and the effects of dust on human health.

How can dust from mine tailings affect your Health?

Dust from mine tailings can affect human health due to its physical characteristics (e.g., small particles are inhaled and deposited into the lungs) and because it might contain a number of potentially hazardous substances. Certain contaminants are more soluble in human fluids and available for absorption by the body (bioavailable) and have a greater potential to be a health concern.

People may be exposed to contaminants in the mine tailings through:

- **dermal (skin contact)**
- **ingestion (swallowing)**
- **inhalation (breathing)**



Skin contact with the contaminants could occur through activities such as playing or gardening in areas with contaminated surface soil or mine tailings. However, skin absorption is limited.

Dust ingestion can occur via hand to mouth contact, drinking water, or through food ingestion (e.g. consumption of food from outdoor vendors or consumption of home grown produce). Contaminants in dust could potentially be absorbed through the intestinal tract. Absorption depends on several factors including solubility of the contaminant and dietary habits of the individual. Poor nutritional status can lead to enhanced absorption.

Dust inhalation is probably the most likely pathway of exposure to the contaminants in mine tailings.



The U.S. Environmental Protection Agency (US EPA) regulates only PM₁₀ and PM_{2.5}. The US EPA has determined that fine particles can pose a risk to human health if they become lodged deep in the lungs. The hazard associated with dust exposure depends on the amount and type of dust inhaled, the duration of exposure, and the overall health condition of the person exposed. Over short periods of time, these fine particles do not pose a serious human health concern. However, individuals exposed to fine particles for long periods of time can develop respiratory disease and sustain lung damage.

Depending on the nature of the ore and mineral processing, dust from mine tailings could contain a number of substances that may pose a health hazard (e.g. lead, arsenic, cadmium, zinc, mercury, etc.).

- **Lead** can have an adverse health impact particularly to the nervous system of children and the unborn.
- Long-term exposure to **arsenic** has been proven to increase the risk of developing cancer and other blood and nerve disorders.
- **Cadmium** can accumulate in the body and cause kidney disease. At high levels, cadmium can damage the lungs.
- Long-term exposure to **zinc** can cause anemia, pancreas damage, and other health problems.
- **Mercury** primarily affects the nervous system, particularly of children and the unborn. It also damages the kidneys and may possibly cause cancer.
- **Selenium** may cause damage to the respiratory tract, gastrointestinal and cardiovascular effects, and irritation of the skin and eyes.