Frack Sand Mining and Processing Health Concerns

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Outline

- What is “fracking”?
- Overview of Risks
- Complexity of Health Risk Assessment
- Sand Mining and Processing
- Particulate Matter
- Crystalline Silica
  - Health effects
- WDNR Non-Regulation of Silica
- Recommendations

What is Fracking?

Oil, gas, and sand mining companies are actively mining and processing sand. This sand is mixed with water and chemicals and injected into wells thousands of meters deep to fracture geologic formations such as shale, in order to remove gas and oil. This process is called 'fracking' or hydraulic fracturing.

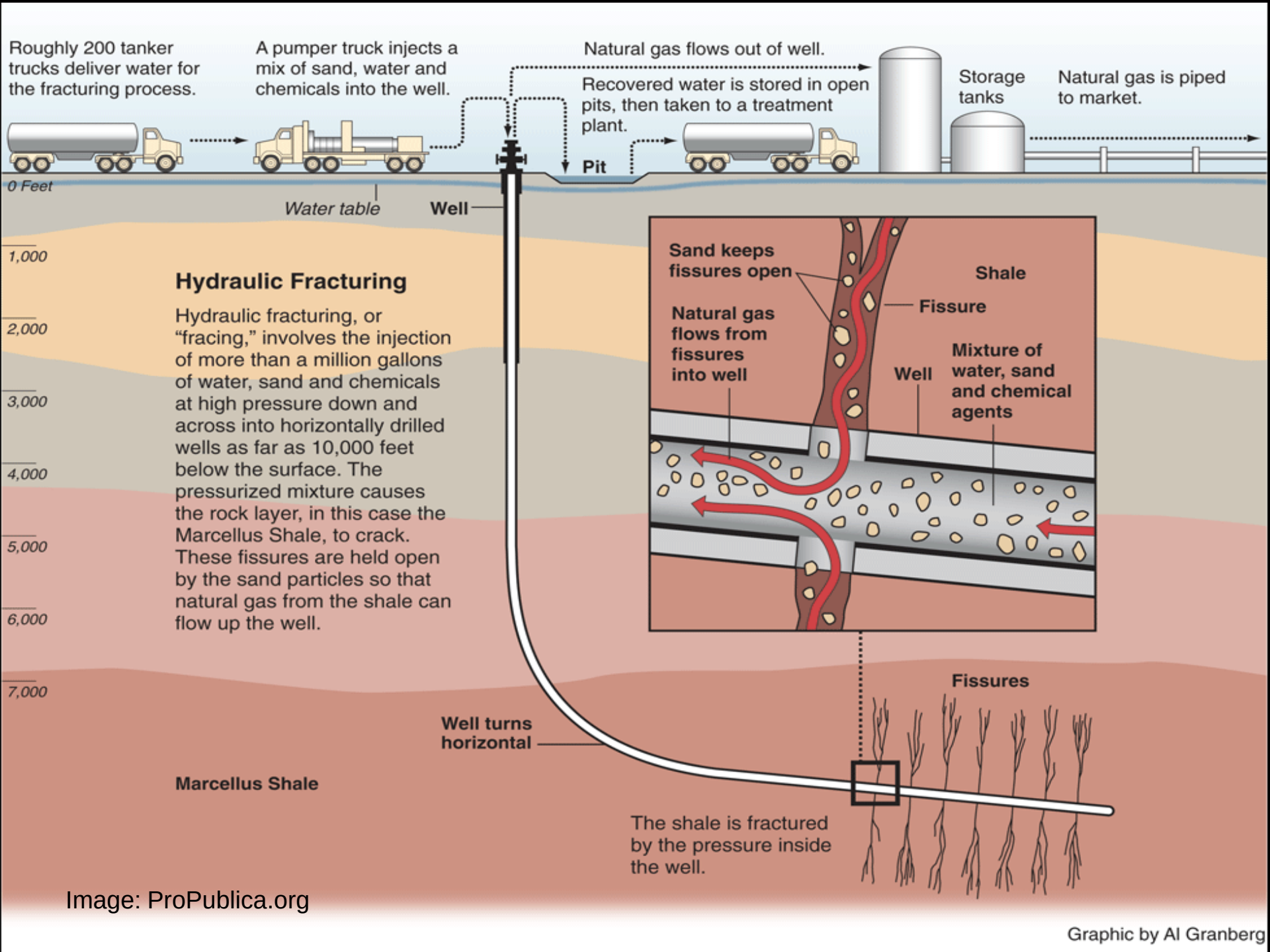


Image: ProPublica.org

Graphic by Al Granberg

- A potential benefit is that methane produces fewer greenhouse gas emissions per unit of energy when used as an energy source compared to coal or oil.
- However, if this methane is released into the atmosphere from drilling or leaking wells, it negatively contributes to climate change

Overview of Health Risks

- Waterborne pollutants that can be ingested.
- **Airborne pollutants that can be inhaled.**
- Noise pollution that can be heard.
- Light pollution that can be seen.
- Wetland loss that affects local water quality.
- Truck traffic that affects road safety.
- Greenhouse gas generation that increases climate change.

Health Risk Estimates are Complex

- Many factors contribute to the potential health risks from an industrial operation:
  - The type and rates of chemicals being emitted to the air, water, and soil.
  - The degree of contact between these chemicals and the public.
  - The way that these chemicals cause short-term and long-term damage to people.

Waterborne Pollutants From Leaking Frack Wells

- A major concern with hydraulic fracturing is the potential for groundwater contamination. This occurs when the chemicals injected into the wells under high pressure to fracture rocks for gas and oil collection leak out.
- Wells and surface waters near hydraulic fracturing operations have been contaminated with chemicals including methane, benzene and radioactive elements.

