



Salton Sea Health Effects: Aerosolized Toxins, Asthma, and Epidemiology

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Salton Sea Health Effects - Overview

- › Childhood asthma in the Salton Sea region, especially among the Mexican immigrant/agriculture worker communities is reported to be very high.
- › Asthma is assumed to be tied to dust levels. Is it linked to proximity to the drying Salton Sea?
- › Our studies suggest that environmental dust from the Salton Sea can trigger lung inflammation, potentially due to bacterial material rather than allergens

(Funding: NIH NIMHD U54 MD013368, Center for Health Disparities Research at UCR)

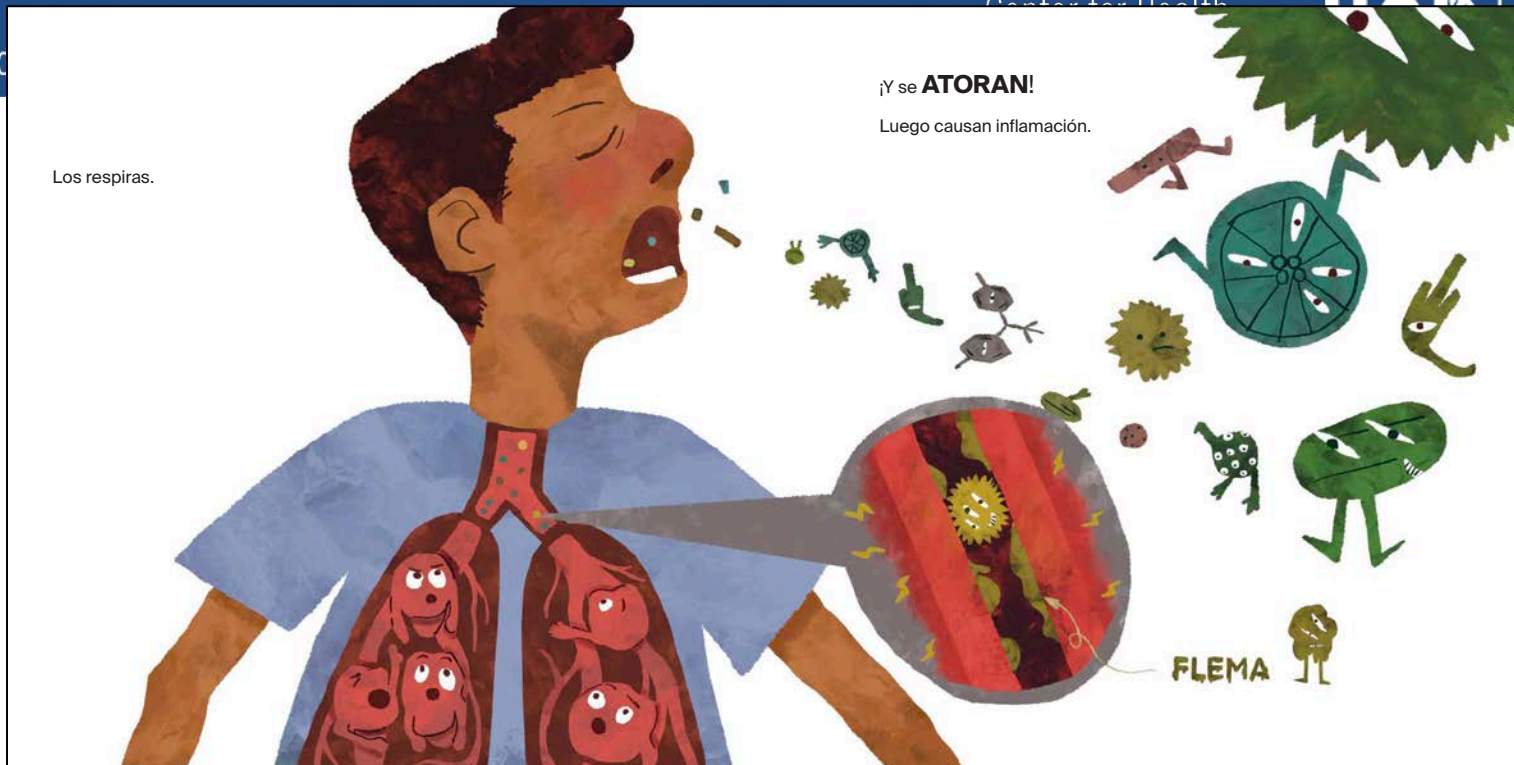


How Is Dust Connected to Asthma?

