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Survey of Reported Health Effects of Owens Lake Particulate Matter

By
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Introduction

Owens Dry Lake is the largest single source of particulate (PM₁₀) pollution in the United States. Numerous scientific studies have been published documenting the multiple adverse health effects caused by particulate air pollution. Upper respiratory problems include runny/stuffy nose, sinusitis, sore throat, wet cough, head cold, hay fever and burning/red eyes. Lower respiratory problems include wheezing, dry cough, phlegm, shortness of breath and chest discomfort or pain. A link between increased particulate matter concentrations and a decrease in lung function has been established. Associations between particulate matter and asthma cases in children as well as aggravation of the disease in adults and children have been documented.

This report attempts to summarize conclusions from major health studies related to particulate matter and health effects, as well as health problems caused by metals found in the lake dust. For years, Owens Valley and Indian Wells Valley residents have complained about adverse health effects suffered because of the lake dust. This report documents the evidence that was collected anecdotally from residents of the Owens and Indian Wells Valleys who believe their health has been compromised from breathing the dust coming off the lakebed. Their reported symptoms are consistent with health effects observed by epidemiologists in studies done in large population areas. This information was collected from residents through phone calls, e-mails, personal interviews and written surveys. Over 100 people responded to requests asking how the dust has affected their health. Doctors and nurses in the area have commented on what they observe in patients shortly after a dust storm has occurred.

Method

Requests for information regarding the health effects people feel they have suffered because of the dust coming off Owens Lake were published in three local newspapers and local newsletters including the bi-weekly newsletter at the China Lake Naval Air Weapons Station. Requests also appeared on the local television and radio stations. Written surveys were left in health clinics and given to faculty and students at Lone Pine High School. People responding to the requests were asked several questions about what health effects they have suffered that they attribute to air pollution from Owens Lake, why they attribute the effects to the lake dust and how that affected their daily activity. The survey asked how long residents have lived in the area and how long he/she had been suffering from the reported health effects. Information was collected beginning in September 1999 and ending in early December 1999. In 1997, an e-mail was sent out to all hands at China Lake Naval Air Weapons Station asking them what health effects they or family members have suffered that they would attribute to the lake dust.

Survey Results

The attached charts show the occurrence of each symptom reported that residents say are caused by the lake dust. Percentages are calculated from the 114 anecdotal reports received since

September 1999. The most common symptoms reported were increased allergies (54%), breathing problems (27%), asthma (26%) and aggravated sinus problems (25%). People reported suffering from headaches (13%), stuffy/runny noses/nasal drip (11%) and congestion (11%) that they say was brought on by the blowing dust. Often times, these allergy and sinus symptoms would develop into sinus infections, which required antibiotics. There were also reports of ear infections (3 reports), which also required antibiotics to treat. Other health problems reported were bronchitis (1 report) and bronchial infections (1 report), eye irritation (20%), sore throats (10 cases), coughing and wheezing (27%) and a general feeling of tiredness (2 reports). Many reported never having any symptoms until moving to this area. There have been several reports stating that when they leave the valley, their symptoms go away. Figure 1 summarizes the health effects reported by respondents in this study. Figure 2 summarizes previous responses on Owens Lake health effects reported through email messages from the Navy.

A common comment was that when the dust blows, people just know to stay indoors to avoid adverse health effects as much as possible. However, most people do not like the fact that their everyday activities must be curtailed when the dust is blowing. Sometimes, just being indoors is not enough. People, especially in the Ridgecrest and Keeler area, have reported that the dust gets in the house even if all windows and doors are shut. It can be seen as a fine film on furniture in the house. Many people have installed HEPA filters in their homes so they won't be breathing as much of the dust. One woman reported spending \$8,000 to install double-paned windows throughout the whole house. Before doing this, the dust would aggravate her asthma so bad she would have to be hospitalized.

Asthma attacks were another prevalent health problem reported for adults and for children. Parents reported keeping their children indoors during dust storms to prevent an asthma attack. There were reports that the dust triggers asthma attacks and increased usage of asthma inhalers and medication. Several students from Lone Pine High School, who responded to a written survey, reported their asthma acting up when the dust blows. A few parents have reported that after a dust storm, their children had to be hospitalized with lung and breathing problems. One 10-year-old boy, never before diagnosed with asthma, had to be hospitalized twice (once for three days and once for two days) in March 1999 after dust storms when he experienced serious lung and breathing problems. Another parent reported her daughter had to be hospitalized for five days following an asthma attack she suffered after a big dust storm.

