

Health Impacts:

Can desert dust really make you sick?

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ADOT/NWSDust Storm Workshop- Casa Grande, AZ- March 6, 2012



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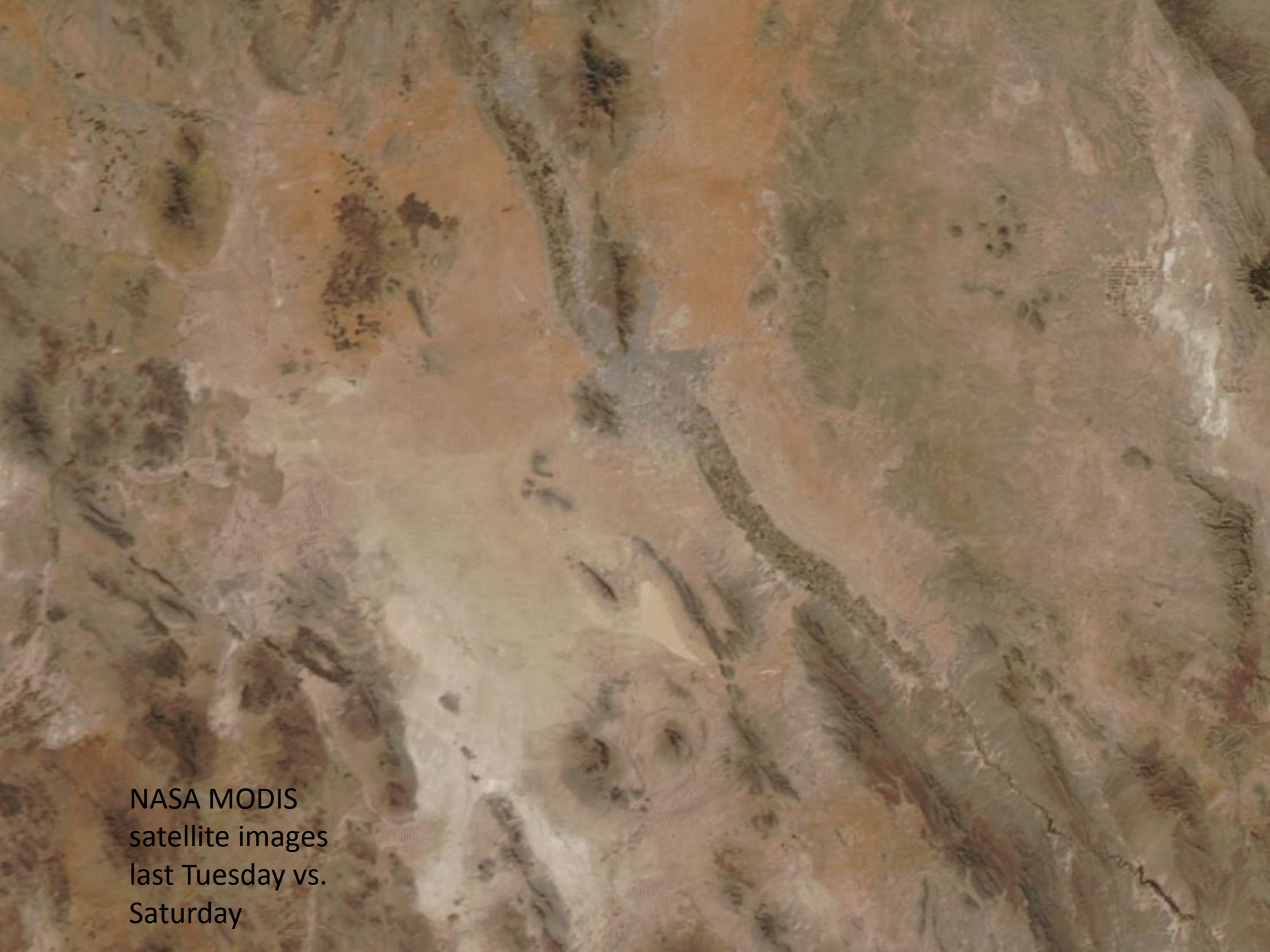
A photograph of a desert landscape with a road on the left. A yellow sign on the right side of the road reads "CAUTION DUST STORMS MAY EXIST". In the background, there are mountains and a clear blue sky. The foreground shows a paved road with a white line and some dry grass. The sign is rectangular and yellow with black text. The text is arranged in three lines: "CAUTION", "DUST STORMS", and "MAY EXIST". The sign is supported by two metal posts. The landscape is flat and arid, with sparse vegetation. The mountains in the distance are low and rounded. The sky is a uniform light blue with a few small, wispy clouds. The overall scene is bright and clear, suggesting a sunny day.