En días secos, el polvo,
moho, polen y virus

¡Flotan en el aire!

- › Dust levels near Salton Sea are higher than in desert areas further from the sea
- › As the Salton Sea retreats it exposes additional playa, and it appears to be especially potent in producing dust
- › But not all dust is created equal; does this dust also have properties that promote lung responses?



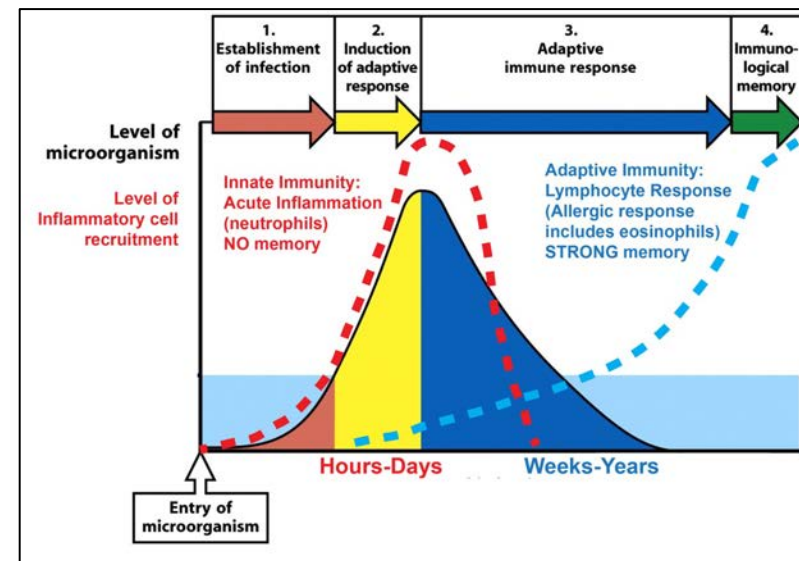
(Yuki Murayama)

Asthma is a chronic inflammatory disease in the lung, causing constricted airways, wheezing and coughing, along with acute attacks with extreme difficulty in breathing. Our studies are aimed at testing whether Salton Sea dust is especially potent in producing lung inflammation, and whether this promotes asthma

Inflammation and Lung Disease

Immune System induction

- › **Innate** triggers such as bacterial infection: “Acute” neutrophil inflammatory cells
- › **Adaptive** triggers such as allergens (e.g., dust mites) or viruses (e.g., COVID): Slower initiation, lymphocytes, eosinophils, and IgE, **chronic** disease
- › Thus, the **character** of the response provides clues to the **causes**
- › **ASTHMA is usually Adaptive/Allergic Immunity. Is this true for asthma seen in residents near Salton Sea?**



Our Research Findings So Far



To test the effect of dust, we use chambers to expose laboratory mice to aerosols see how their lungs respond to long exposures