In the absence of scientific studies conducted on health effects caused by Owens Lake dust, doctors in this area are reluctant to say that the lake dust is the cause of many health problems people in the Owens Valley and Indian Wells Valley suffer. A doctor from Ridgecrest said that when the wind blows the dust so bad that the Sierras cannot be seen, he knows it will be a busy day for him. He will see people with bad sinus headaches and chronic sinus infections. He doesn't know if the dust causes asthma, but in his asthmatic patients he does notice more aggravation. Many patients tell him that when they leave the valley they get better, but their problems resume as soon as they return. A doctor who has practiced in the area for 36 years said he noticed an increase of patients with cold, sinus and allergy problems when the dust would blow. He also said that people with pre-existing conditions such as asthma and other respiratory problems, would experience aggravation of these diseases.

A former nurse in southern Inyo noticed that when the dust would blow, clinic visits would increase. Many of these visits would be from patients with pre-existing conditions such as emphysema, chronic obstructive pulmonary disease (COPD) or asthma that would have aggravated symptoms. Sometimes, their regular medications would not be strong enough and they would have to either increase their dosage and/or get stronger medication temporarily. Some patients experienced bad air exchange and had to increase their oxygen supply. Symptoms she observed in patients coming in during dust storms were wheezing, difficulty breathing, difficulty in catching breath and bad air exchange. When the dust storms stopped, she said there were far fewer clinic visits for respiratory symptoms.

A nurse currently working in southern Inyo states that asthmatics do get worse when they are exposed to the dust. She gets complaints of skin burning when the dust is really bad. Spring seems to be the worst. Another nurse at Southern Inyo Hospital said that when the dust storms kick up, the hospital usually expects to see about 1-2 people in the emergency room. She also stated that since the hospital only has four beds, it is hard to correlate hospital admissions rates with the dust storms. This was supported by another medical staff person who said that it is a fact that more patients come in when the dust blows. She has seen patients with existing respiratory problems come in when the dust blows with exacerbated symptoms such as difficulty breathing and shortness of breath. People with allergies have increased symptoms such as itchy runny eyes and noses along with post-nasal drip. In asthma patients, she has seen exacerbated attacks.

A former staff member at Lo-Inyo Elementary noticed that every time there was a dust storm, the asthmatic students had difficulty breathing and came into the office for their doctor-prescribed asthma medications. This was documented at the time. Records of past years documenting each time a student came in for asthma medication were not available.

Known Health Effects of Particulates

Many scientific studies have been published documenting health effects from particulate air pollution. The Harvard Six City Study (Dockery, et. al. 1993) followed the health of over 8,000 adults and children in six cities for 14-16 years to study the effects of air pollution on human health. The six cities chosen ranged from relatively clean to very polluted. The study looked at various sources of particle pollution. The samples of each city were representative of age, sex and occupational distribution of the population of each city. The study found that even after eliminating factors such as cigarette smoking, occupational exposure, obesity and socio-economic status, a direct relationship between particle concentrations in the air and increased mortality rates was found. It also shows lung cancer and cardiopulmonary disease to be associated with air pollution.

The American Lung Association (ALA 1994) found that there is an association between particulate matter air pollution and chronic cough, respiratory illness, asthma attacks and death. They also found that illness, morbidity and mortality all increase even at particulate matter levels below federal standards.

The booklet, *Breath Taking: Premature Mortality due to Particulate Air Pollution in 239 American Cities*, published by the Natural Resources Defense Council (NRDC, 1996),

summarizes studies conducted on different cities regarding the health effects of particulate pollution. The Utah Valley Studies were conducted in Utah County where the percentage of smokers is the lowest in the nation. A local steel mill (the largest source of air pollution in the valley) was shut down for 13 months (1986-87) due to a strike. PM levels during this period were half the rate compared to when the mill was open. Hospital admissions for children were 2-3 times higher during winters when the mill was open. Hospital admissions for pre-school aged children with bronchitis and asthma were twice as high. It was found that higher PM₁₀ concentrations were associated with a decline in lung function. There were increased reports of respiratory disease and asthma medication usage. These results were reported at air quality levels below the national standard.