CAUTION
DUST STORMS
MAY EXIST



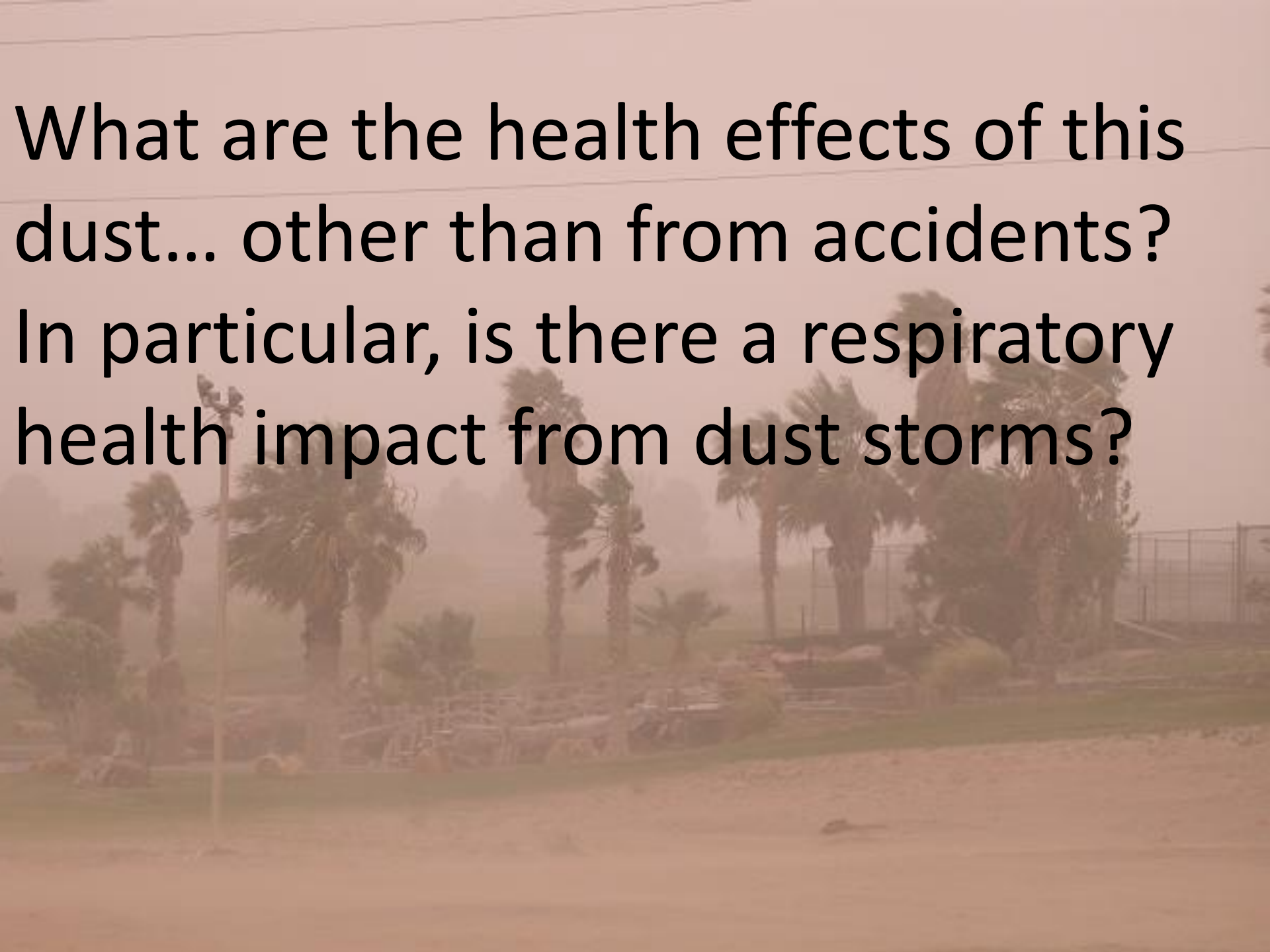


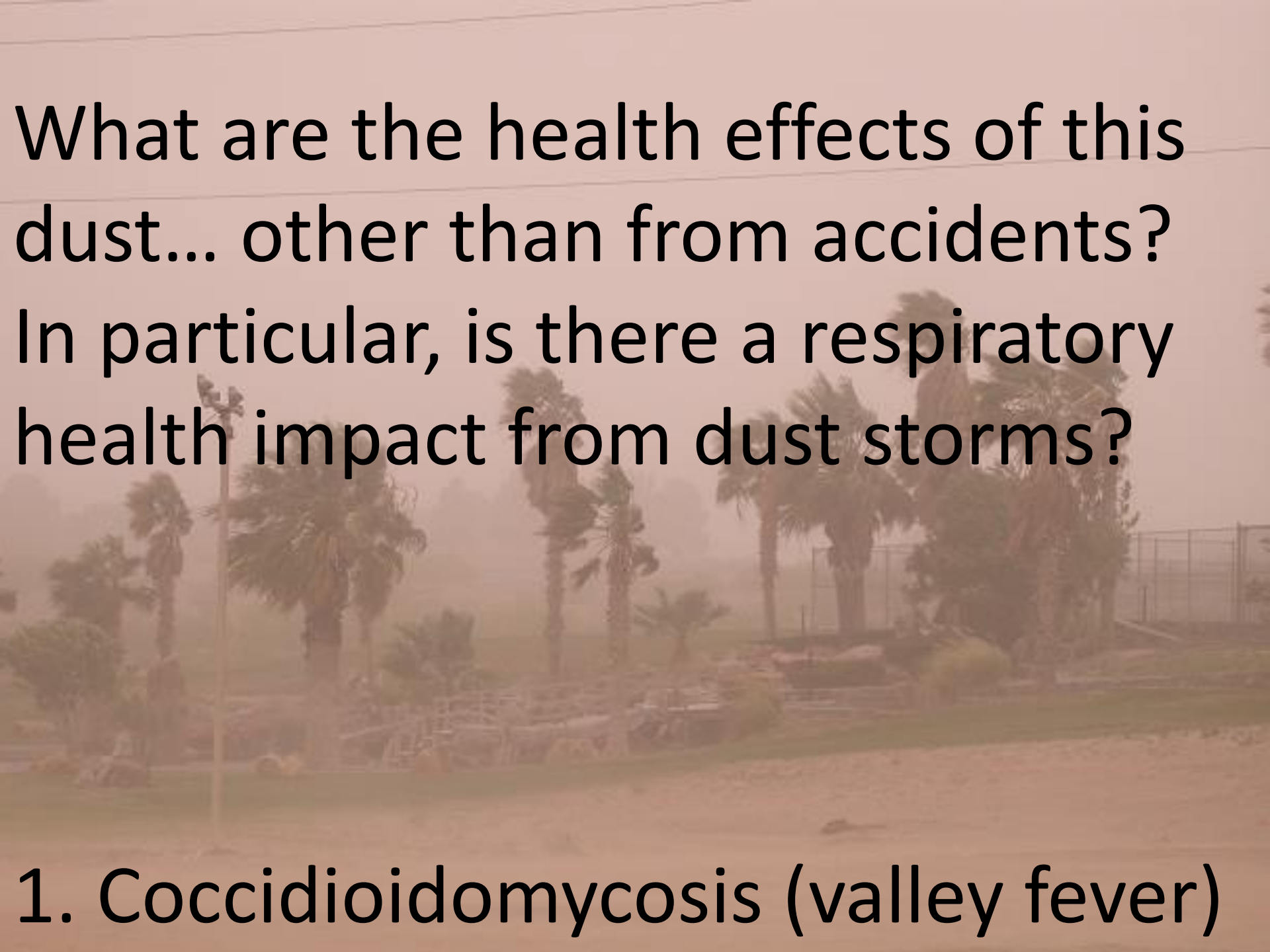
Image from TCEQ Chelsea Street Webcam, El Paso



NASA MODIS
satellite images
last Tuesday vs.
Saturday

What are the health effects of this dust... other than from accidents?
In particular, is there a respiratory health impact from dust storms?



The background image shows a park-like area with several palm trees and a chain-link fence. The scene is heavily obscured by a thick, brownish dust storm, which is the subject of the text overlay. The text is in a large, black, sans-serif font, centered on the upper half of the image.

What are the health effects of this dust... other than from accidents? In particular, is there a respiratory health impact from dust storms?

1. Coccidioidomycosis (valley fever)

A.D.A.M. Medical Encyclopedia.

Valley fever

San Joaquin Valley fever; Coccidioidomycosis

Last reviewed: August 29, 2011.

Valley fever is an infection that occurs when the [spores](#) of the fungus *Coccidioides immitis* enter your body through the lungs.

Causes, incidence, and risk factors

Valley fever is a fungal infection most commonly seen in the desert regions of the southwestern United States, and in Central and South America. You get it by breathing in fungal particles from soil. The infection starts in the lungs.

Valley fever may also be called coccidioidomycosis.

Traveling to an area where the fungus is commonly seen raises your risk for this infection. You are also more likely to develop a serious infection if you have a weakened immune system due to:

- Anti-tumor necrosis factor (TNF) therapy
- Cancer
- Chemotherapy
- Diabetes
- Glucocorticoid medications ([prednisone](#))
- Heart-lung conditions
- HIV
- Organ transplant
- Pregnancy (especially the first trimester)

People of Native American, African, or Philippine descent may also get more severe cases.

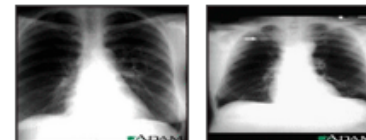
Symptoms

Most people with Valley fever never have symptoms. Others may have cold- or flu-like symptoms or symptoms of pneumonia. If symptoms occur, they typically start 5 to 21 days after exposure to the fungus.