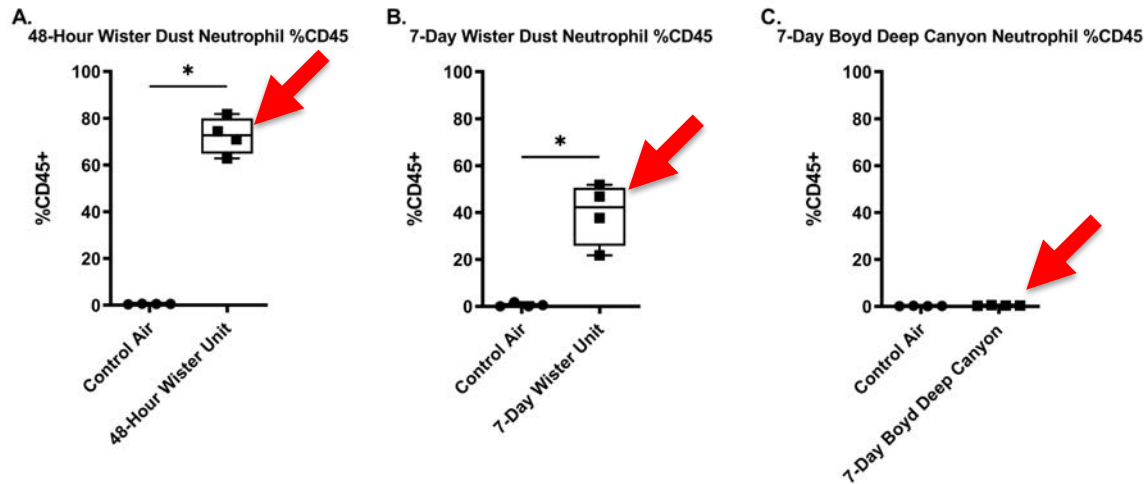
Dust Effects on Lungs

Dust was collected from several sites around the Salton Sea, including the Imperial Wildlife Area Wister Unit, with Boyd Deep Canyon above Palm Desert as a comparison

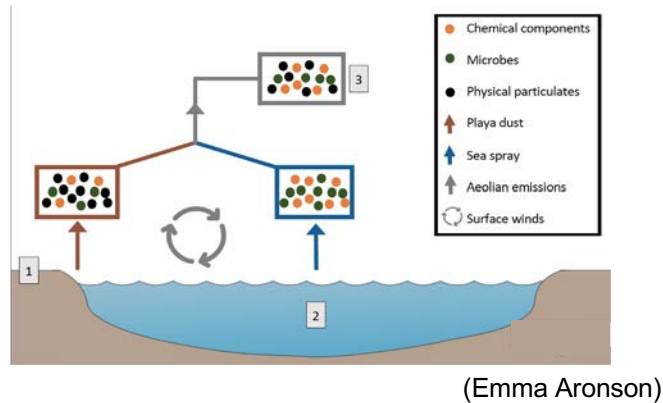
- For conventional asthma, we expected to see signs of *allergic* inflammation (e.g., eosinophils)
- Surprisingly, Wister dust triggered *acute/innate* inflammatory response (*Neutrophils*, but **NO** allergic eosinophils!). Only the dust from Salton Sea sites induced this type of inflammation



Lung *Neutrophil* Recruitment In Response To Salton Sea Dust



- 1) Wister and Sonny Bono dust triggers neutrophil (innate) response in exposed lungs (NO Eosinophils, so **NOT** allergic!). Similar results for Dos Palmas near North Shore.
- 2) NO inflammatory response to Boyd Deep Canyon dust
THUS, Proximity to the Salton Sea is associated with significant dust toxicity
- 3) Also note – the 48 hour Wister was *stronger* than the 7 day response, suggestive of classic innate responses to bacterial components

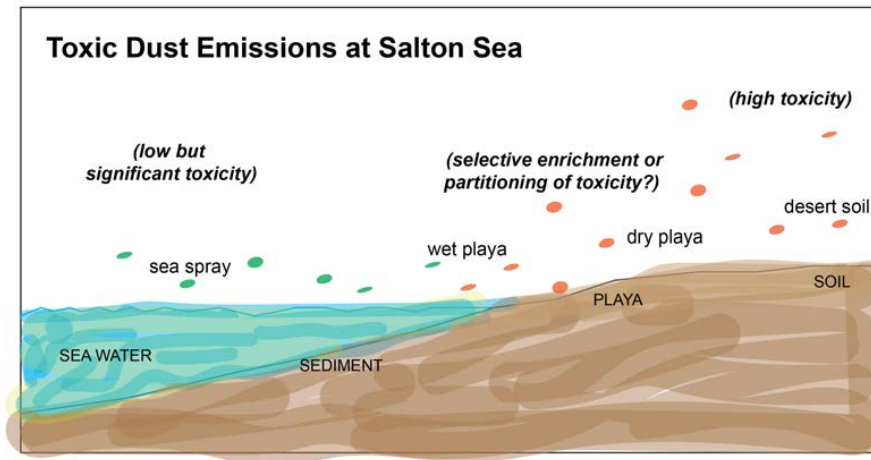


Ecology and the Sea

The Salton Sea is increasing in salinity, but possibly more important there is a high input of fertilizer from agriculture runoff. This nutrient burden may be promoting growth of bacteria and algae, and this microbial biomass may be a key component in playa dust

Preliminary metagenomic analysis indicates differences in microbiome of Salton Sea dust vs desert dust. Does microbial adaptation to hypersaline conditions involve an increase in microbial components (e.g., cell wall) that promote lung inflammation?