Opponents: 1,000 Cases of Water Contamination

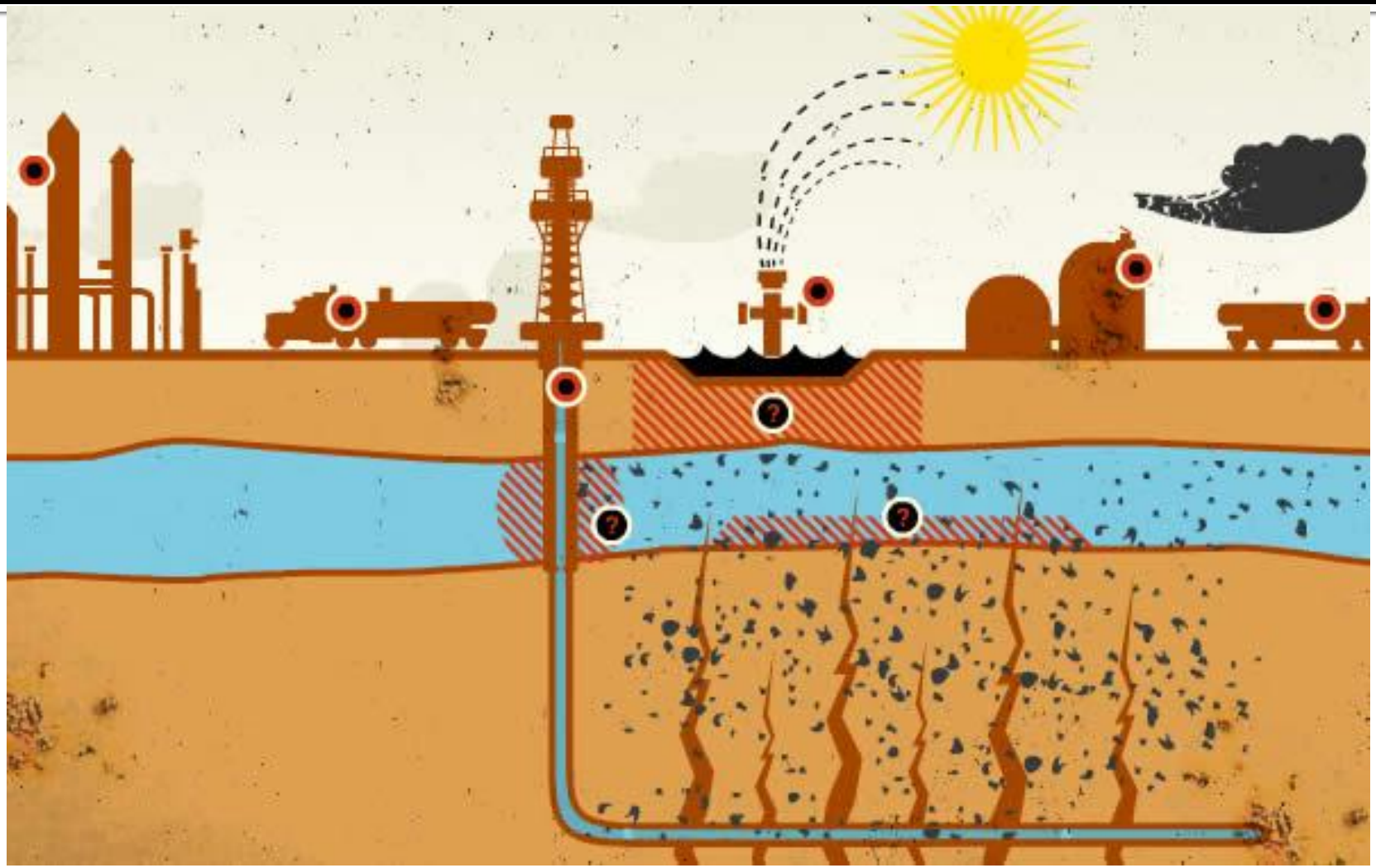


Image: Gaslandthemovie.com

Drillers: Fracking Distant From Water Tables

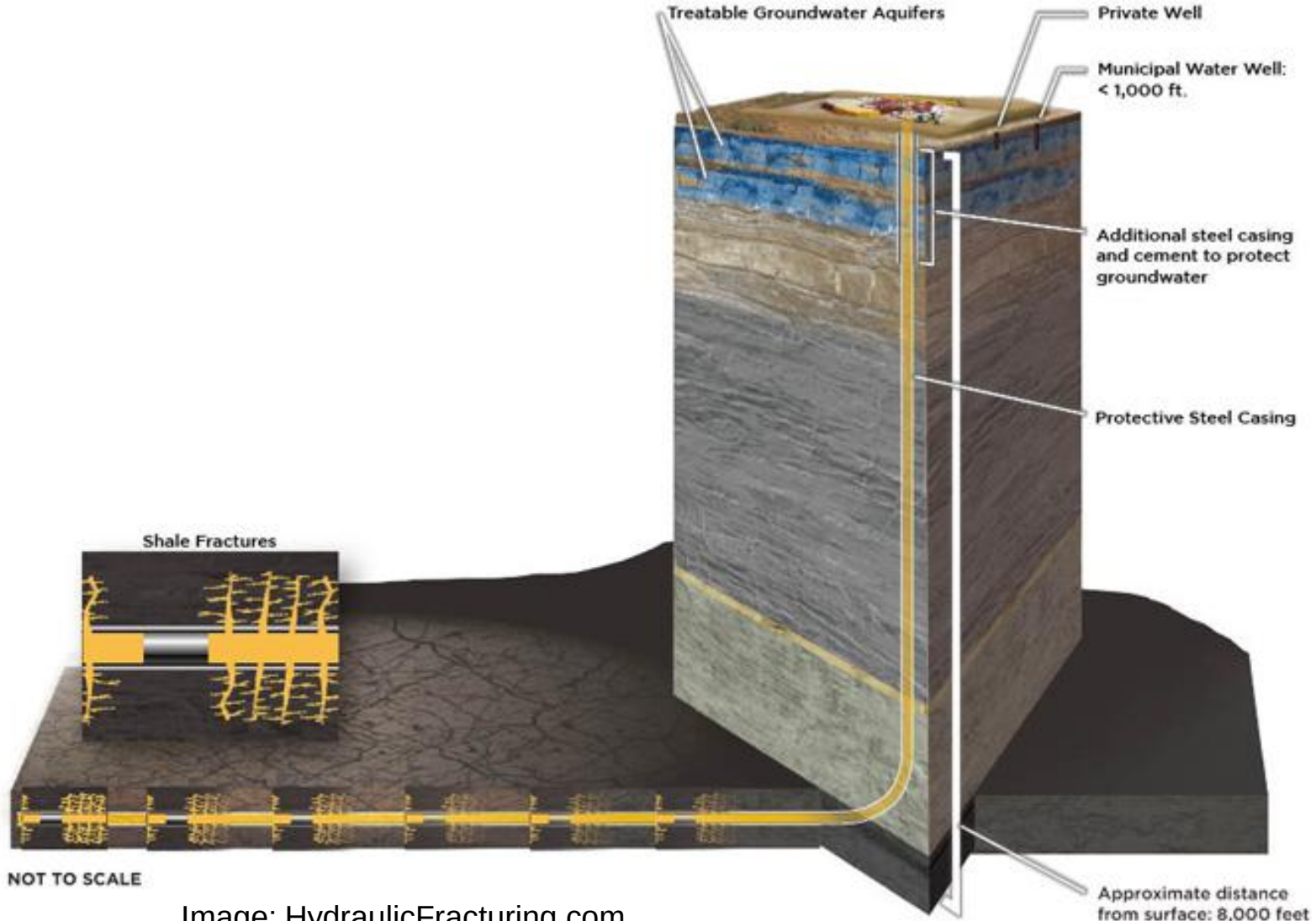


Image: HydraulicFracturing.com

Sand Mining and Processing

- Sand and Gravel Quarry Activities