Common symptoms include:

- Ankle, feet, and leg swelling
- [Chest pain](#) (can vary from mild to severe)
- Cough, possibly producing blood-tinged phlegm (sputum)
- Fever and night sweats

Figures



Drugs of interest

[Fluconazole](#)

[Amphotericin B Injection](#)

[Itraconazole](#)

[Posaconazole](#)

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[Valley Fever](#)

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Learn about...

TESTING

How we know if a treatment works

Testing Treatments is a link to learn more about clinical trials.

Symptomatic coccidioidomycosis following a severe natural dust storm. An outbreak at the Naval Air Station, Lemoore, Calif.

Williams PL, Sable DL, Mendez P, Smyth LT.

Abstract

Eighteen newly diagnosed cases of symptomatic coccidioidomycosis developed two to four weeks following exposure to a severe natural dust storm. The population at risk consisted of 26,000 residents of the San Joaquin Valley with access to health care at the Naval Hospital, Lemoore, Calif. Eight patients were white, and ten were nonwhite. The number of cases per 100,000 was estimated to be 36 for the white group and 254 for the nonwhite group. The disease was disseminated in four patients, and all were from the nonwhite group. One patient with disseminated disease, a black man, died. These data suggest that nonwhites may be relatively more susceptible to acquiring primary disease, in addition to developing disseminated disease. Dust storms of this magnitude must be considered a threat to health for populations living within areas endemic for coccidioidomycosis.

PMID: 498830 [PubMed - indexed for MEDLINE] [Free full text](#)

JAMA. 1997 Mar 19;277(11):904-8.

A coccidioidomycosis outbreak following the Northridge, Calif, earthquake.

Schneider E, Hajjeh RA, Spiegel RA, Jibson RW, Harp EL, Marshall GA, Gunn RA, McNeil MM, Pinner RW, Baron RC, Burger RC, Hutwagner LC, Crump C, Kaufman L, Reef SE, Feldman GM, Pappagianis D, Werner SB.

Epidemic Intelligence Service (EIS), Community Disease Control, County of San Diego Department of Health Services, CA, USA.

Abstract

OBJECTIVE: To describe a coccidioidomycosis outbreak in Ventura County following the January 1994 earthquake, centered in Northridge, Calif, and to identify factors that increased the risk for acquiring acute coccidioidomycosis infection.

DESIGN: Epidemic investigation, population-based skin test survey, and case-control study.

SETTING: Ventura County, California.

RESULTS: In Ventura County, between January 24 and March 15, 1994, 203 outbreak-associated coccidioidomycosis cases, including 3 fatalities, were identified (attack rate [AR], 30 cases per 100,000 population). The majority of cases (56%) and the highest AR (114 per 100,000 population) occurred in the town of Simi Valley, a community located at the base of a mountain range that experienced numerous landslides associated with the earthquake. Disease onset for cases peaked 2 weeks after the earthquake. The AR was 2.8 times greater for persons 40 years of age and older than for younger persons (relative risk, 2.8; 95% confidence interval [CI], 2.1-3.7; $P < .001$). Environmental data indicated that large dust clouds, generated by landslides following the earthquake and strong aftershocks in the Santa Susana Mountains north of Simi Valley, were dispersed into nearby valleys by northeast winds. Simi Valley case-control study data indicated that physically being in a dust cloud (odds ratio, 3.0; 95% CI, 1.6-5.4; $P < .001$) and time spent in a dust cloud ($P < .001$) significantly increased the risk for being diagnosed with acute coccidioidomycosis.

CONCLUSIONS: Both the location and timing of cases strongly suggest that the coccidioidomycosis outbreak in Ventura County was caused when arthrospores were spread in dust clouds generated by the earthquake. This is the first report of a coccidioidomycosis outbreak following an earthquake. Public and physician awareness, especially in endemic areas following similar dust cloud-generating events, may result in prevention and early recognition of acute coccidioidomycosis.

Point-source outbreak of coccidioidomycosis in construction workers.

Cummings KC, McDowell A, Wheeler C, McNary J, Das R, Yugia DJ, Mohle-Boetani JC.

Infectious Diseases Branch, Division of Communicable Disease Control, Center for Infectious Diseases, California Department of Public Health, Richmond, CA, USA.
kate.cummings@cdph.ca.gov

Abstract

Coccidioidomycosis results from inhaling spores of the fungus *Coccidioides* spp. in soil or airborne dust in endemic areas. We investigated an outbreak of coccidioidomycosis in a 12-person civilian construction crew that excavated soil during an underground pipe installation on Camp Roberts Military Base, California in October 2007. Ten (83.3%) workers developed symptoms of coccidioidomycosis; eight (66.7%) had serologically confirmed disease, seven had abnormal chest radiographs, and one developed disseminated infection; none used respiratory protection. A diagnosis of coccidioidomycosis in an eleventh worker followed his exposure to the outbreak site in 2008. Although episodic clusters of infections have occurred at Camp Roberts, the general area is not associated with the high disease rates found in California's San Joaquin Valley. Measures to minimize exposure to airborne spores during soil-disrupting activities should be taken before work begins in any coccidioides-endemic area, including regions with only historic evidence of disease activity.

PMID: 19845993 [PubMed - indexed for MEDLINE]

Clin Microbiol Rev. 2007 Jul;20(3):459-77, table of contents.

Atmospheric movement of microorganisms in clouds of desert dust and implications for human health.

Griffin DW.

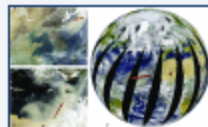
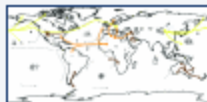
U.S. Geological Survey, St. Petersburg, Florida 33701, USA. dgriffin@usgs.gov