In St. Louis, Missouri and Kingston/Harriman, Tennessee (NRDC, 1996), total mortality was strongly associated with PM₁₀ concentrations. In Detroit, Michigan (NRDC, 1996), PM₁₀ was associated with daily admissions for ischemic heart disease and heart failure. Daily monitoring data is available for PM₁₀ in Birmingham, Alabama (NRDC, 1996). PM₁₀ levels were associated with hospital admissions for pneumonia and chronic obstructive pulmonary disease (COPD). In Seattle, Washington (NRDC, 1996), it has been observed and studied that emergency room visits were highly associated with PM₁₀ exposure from the previous day. 12% of emergency room visits for asthma were associated with average PM₁₀ concentrations in the Seattle area, where these concentrations never exceeded 70% of the current National Ambient Air Quality Standards. PM₁₀ was strongly associated with increased hospital admissions for the elderly in New Haven, Connecticut, and Tacoma, Washington. In March 1995, the American Cancer Society Cohort Study was published (NRDC, 1996). The ACS followed the health of 552,138 people between 1982 and 1989, in an attempt to determine the number of people who had died. The large number of people used gave it significant statistical power. This study was not representative of the general population because participants were recruited for the study. They found that exposure to air pollution is shortening lives by several years.

A study published in the May/June 1999 issue of Archives of Environmental Health (Goren et. al. 1999) looked at 638 children living in an area near an industrial zone and 338 children in an area not exposed to the industrial source. The children living near the industrial zone had a higher instance of physician diagnosed asthma, cough without cold, sputum without cold and cough with sputum. Expiratory flow was measured and it was found that the peak expiratory flow was significantly lower for children near the industrial zone.

Concentrations of particulate matter have been found to be inversely related to lung function (Jedrychowski, et. al. 1999). Also, positive associations between lung cancer and particulate matter exist. A study done by the School of Public Health at Loma Linda University has found excess lung cancer risk at levels below the federal standard for PM₁₀ (Abbey, et. al. 1995).

A study by the Department of Public Health and Epidemiology at the University of Birmingham Medical School (Wordley, et. al. 1996) observed variations in hospital admissions and mortality with variations in particulate matter air pollution. This was found for respiratory and bronchial admissions for same day PM₁₀ concentrations. Pneumonia and asthma admissions increased for PM₁₀ concentrations over three days. Mortality rates from COPD, circulatory deaths were

associated with 24-hour PM₁₀ concentrations. These associations have all been seen at levels below the federal standards.

Asthma and Particulate Matter

There have been many recent studies documenting the association of asthma and particulate air pollution. Asthma is the most common chronic disease in children. Particulate matter has been shown to exacerbate asthma and asthma conditions. Asthma symptoms include wheezing, shortness of breath, tightness in chest and coughing. Allergic asthma is characterized by an immediate reaction (within an hour, often minutes) of exposure. Particulate matter has been associated with increased asthma symptoms, increased emergency room visits, increased asthma medication usage and increased hospital admissions for asthma. Increases in morbidity and mortality after air pollution episodes have been observed. Several studies (Lipsett, et. al. 1997; Norris, et. al. 1999; Schwartz, et. al. 1993) have documented particulate air pollution associations with emergency room visits for asthma. Three separate studies (Norris, et. al. 1999) have been done in Seattle that shows a significant association between aggravated asthma and PM₁₀.

Metals and Adverse Health Effects

Owens Lake dust contains elements such as arsenic, cadmium and nickel. All three of these elements have adverse health effects associated with them. Studies published in International Archives of Occupational and Environmental Health (Byrd, et. al. 1996), Epidemiological Reviews (Engel, et. al. 1994) and in Regulatory Toxicology and Pharmacology (Hughes, et. al. 1994) have all reported an association between inhaled inorganic arsenic and lung and respiratory cancers. Cadmium (Kahan, et. al. 1992) can be very toxic in high doses. Reduced sense of smell, ulceration of the nose, emphysema, renal tubular syndrome and anemia can all occur from prolonged exposure to cadmium dust. There may also be an association between inhaled cadmium compounds and incidences of lung cancer. Nickel (Barceloux 1999) is an irritant of the respiratory tract. It is recognized as having carcinogenic potential. The inhalation of nickel can cause asthma (in rare instances), sinusitis and nasal polyposis.

Conclusions

Particulate matter has been shown in several recent scientific studies to cause various adverse health effects such as wheezing, coughing, sore throat, sinus problems and asthma. These studies show symptoms occur even when PM₁₀ levels are within federal standards. PM₁₀ has been found to increase both mortality and morbidity rates. The anecdotal claims collected from residents of the Owens Valley and Indian Wells Valley are consistent with evidence found in the studies. The most common symptoms reported by people affected by Owens Lake dust storms are aggravated sinus problems, increased allergies, headaches, and ear infections. These allergies and sinus problems often developed into infections requiring antibiotics. Owens Lake dust was also implicated in aggravating existing health problems related to lung disease such as bronchitis and asthma, with reports of increased medical treatments and asthma attacks.

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Figure 2. Previously Reported Health Effects from Navy Emails