- Sand Conveying
- Sand Processing Plant
- Hydraulic Fracturing Operation

Chemicals of Concern: Particulate Matter (PM)

- Increased respiratory symptoms, such as irritation of the airways, coughing, or difficulty breathing, for example;
- Decreased lung function;
- Aggravated asthma;
- Development of chronic bronchitis;
- Irregular heartbeat;
- Nonfatal heart attacks; and
- Premature death in people with heart or lung disease.

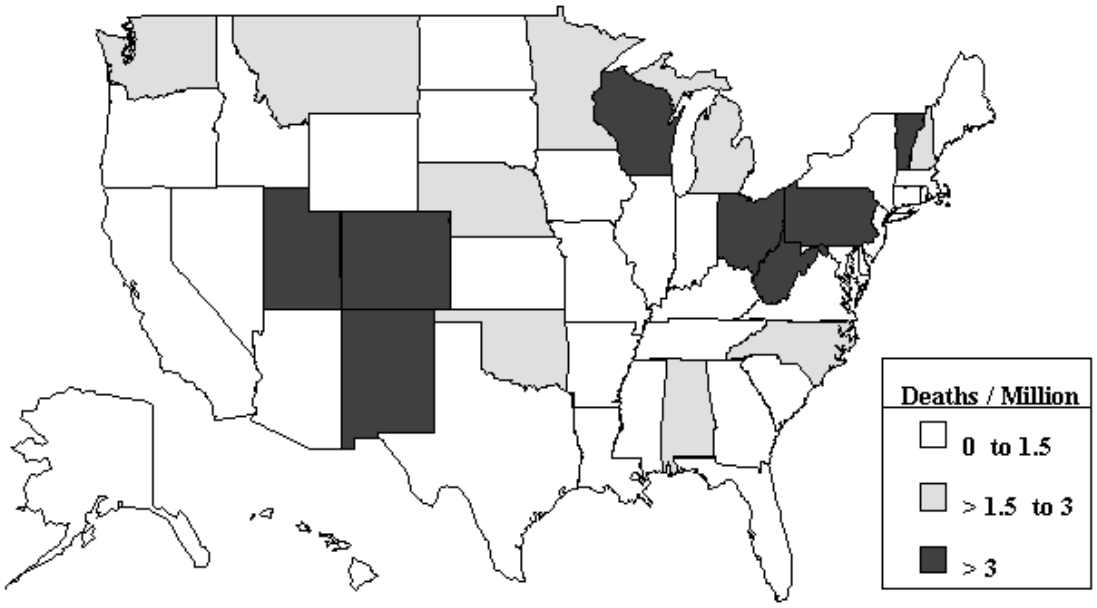
- The mining and processing activities generate PM through blasting, mining, transporting, and processing “frack sand”; and transporting “waste sand.”