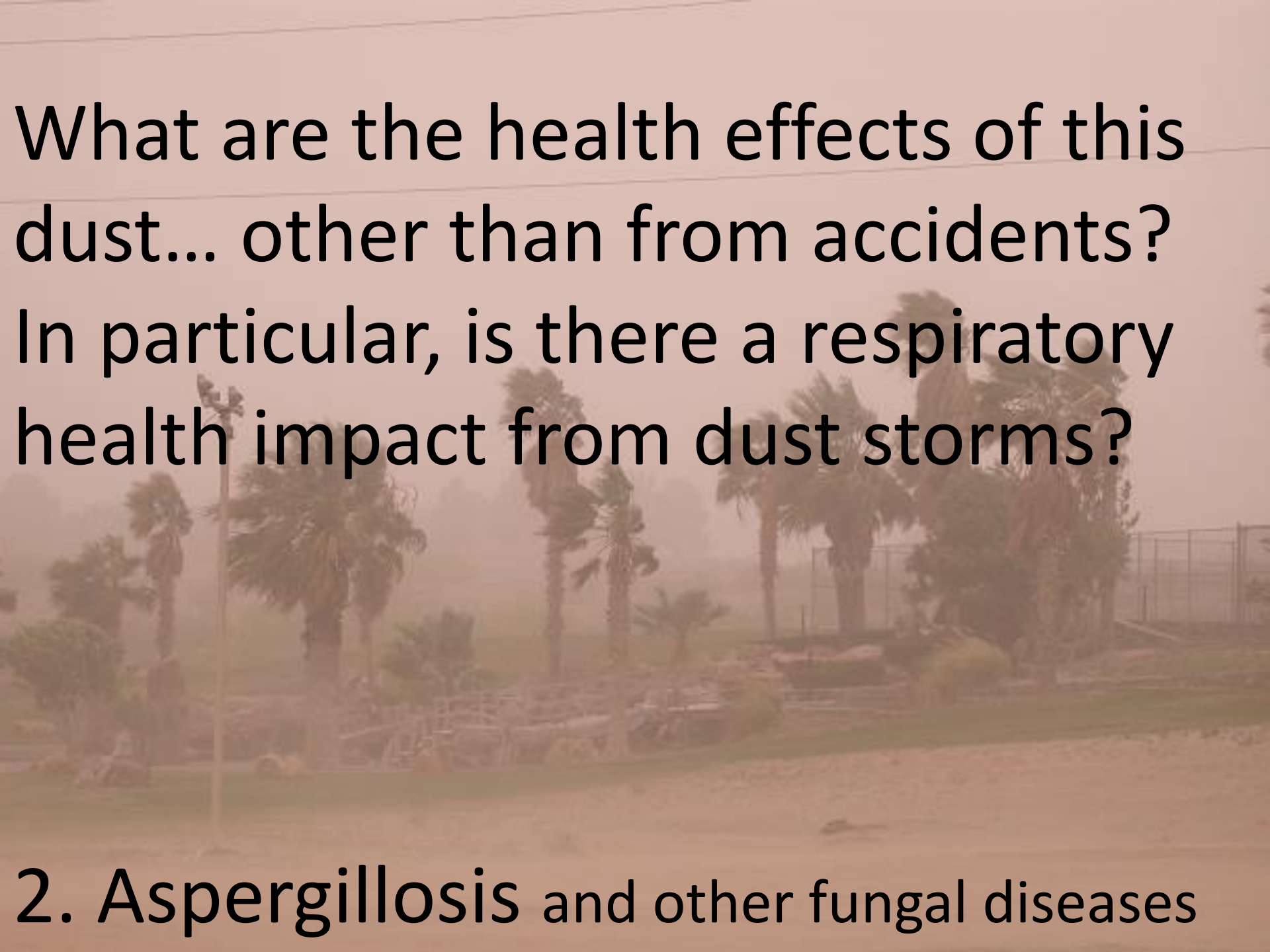
Abstract

Billions of tons of desert dust move through the atmosphere each year. The primary source regions, which include the Sahara and Sahel regions of North Africa and the Gobi and Takla Makan regions of Asia, are capable of dispersing significant quantities of desert dust across the traditionally viewed oceanic barriers. While a considerable amount of research by scientists has addressed atmospheric pathways and aerosol chemistry, very few studies to determine the numbers and types of microorganisms transported within these desert dust clouds and the roles that they may play in human health have been conducted. This review is a summary of the current state of knowledge of desert dust microbiology and the health impact that desert dust and its microbial constituents may have in downwind environments both close to and far from their sources.

PMID: 17630335 [PubMed - indexed for MEDLINE] PMCID: PMC1932751 [Free PMC Article](#)

Images from this publication. [See all images \(2\)](#) [Free text](#)



The background image shows a park or sports field during a dust storm. The air is thick with orange-brown dust, obscuring the view. Several palm trees are visible, some leaning slightly. In the distance, a chain-link fence is partially visible. The overall scene is hazy and desaturated due to the dust.

What are the health effects of this dust... other than from accidents?
In particular, is there a respiratory health impact from dust storms?

2. **Aspergillosis** and other fungal diseases

Chao et al. 2012: “*Aspergillus* is consistently the most frequently recovered fungal genus in both Asian and African dust events. In our study, *A. niger* was specifically identified in dust events. *A. niger* is a ubiquitous species, usually isolated from soils, plant litter, plant rhizospheres, seeds, dried fruits and nuts. It is one of the most commonly reported fungi from food, indoor environments, and outdoor niches, occasionally causing aspergillosis in immunocompromised patients (Klich 2002; St-Germain and Summerbell 1996).”

→ The New Mexico Office of Border Health is sponsoring a study in the border regions of New Mexico to assess *Aspergillus* levels in soil and consider that aspergillus-caused respiratory infections may be under-reported.

→ There are reports that aspergillosis may be under-diagnosed as a cause of respiratory infections in persons inhaling desert dust: symptoms may vary.

→ Appears to be a higher incidence in areas of new construction around Las Cruces, etc., where desert soils are being broken up for development.

Conjunctivitis (pink-eye) known to be associated with fungi in Asian dust in Taiwan

Journal of Toxicology and Environmental Health, Part A, 69:1673–1680, 2006

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ISSN: 1528–7394 print / 1087–2620 online