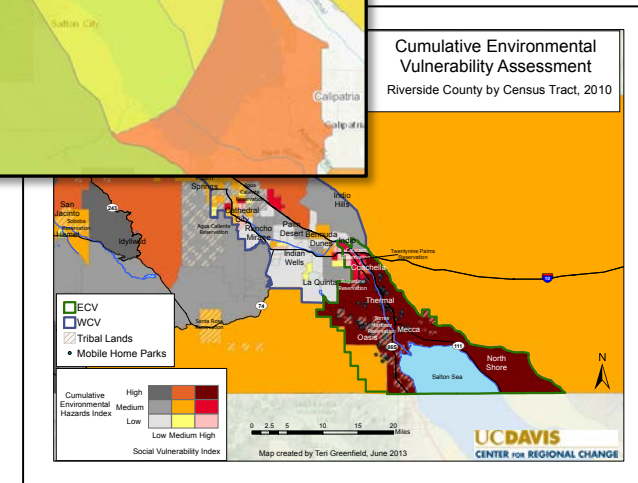
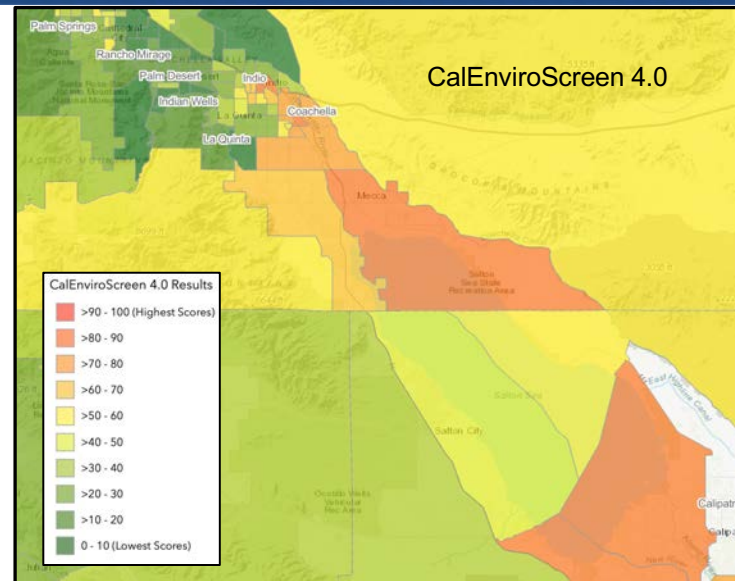
Also, how does it get into the dust?



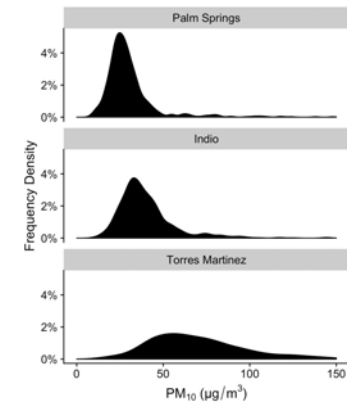
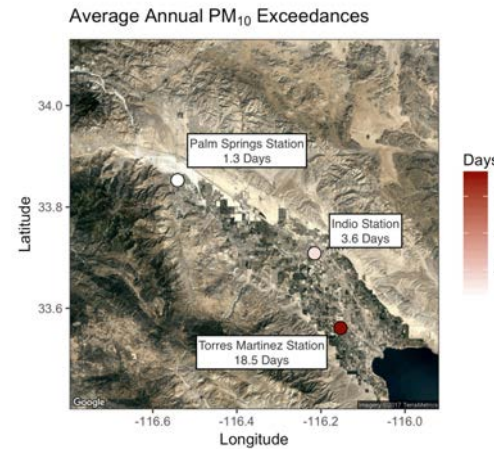
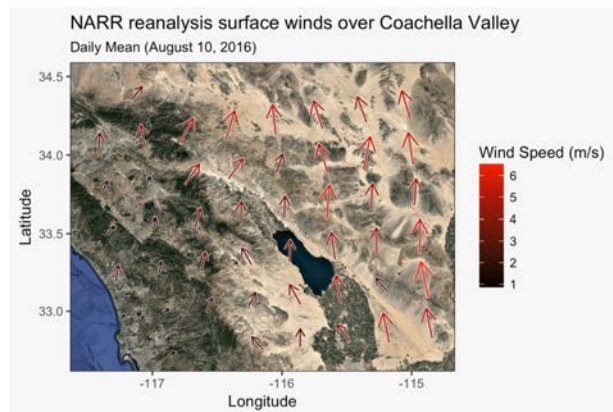
Assessing Health Impacts: What Do We Know, What Can We Know?