Chemicals of Concern: Crystalline Silica

Health Effects

- Silicosis –a fibrosis (scarring) of the lungs. Silicosis is progressive and leads to disability and death.
- About 200 people in the US will die this year due to workplace exposure to silica (NIOSH 2008).

- **Silicosis: Crude mortality rates by state, U.S. residents age 15 and over, 1991-1992.**



- SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

http://www.cdc.gov/niosh/docs/96-134/pdfs/96-134e.pdf

- Lung Cancer – Crystalline silica (quartz) is classified as a human carcinogen by the following regulatory agencies:
  - **International Agency for Research on Cancer (IARC)**
  - **National Toxicology Program**
  - **California Proposition 65**
  - **American Conference of Governmental Industrial Hygienists**
  - **Occupational Safety and Health Administration - Potential Cancer Hazard**
  - **National Institute for Occupational Safety and Health (NIOSH) – Potential Cancer Hazard**

- Tuberculosis – Silicosis increases the risk of tuberculosis.
- Autoimmune and Chronic Kidney Disease – Some studies show excess numbers of cases of scleroderma, connective tissue disorders, lupus, rheumatoid arthritis, chronic kidney diseases and end-stage kidney disease.
- Non-Malignant Respiratory Diseases (other than Silicosis) – Some studies show an increased incidence in chronic bronchitis and emphysema in workers.

Silica is a Component of Sand

- Crystalline silica is a common component of sand. Sand deposits in Wisconsin have high levels of crystalline silica.

- Silica is a natural component of soils. However, the "weathered" silica from agricultural soils is less damaging than the "freshly-fractured" silica from mining and processing operations.

WDNR Non-Regulation of Silica

- The Wisconsin Department of Natural Resources admits that crystalline silica is a human carcinogen (Andrew Stewart, 9/2009), but is not regulating it as a hazardous air pollutant (NR 445).

Recommendations

- While ambient silica concentration data from Wisconsin are lacking, numerous occupational and environmental studies have documented ambient levels (WHO 2000, US EPA 1996 [in Myers 2010]; and Shiraki and Holmén 2002, De Berardis et al., 2007, and Trzepla-Nabaglo et al. 2006).

- Five states are now regulating crystalline silica exposure: the State of California OEHHS has done a careful job of establishing a non-cancer risk threshold of 3 ug/m3 to protect the public from silicosis (Myers 2010).

- Adopt the 3 ug/m3 standard.
- Require that all sand mining and processing operations install air monitors and meet this standard.

References

- De Berardis et al. (2007) Airborne silica levels in an urban area. Sci Total Environ. 2007 Sep 1;382(2-3):251-8. Epub 2007 Jun 5.
- EPA (1996) Ambient Levels andNoncancer Health Effects of Inhaled Crystalline and Amorphous Silica: Health Issue Assessment. EPA/600/R-95/115 (1996).
- Myers (2010) Status Report to the Natural Resources Board: Silica Study: *http://dnr.wi.gov/air/pdf/DraftForPublicComment-SilicaStudyStatusReport.pdf*
- NIOSH (2008) **Silicosis: Number of deaths, crude and age-adjusted mortality rates, U.S. residents age 15 and over, 1968-1992**: http://www.njaiha.org/Portals/0/Presentations/NJAIHA%20Faye%20Rice%20NIOSH%20Silica%20112008.pdf
- OEHHA (2005): State of California Office of Environmental Health Hazard Assessment February 2005 *CHRONIC TOXICITY SUMMARY* ,SILICA (CRYSTALLINE, RESPIRABLE): http://www.oehha.ca.gov/air/chronic_rels/pdf/SILICAcREL_FINAL.pdf