DOI: 10.1080/15287390600630096

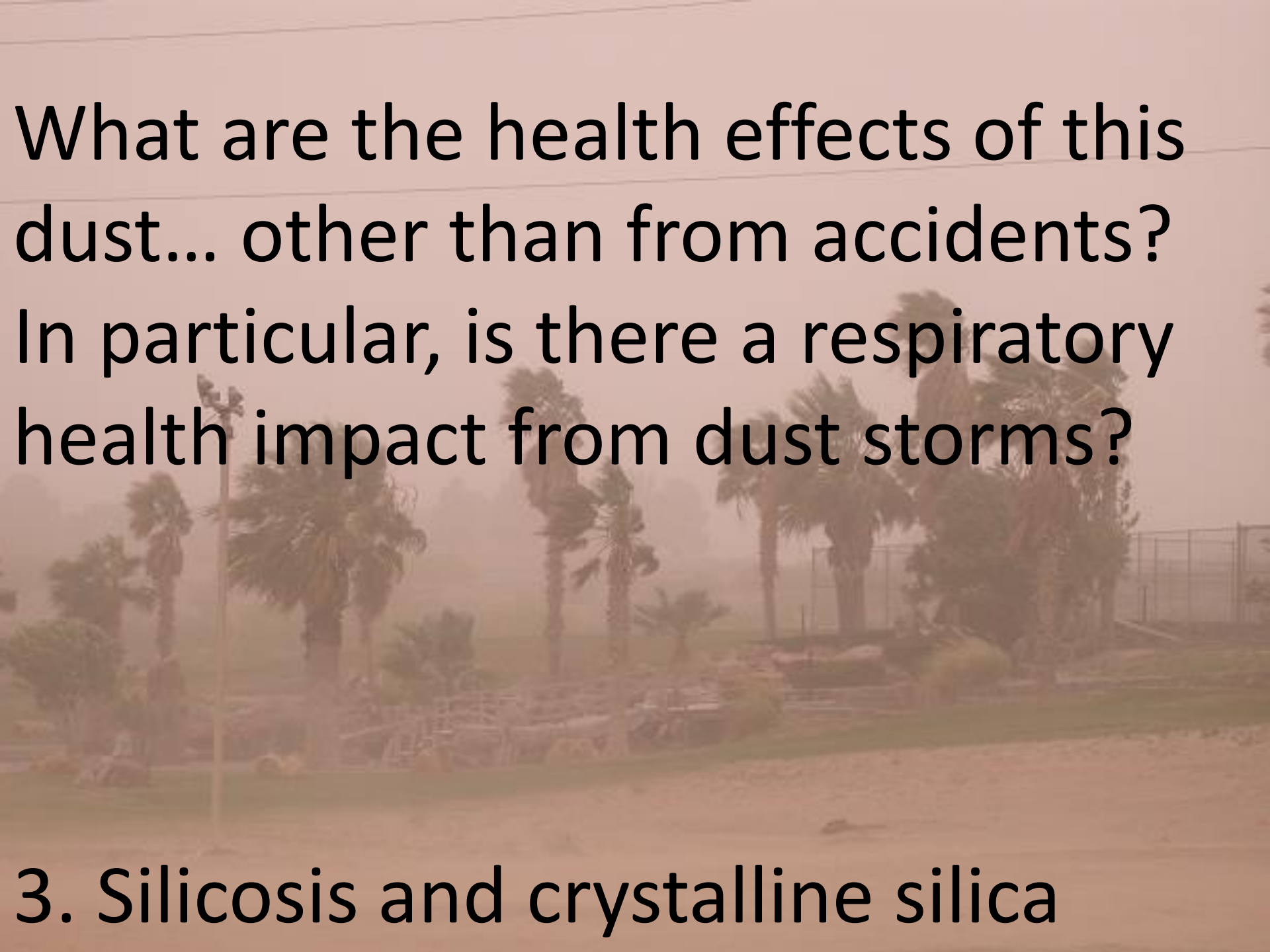


EFFECTS OF ASIAN DUST STORM EVENTS ON DAILY CLINICAL VISITS FOR CONJUNCTIVITIS IN TAIPEI, TAIWAN

Chun-Yuh Yang

Institute of Public Health, College of Health Sciences, Kaohsiung Medical University, Kaohsiung, Taiwan

In spring, windblown dust storms originating in the deserts of Mongolia and China make their way to Taipei city. These occurrences are known as Asian dust storm (ADS) events. The objective of this study was to assess the possible associations of ADS with daily clinic visits for conjunctivitis in residents in Taipei, Taiwan, during the period from 1997–2001. Forty-nine dust storm episodes were classified and classified as index days. Daily clinical visits for conjunctivitis on the index days were compared with clinical visits on the comparison (non-storm) days. Two comparison days for each index day, 7 d before the index days and 7 d after the index days, were selected. The effects of dust storms on clinic visits for conjunctivitis were prominent 4 d after the event. However, the association was not statistically significant. There may not have been enough power to detect associations resulting from the inadequate sample size of conjunctivitis visits on ADS events days. However, it seems worthwhile to pay more attention to the ADS events and health in the future.

The background image shows a park or sports field during a dust storm. The air is thick with orange-brown dust, obscuring the view. Several palm trees are visible, some leaning slightly. In the distance, a chain-link fence and some structures are barely visible through the haze. The overall scene is hazy and desaturated due to the dust.

What are the health effects of this dust... other than from accidents?
In particular, is there a respiratory health impact from dust storms?

3. Silicosis and crystalline silica

Nonindustrial Silicosis

E. Derbyshire, 2007: Ambio 36: 73- 77.

Nonindustrial silicosis has long been recognized in northeast Africa and the Middle East, where it is referred to as “desert lung syndrome,” the earliest known cases being found in some ancient Egyptian mummified bodies (18). Nonindustrial deposition of silica in human lung tissue was first reported in living populations in a study of three inhabitants of the Sahara Desert more than half a century ago (19). Typical autopsy results showed a high content of fine ($<3 \mu\text{m}$) silica dust.

→ Most desert dust in the Southwest is comprised primarily of silica (silicon dioxide-quartz).

→ There is only one old (1970s) report tying silicosis in the Southwest possibly to dust storms.

→ There is some evidence that silicosis in residents of other parts of the world may be related to inhalation of dust.

→ Probably not a major concern for health effects of dust in our region.

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Research Article

Occupational exposure to crystalline silica and autoimmune disease.

C G Parks, K Conrad, and G S Cooper

Epidemiology Branch, National Institute of Environmental Health Sciences, Research Triangle Park, NC 27709, USA.
parks@niehs.nih.gov▶ This article has been [cited by](#) other articles in PMC.**Abstract**

Occupational exposure to silica dust has been examined as a possible risk factor with respect to several systemic autoimmune diseases, including scleroderma, rheumatoid arthritis, systemic lupus erythematosus, and some of the small vessel vasculitides with renal involvement (e.g., Wegener granulomatosis). Crystalline silica, or quartz, is an abundant mineral found in sand, rock, and soil. High-level exposure to respirable silica dust can cause chronic inflammation and fibrosis in the lung and other organs. Studies of specific occupational groups with high-level silica exposure (e.g., miners) have shown increased rates of autoimmune diseases compared to the expected rates in the general population. However, some clinic- and population-based studies have not demonstrated an association between silica exposure and risk of autoimmune diseases. This lack of effect may be due to the limited statistical power of these studies to examine this association or because the lower- or moderate-level exposures that may be more common in the general population were not considered. Experimental studies demonstrate that silica can act as an adjuvant to nonspecifically enhance the immune response. This is one mechanism by which silica might be involved in the development of autoimmune diseases. Given that several different autoimmune diseases may be associated with silica dust exposure, silica dust may act to promote or accelerate disease development, requiring some other factor to break immune tolerance or initiate autoimmunity. The specific manifestation of this effect may depend on underlying differences in genetic susceptibility or other environmental exposures.