Calculated Risk Associated With Environmental Exposure

- Risk and environmental hazard is a sum of weighted assessments including social determinants (and SES), toxic chemicals, pesticides, water quality, air quality, etc.
- Salton Sea assessed as high risk, but this is not specific for only pulmonary health hazards; multiple factors can be at work in this setting



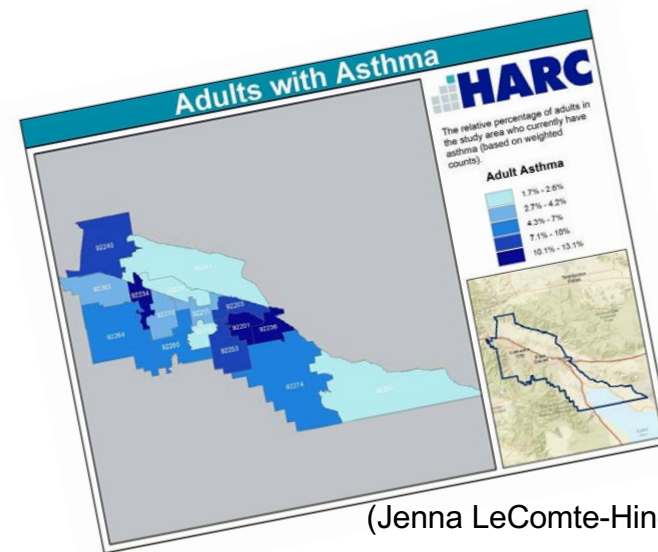
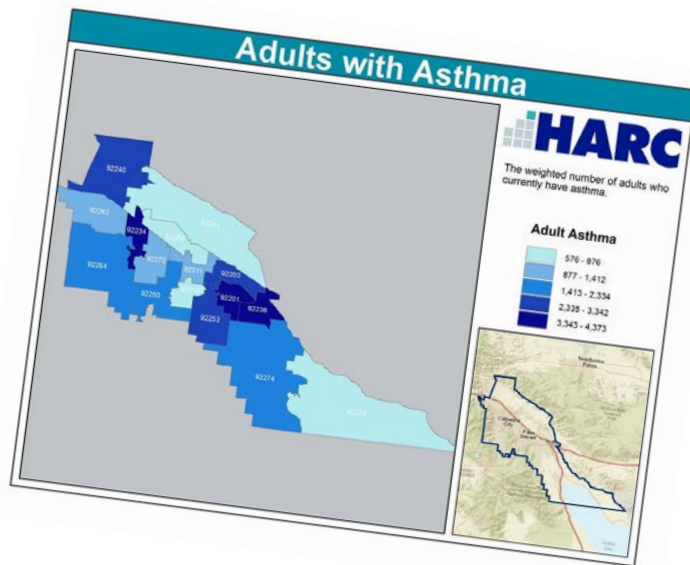
Aerosol PMs And Seasonal Winds Are Knowable, But Do They Tell Us What We Need To Know?