- Ruble and Goldsmith (1997) Ambient PM10 emissions: contributions and impact on silica emissions. J Expo Anal Environ Epidemiol. 1997 Jul-Sep;7(3):327-44.
- Shiraki R, Holmén BA. (2002). Airborne respirable silica near a sand and gravel facility in central California: XRD and elemental analysis to distinguish source and background quartz.
- Trzepla-Nabaglo K, Shiraki R, Holmén BA. (2006) J Hazard Mater. Apr 30;132(1):14-25. Lidar characterization of crystalline silica generation and transport from a sand and gravel plant.
- World Health Organization (2000) Crystalline silica, quartz. Concise International Chemical Assessment Document 24.

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- Video: http://desi.uwec.edu/PIERCECH/Sand_Mining_1024.asx

extra slides

- The State of California Office of Environmental Health Hazard Assessment (OEHHA, 2005) states that "… PM10 would be useful as a screening method to establish that a particular situation is unlikely to present a hazard. For example, if the silica concentration in PM10 modeled at a receptor is less than the REL (3 $\mu g/m^3$), occupationally respirable silica will also be less than 3 $\mu g/m^3$, so a facility would not pose a risk due to silica at that receptor."

- One estimate of emissions from a sand and gravel plant found that crystalline silica was 15–27% of PM10 emissions (Trzepla-Nabaglo et al., 2006).
- Other studies have found that silica content ranged from 1.6-10.4% in urban air (De Berardis et al., 2007) and 0.4-21% (Ruble and Goldsmith, 1997).

- In approving the Construction and Operation Permit for Canadian Sand and Proppants, Inc. in Chippewa Falls (2009), the DNR stated "According to EPA (Ambient Levels and Noncancer Health Effects of Inhaled Crystalline and Amorphous Silica: Health Issue Assessment. EPA/600/R-95/115) 'Data from Goldsmith (1991) indicate that a reasonable estimate of the crystalline silica fraction in off-site fugitive dust from quarrying activities might be 7% [of PM10]…'"

- The US Environmental Protection Agency (EPA 1996) has also used a 10% fraction of PM_{10} as silica in estimates of ambient (environmental) exposure.

- Based on these four studies, including the DNR's finding in the Chippewa Falls Construction and Operation, an average of about 10% of PM10 emissions would be crystalline silica.

Recommendation

- The Trempealeau County Environment and Land Use Committee (2010) has recently set a goal for crystalline silica exposure in the Winn Bay Sand conditional use permit:
  - "Minimum of 3 scientific approved air quality monitors in active mining area available for staff review and data collection at all times. Type/brand of monitor will be pre approved by all parties including Winn Bay, staff and Dr. Pierce. 30 micrograms per cubic meter pm10 or lower shall be a personal goal for Winn Bay to achieve related to air quality monitoring."

Recommendation

- Using the OEHHA standard of 3 ug/m^3 and the estimate of 10% silica in PM10, require that long-term (e.g., monthly) levels measured by onsite monitors at the mine site in Howard and processing plant in Chippewa Falls be 30 ug/m^3 PM10 or lower.

- The Trempealeau County Environment and Land Use Committee (2010). Draft Approved Conditions in addition to Standard Non-Metallic Mining Conditions for Winn Bay Sand LLP.
- Trzepla-Nabaglo K, Shiraki R, Holmén BA. (2006). Lidar characterization of crystalline silica generation and transport from a sand and gravel plant. J Hazard Mater. 2006 Apr 30;132(1):14-25. Epub 2006 Jan 18.