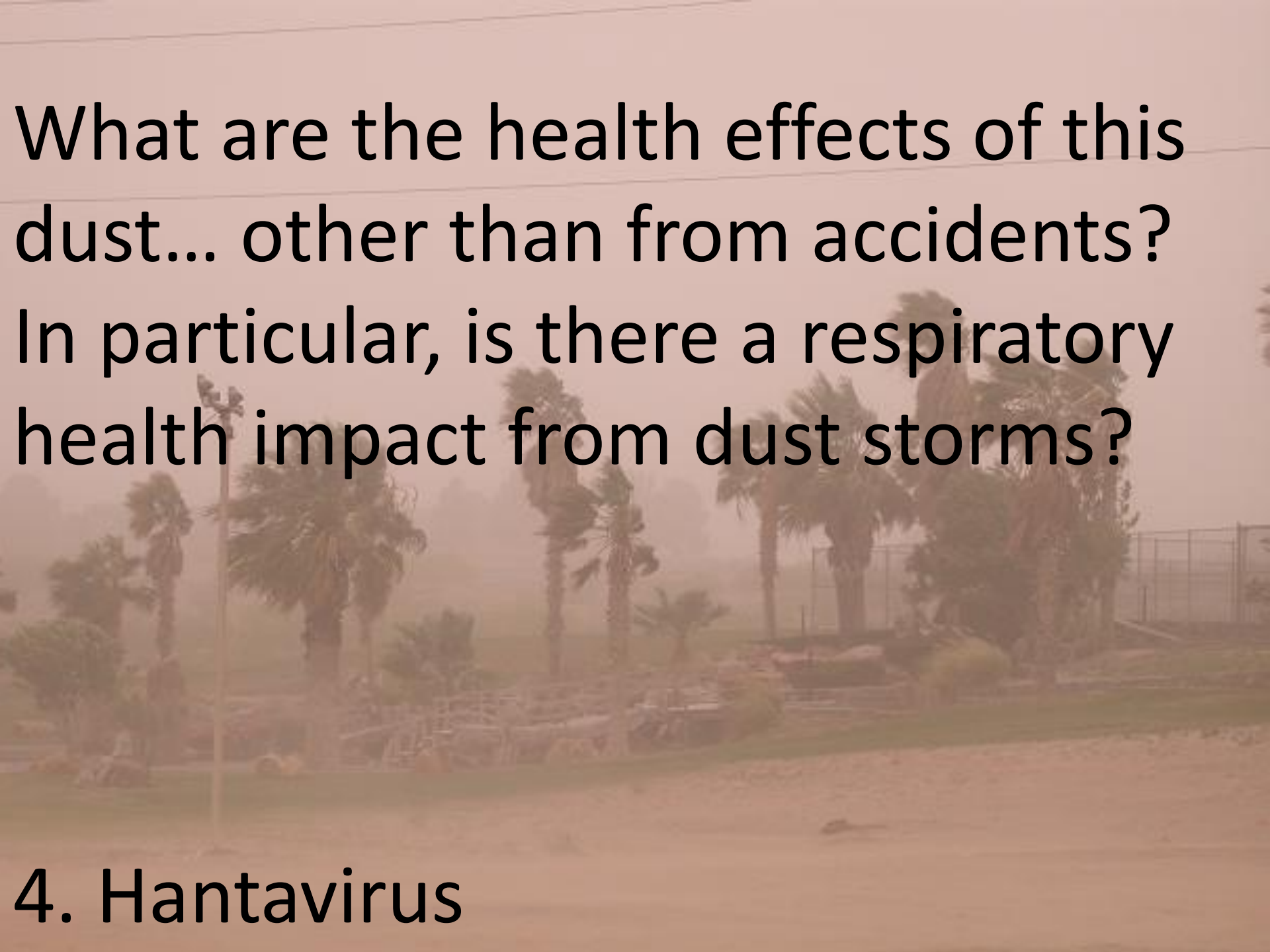
IS INHALATION OF CRYSTALLINE SILICA *PER SE* A HEALTH RISK?

→ Most desert dust in the Southwest is comprised primarily of silica (silicon dioxide- quartz). Quartz is a crystalline silica.

→ Some studies have suggested that exposure to silica dust is a risk factor for a number of auto-immune diseases, and also for lung cancer.

→ This assertion is still controversial and the actual risks are uncertain and much less proven (in my opinion) than of other real risks to health from dust.

→ Certain crystalline silica minerals such as cristobalite are clearly posing a higher risk: but cristobalite is a rare mineral very uncommon in our dust

A background image showing a dust storm in a park. The air is thick with orange-brown dust, obscuring the view. In the background, several palm trees are visible, some leaning slightly. To the right, a chain-link fence is partially visible. The overall scene is hazy and desaturated due to the dust.

What are the health effects of this dust... other than from accidents? In particular, is there a respiratory health impact from dust storms?

4. Hantavirus

Hantavirus cardiopulmonary syndrome

- Often fatal disease caused by exposure to the hantavirus
- “Sin nombre” hantavirus was originally identified in the Four Corners region
- Carried by the deer mouse- *Peromyscus maniculatus*



Transmission of the virus deposited in the droppings of the mouse can be facilitated during windy or dusty periods when the virus can get airborne and be inhaled.

What are the health effects of this dust... other than from accidents?
In particular, is there a respiratory health impact from dust storms?

The Big One

4. Asthma and Bronchitis

Asthma cases rise in kids due to dust

Publish Date: Sunday, 4 March, 2012, at 12:51 PM Doha Time

By Noimot Olayiwola/Staff Reporter

A rising number of children are suffering from asthma and bronchitis due to the dusty wind, which has enveloped the entire city since the past three days, it was found.

"Since the dust storm began, we have noticed at the Paediatric Emergency Centres (PECs) across the country, a significant increase of between 15 and 20% of cases of asthma and bronchitis among children, especially those aged below five," PECs director Dr Khalid al-Ansari said yesterday.

According to him, out of a total of 1,200 emergency cases seen at the Al Saad PEC on Friday, some 360 had with both illnesses.

Some 40 children were reported to be admitted for observation at the Hamad Hospital having suffered bronchial problems.

"Apart from these two major respiratory-related health problems, other cases we also received include fever, viral meningitis and gastro-enteritis. However, the high figure we recorded on Friday was not new because during early winter say around January, we usually record even higher number of cases," he said.

Asked whether the PECs have changed the rule not to prescribe cold and flu medications for children below five years, he said the ruling still remained as there were no new evidence that the drugs work in the children.

"This decision was made according to the recommendations of the US Food and Drugs and Administration (FDA) that those cough and cold medications do more harm than good to the children," he said.

However, the official said that medications will be prescribed if the affected children show signs of asthma or bronchitis or other serious respiratory health problems.

Dr al-Ansari advised parents to protect their children from the dust by keeping them indoors.



Dr al-Ansari: protect children from dust

K. Gyan · W. Henry · S. Lacaille · A. Laloo ·
C. Lamsee-Ebanks · S. McKay · R. M. Antoine ·
M. A. Monteil

African dust clouds are associated with increased paediatric asthma accident and emergency admissions on the Caribbean island of Trinidad

Received: 23 January 2004 / Revised: 2 June 2004 / Accepted: 12 January 2005 / Published online: 4 February 2005
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Association of desert dust with respiratory disease such as asthma, bronchitis, sinus infections, pneumonia, etc. has been well established in the Caribbean; in Korea, Japan, and Taiwan; and in Australia.

Scientific Research and Essays Vol. 5(24), pp. 4044-4052, 18 December, 2010
Available online at <http://www.academicjournals.org/SRE>
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Full Length Research Paper

Relationship between influx of yellow dust and bronchial asthma mortality using satellite data

Kensuke Goto^{1*}, Jephtha Christopher Nmor^{1,2}, Ryoma Kurahashi³, Kazuo Minematsu⁴, Tkeshi Yoda¹, Yasuyuki Rakue^{5,6}, Tsutomu Mizota⁷ and Keinosuke Gotoh⁷

Shannon Rutherford · Emma Clark
Grant McTainsh · Rod Simpson · Charles Mitchell

Characteristics of rural dust events shown to impact on asthma severity in Brisbane, Australia

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Association of desert dust with respiratory disease such as asthma, bronchitis, sinus infections, pneumonia, etc. has been well established in the Caribbean; in Korea, Japan, and Taiwan; and in Australia.

However, no studies had been done either with North American dust, or dust that has not travelled far from its source.

Shannon Rutherford · Emma Clark
Grant McTainsh · Rod Simpson · Charles Mitchell

Characteristics of rural dust events shown to impact on asthma severity in Brisbane, Australia

Hospital admissions for asthma and acute bronchitis in the Paso del Norte: the impacts of dust and low wind events

- ▶ **Research Team:**
- ▶ **Sara E. Grineski**
- ▶ **Joan G. Staniswalis**
- ▶ **Roberto Hurtado**
- ▶ **Thomas E. Gill**
- ▶ **Amista Salcido**
- ▶ **Yanlei Peng (MS student)**
- ▶ **Priyangi Bulathsinhala (MS student)**

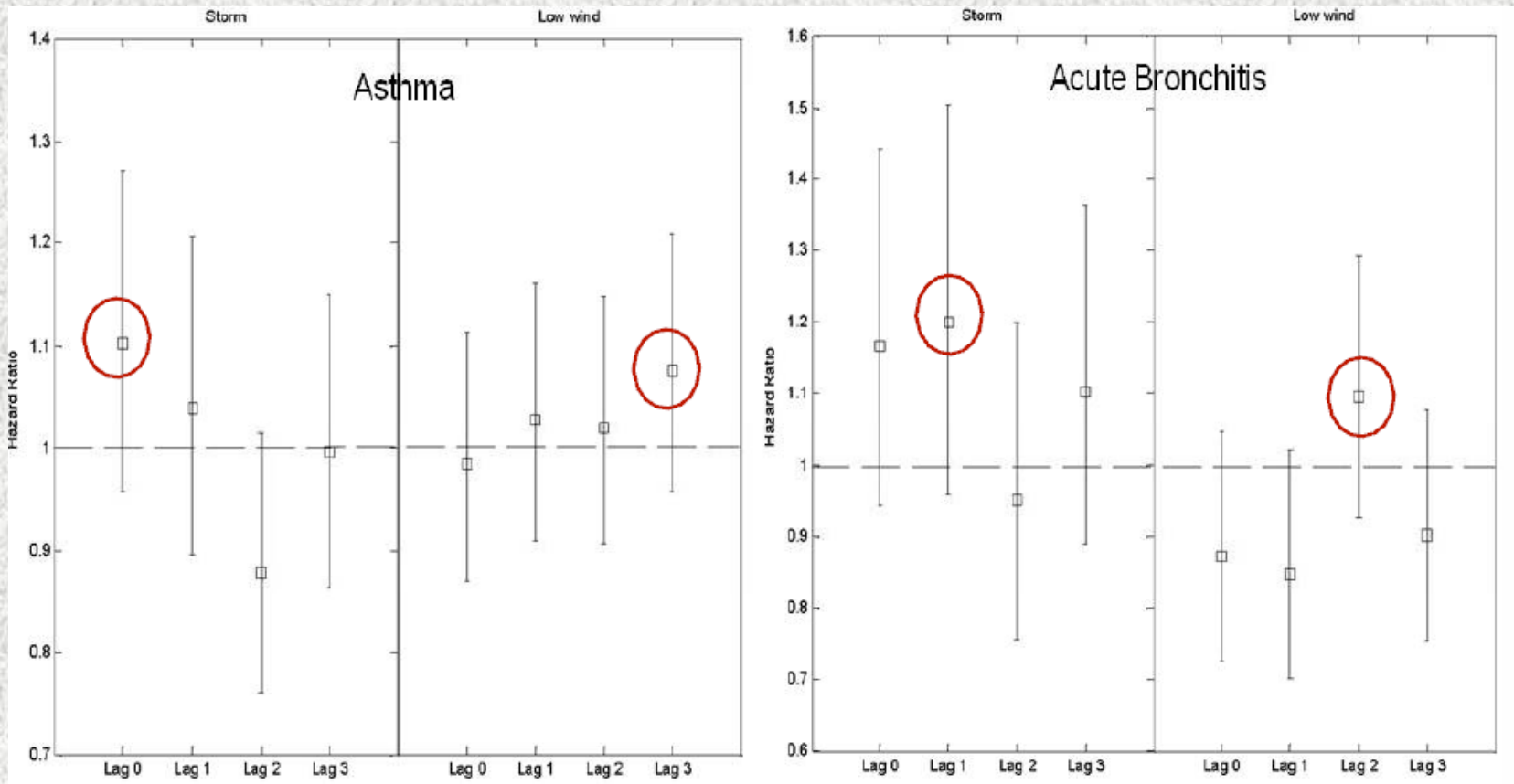


The Paso Del Norte area- El Paso and Ciudad Juarez- is more dusty than Arizona, we average about 15 dust storm days per year: and they are longer lasting. So these results may not hold here in Arizona.



- Ciudad Juarez, Mexico

Weeks when at least one dust storm happened had 8% more hospital admissions for asthma, respiratory infections, and pneumonia (combined) than weeks without a dust storm – although this was not statistically significant.



- El Paso, Texas

We found that hospital visits for both asthma and acute bronchitis were higher on dust storm days and immediately thereafter.



- **El Paso, Texas**

Both children and adults were 16% more likely to make hospital visits for asthma when there was a dust storm and immediately thereafter. The population overall was 11% more likely to visit the hospital during and immediately after a dust storm.

The population overall was 23% more likely to visit the hospital for acute bronchitis the day after a dust storm, and 33% more likely for children. The effect was much stronger for women and girls.

These were statistically significant results.



- **El Paso, Texas**

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Hospital admissions for asthma and acute bronchitis in El Paso, Texas: Do age, sex, and insurance status modify the effects of dust and low wind events? ☆, ☆ ☆

Sara E. Grineski^{a,*}, Joan G. Staniswalis^b, Priyangi Bulathsinhala^b, Yanlei Peng^c, Thomas E. Gill^d

^a Department of Sociology and Anthropology, University of Texas at El Paso, 500 W. University Ave., El Paso, TX 79902, USA

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^c Department of Statistics, University of South Carolina, USA

^d Department of Geological Sciences and the Environmental Science and Engineering Program, University of Texas at El Paso, USA

Our peer-reviewed study was published last November.

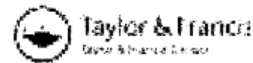
Adults covered by Medicaid and adults without health insurance had higher risks of hospitalization for asthma and acute bronchitis after dust events.

Conclusions: Results suggest that there were respiratory health effects associated with dust events in El Paso, with stronger impacts among children and poor adults. Girls and boys with acute bronchitis were differentially sensitive to dust events.

Other issues

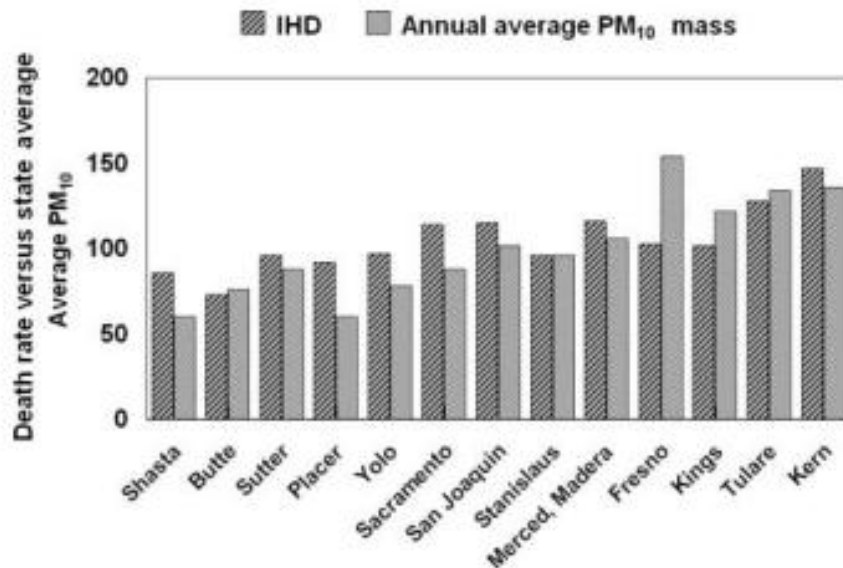
- Cardiovascular effects- heart disease/attacks?

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DOI: 10.1080/15287390590967388



EFFECTS OF ASIAN DUST STORM EVENTS ON DAILY HOSPITAL ADMISSIONS FOR CARDIOVASCULAR DISEASE IN TAIPEI, TAIWAN

Yong-Shing Chen¹, Chun-Yuh Yang²



Other issues

- Is Particulate matter *per se* a health hazard???
- Are desert dust events a natural event beyond the scope of USEPA PM standards?

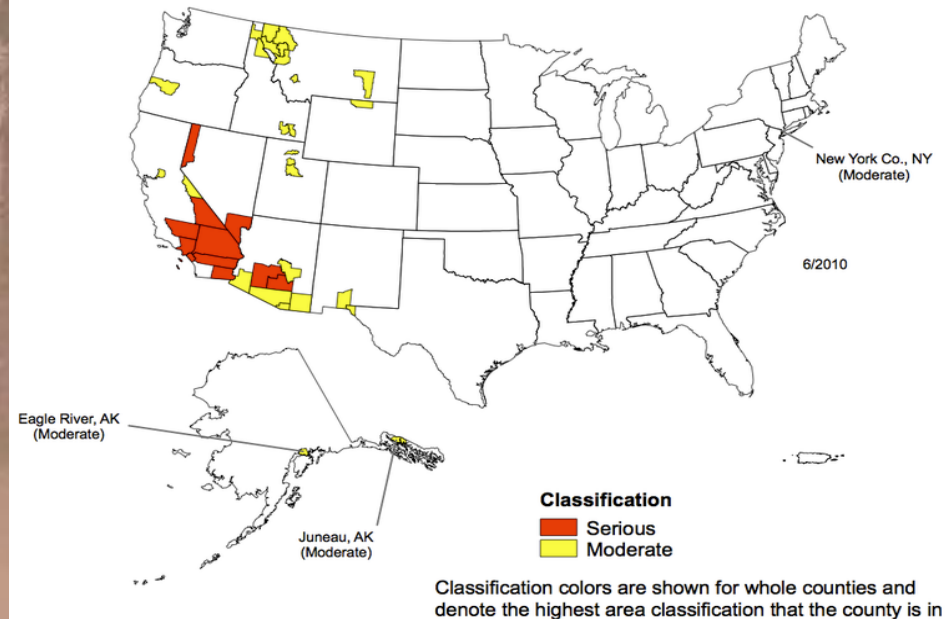
PM-2.5 Nonattainment Areas (2006 Standard)



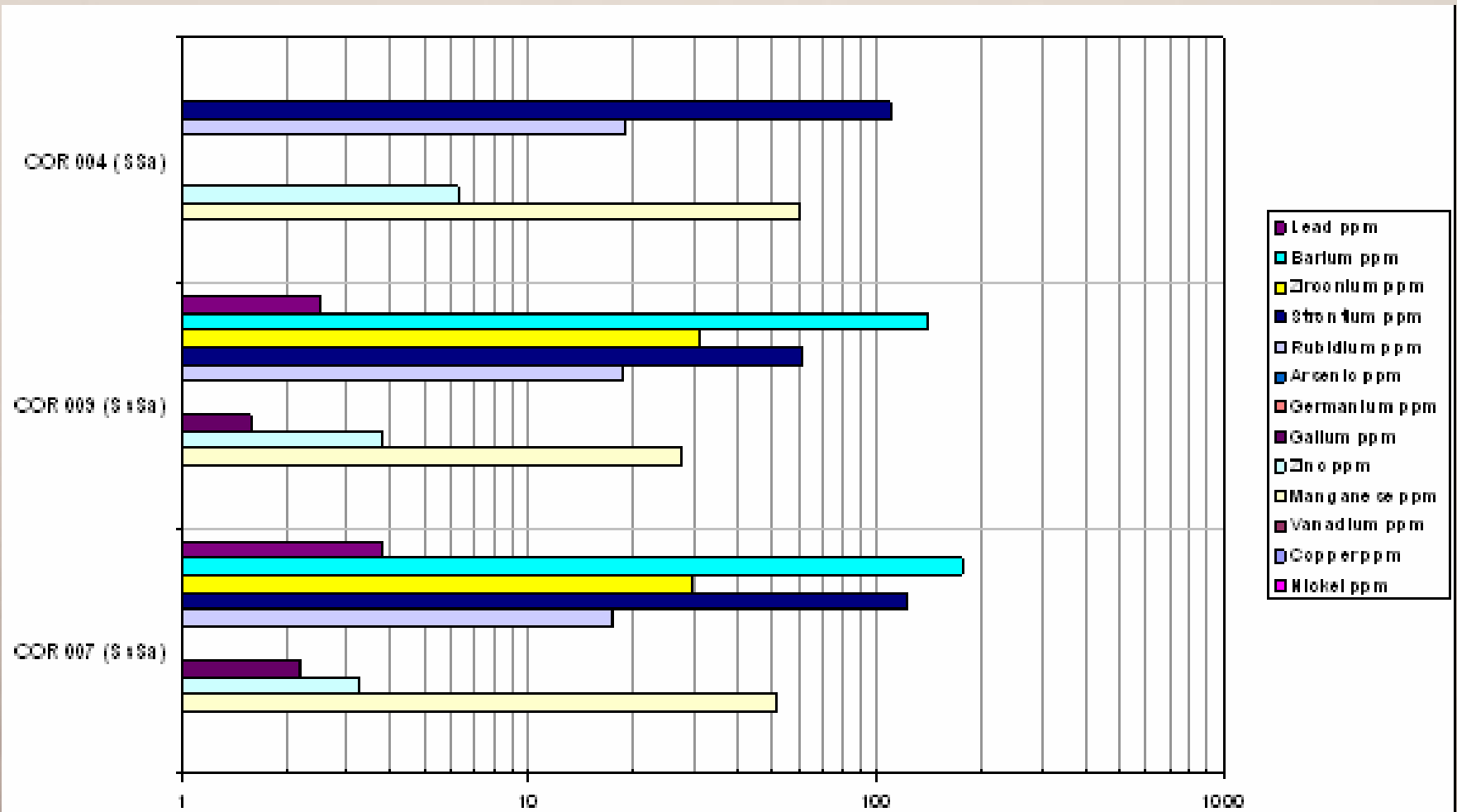
Nonattainment areas are indicated by color. When only a portion of a county is shown in color, it indicates that only that part of the county is within a nonattainment area boundary.

6/2010

Counties Designated Nonattainment for PM-10



Potentially toxic metals such as lead, zinc and arsenic have been detected in individual dust samples.



CONCLUSIONS

- Dust storms certainly do appear to pose health risks beyond those just due to vehicular accidents, etc.
- Respiratory problems, especially asthma and bronchitis, certainly do appear to become worse during and after dust storms, and certain populations are more sensitive.
- “Valley fever,” aspergillosis, and other disease-causing fungal pathogens can be transmitted in dust storms.
- Other diseases: the jury is still out.