(Will Porter)

***Aerosol dust monitoring can be useful but it is insufficient
to tell us where the most severe health impacts are***

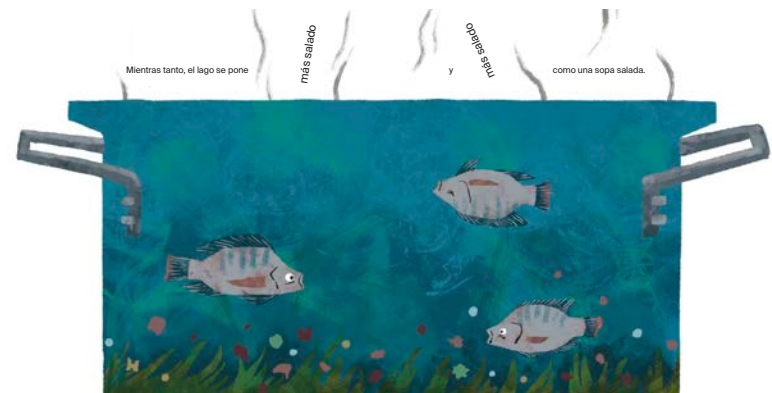
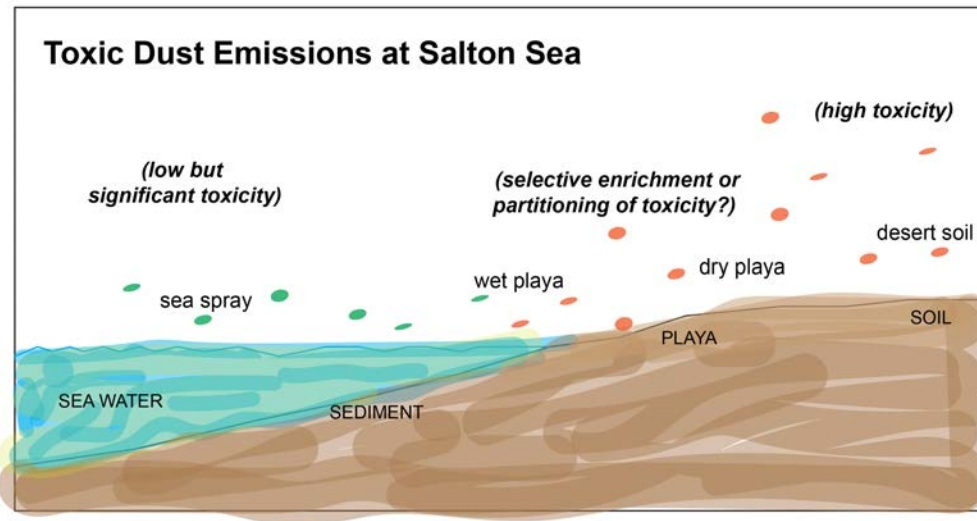
Asthma Incidence In Coachella Valley



(Jenna LeComte-Hinely)

The general incidence of asthma is known at the level of large tracts, such as zip code/county, but it does not provide neighborhood level detail and proximity to sources of types of dust

With chronic drought and warming temperatures, the sea is drying up faster. This emphasizes the importance of understanding the ecological crisis at the Salton Sea and its **health impacts**



(Yuki Murayama)

“A journey of a thousand miles begins with a single step”

- › To know the actual health impacts of Salton Sea-generated dusts, a detailed epidemiology study is needed to compile specific symptoms, associations with season, winds and related environmental conditions, as well as geographic information (geospatial tagging)
- › An initial study should provide a comprehensive assessment of existing conditions, in part to determine which communities are most severely affected
- › Repeated assessments over time will be especially important to evaluate benefits, if any, of environmental mitigation projects

CALIFORNIA LEGISLATURE—2023–24 REGULAR SESSION

ASSEMBLY BILL

No. 827

Introduced by Assembly Member Garcia

February 13, 2023

An act to add Chapter 9 (commencing with Section 104324.6) to Part 1 of Division 103 of the Health and Safety Code, relating to public health.

LEGISLATIVE COUNSEL'S DIGEST

AB 827, as introduced, Garcia. Public health: pulmonary health: Salton Sea region.

Existing law establishes the State Department of Public Health and prescribes its duties related to public health, including the prevention of disease and the promotion of health. Among other duties, contingent on appropriation in the annual Budget Act, the department is required to analyze asthma morbidity and mortality data, periodically assess the burden of asthma on the state's medical and economic resources, and identify those populations most seriously affected by the disease.

This bill would require the department to conduct a study of the pulmonary health of communities in the Salton Sea region. The bill would also make related findings and declarations.

Vote: majority. Appropriation: no. Fiscal committee: yes. State-mandated local program: no.

The people of the State of California do enact as follows:

1 SECTION 1. The Legislature finds and declared all of the
2 following: