Health Consultation

MARY MCLEOD BETHUNE SCHOOL AND
SOUTH PHOENIX AIR MONITORING

PHOENIX, MARICOPA COUNTY, ARIZONA

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U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
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Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency’s opinion, indicates a need to revise or append the conclusions previously issued.

HEALTH CONSULTATION

MARY MCLEOD BETHUNE SCHOOL AND SOUTH PHOENIX AIR MONITORING

PHOENIX, MARICOPA COUNTY, ARIZONA

Prepared by:

U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation

Purpose

The Arizona Department of Health Services has a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR) to conduct health consultation activities. The purpose of this health consultation is to evaluate the air monitoring conducted by the Arizona Department of Environmental Quality (ADEQ) at Mary McLeod Bethune School (Phoenix, AZ) and evaluate the potential impact on public health. The air monitoring data includes particulate matter and metals. The ADEQ's primary objective of this air sampling is to provide an understanding of the hazardous air pollutants in the Phoenix area

Introduction

The ADEQ is monitoring for hazardous air pollutants at six locations throughout the Phoenix Metro Area as part of the Hazardous Air Pollutant Cooperative Study. The Mary McLeod Bethune School is one of these locations.

The Mary McLeod Bethune School is located at 1310 South 15th Avenue in south Phoenix, Arizona. The air monitoring equipment was located on the roof of the school. The ADEQ has relocated the equipment to ground level where it will provide educational opportunities for the students at the school and the sampling results will be more representative of human exposure concentrations (ADEQ 2004a).

The school is within the area defined by the South Phoenix Toxics Reduction Project and the Community Action Council. The United States Environmental Protection Agency (U.S. EPA) funds this project by a grant awarded to the ADEQ. The reduction of air pollution is the focus of the initial phase of the project. South Phoenix residents have expressed concerns about the health impacts of air pollution from the industries in the target area.

The Community Action Council is comprised of volunteers from the area, assisted by the ADEQ, Maricopa County Environmental Services, and City of Phoenix staff. The project's outcome is recommendations for pollution reduction in the pilot target area defined by the council. The council gave these recommendations to the ADEQ in September 2004. One of the recommendations identifies a limitation of implementing pollution reduction strategies. The community feels that there is a lack of an adequate understanding of actual health and safety risks posed to the community (AJAY 2004).

This health consultation focuses on the particulate matter air monitoring data collected at the school and evaluates the impact on public health. Future health consultations will focus on additional air data collected from the 6 air monitoring stations located throughout metro Phoenix, including other south Phoenix sites and the Mary McLeod Bethune School.

Air Monitoring Data

The ADEQ began collecting and analyzing air monitor data in January 2003. The air monitor collected data for particulate matter ($PM_{10\ and}$ $PM_{2.5}$) and particulate metal air toxics through June 2004. The results will enable the ADEQ to establish which pollutants are of most concern in the area.

The monitor at Mary McLeod Bethune School collected a 24-hour sample every 6th day. In March 2003, a particulate matter 2.5 ($PM_{2.5}$) sampler was added to the site. PM_{10} is particulate matter that is less than 10 microns in size; $PM_{2.5}$ is particulate matter less than 2.5 microns in size (ADEQ 2004b).

Air Quality Guidelines

The Clean Air Act, which was last amended in 1990, requires the U.S. EPA to set National Ambient Air Quality Standards for pollutants considered harmful to public health and the environment. The standards set limits to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly (USEPA 2004a).

The Arizona Ambient Air Quality Guidelines (AAAQGs) are residential screening values that are protective of human health, including children. Chemical concentrations that exceed the guidelines may not necessarily represent a health risk. If contaminant concentrations exceed these guidelines, whether or not there is a true threat to human health requires further evaluation.

The AAAQGs are not enforceable standards. Rather, they are intended to provide health-based guidelines that may be useful in making environmental risk management decisions. The guidelines consider human health risk from inhalation of contaminants in ambient air. They do not consider odor thresholds (ADEQ 1999)

Agency for Toxic Substances and Disease Registry Comparison Values

The Arizona Department of Health Services uses media specific comparison values maintained by the ATSDR for use in evaluating environmental public health concerns. The ATSDR's comparison values are derived from a review of scientific research on the effects of exposure to the chemical and standard assumptions regarding human exposure pathways such as breathing rates and oral ingestion factors. Chemical levels below the comparison values are considered safe for all public health exposures. Chemical levels above the comparison values are not predictors of adverse health effects. They are used to focus concern on chemicals, which require further evaluation for the specific amounts, pathways, and periods of exposure from a specific site (ATSDR 2005).

Particulate Matter (PM_{10} and $PM_{2.5}$)

(1) PM_{10}

The ADEQ collected particulate matter or PM_{10} data at the Mary McLeod Bethune School from January 2003 through June 2004. Fifty-five samples were collected in 2003; and 28 samples were collected from January 2004 through June 30, 2004.

The current National Ambient Air Quality Standard (NAAQS) for PM_{10} is 150 micrograms per cubic meter of air ($\mu g/m^3$) averaged over 24 hours, and 50 $\mu g/m^3$ averaged over a one-year period. As shown in Table 1, the 2003 annual average for PM_{10} was 47 $\mu g/m^3$ and the 2004 annual average for PM_{10} was 40.8 $\mu g/m^3$. The 2004 1st quarter average was 37 $\mu g/m^3$; and the 2nd quarter average was 41 $\mu g/m^3$.

The highest recorded 24-hour reading of 145 $\mu g/m^3$ in 2003 occurred on July 14, 2003. A dust storm on this day in the Phoenix Metro area reduced visibility to less than 6 miles. The highest

24-hour reading for PM_{10} in the 1st quarter of 2004 was 90 $\mu g/m^3$ in March; and the highest 24-hour reading of 100 $\mu g/m^3$ in the 2nd quarter occurred on May 27, 2004 (Table 1).

(2) $PM_{2.5}$

The current National Ambient Air Quality Standard (NAAQS) for $PM_{2.5}$ is 65 $\mu g/m^3$ averaged over 24 hours and 15 $\mu g/m^3$ averaged over a one-year period. Air monitoring data for $PM_{2.5}$ from the school was below the 24-hour and annual standards. The annual averages of $PM_{2.5}$ were 12.1 $\mu g/m^3$ for 2003 and 12 $\mu g/m^3$ for 2004 (ADEQ 2004c).

Table 1. Particulate Matter (PM_{10} and $PM_{2.5}$) Measurements in micrograms per cubic meter ($\mu g/m^3$) at Bethune School from January 2003 to June 2004.

	Annual National Ambient Air Quality Standard ($\mu g/m^3$)	24-hour National Ambient Air Quality Standard ($\mu g/m^3$)	Annual average Level of particulate matter at Bethune School ($\mu g/m^3$)		Highest Recorded 24-hour Level of particulate matter at Bethune School ($\mu g/m^3$)	
Year			**2003**	**2004**	**2003**	**2004**
PM_{10}	50	150	47 (Annual)	40.8 (Annual)	145	100
$PM_{2.5}$	15	65	12.1	12	25.0	25.8

Particulate Matter Metals

All particulate matter metals were within the 24-hour Arizona Ambient Air Quality Guidelines (AAAQGs). However, cadmium and arsenic exceeded the annual AAAQGs. Cadmium exceeded the AAAQG of 0.00056 micrograms per cubic meter of air by a factor of 13 (0.00728). Arsenic exceeded the annual AAAQG of 0.00023 micrograms per cubic meter of air by a factor of 6 (0.00138 micrograms per cubic meter of air). The annual concentrations for arsenic and cadmium both exceed the ATSDR's Cancer Risk Evaluation Guides (Table 2).

Table 2. Metals Detected in Bethune School Air Monitoring Station

Metal	Annual Concentration ($\mu g/m^3$)	Annual AAAQG[a] ($\mu g/m^3$)	ATSDR's CREG[b] ($\mu g/m^3$)	Exceeds Annual AAAQG	Exceeds ATSDR's CREG
Arsenic	0.00138	0.00023	0.0002	**Yes**	**Yes**
Cadmium	0.00728	0.00056	0.0006	**Yes**	**Yes**

[a] AAAQG: Arizona Ambient Air Quality Guideline
[b] CREG: Cancer Risk Evaluation Guide

Discussion

Human contact or exposures to chemical contaminants drive the ATSDR public health assessment process. The release or disposal of chemical contaminants into the environment does not always result in exposure or contact. Chemicals only have the potential to cause adverse health effects if people actually come into contact with them. People may be exposed to chemicals by breathing, eating, or drinking a substance containing the contaminant or by skin (dermal) contact with a substance containing the contaminant.

When people are exposed to chemicals, the exposure does not always result in adverse health effects. The type and severity of health effects that may occur in an individual from contact with contaminants depend on the toxicological properties of the contaminants, how much of the contaminant to which the individual is exposed, how often and or how long the individual is exposed. Once exposure occurs, characteristics such as age, sex, nutritional status, genetics, life style and health status of the exposed individual influence how the individual absorbs, distributes, metabolizes, and excretes the contaminant. These factors and characteristics influence whether exposure to a contaminant could or would result in adverse health effects.

The ATSDR has developed Minimal Risk Levels (MRLs) to estimate the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse noncancer health effects over a specified duration of exposure. These substance-specific estimates, which are intended to serve as screening levels, are used to identify contaminants and potential health effects that may be of concern. MRLs are not intended to define clean up or action levels for hazardous waste sites. Inhalation minimal risk levels for cadmium and arsenic are not available from ATSDR (ATSDR 2004).

Particulate Matter (PM_{10} and $PM_{2.5}$)

South Phoenix is bordered by Interstates 10 and 17 and is subject to emissions from heavy vehicular traffic from these highways and numerous surface streets. Because of the heavy traffic, dust, and because it is the lowest point in the valley, South Phoenix has the highest concentration of airborne particulate matter of the Phoenix Metro Area.

Particulate matter is a mixture of solid and liquid droplets of material that vary in size and origin. Since only very small particles (less than 10 microns in size) can be inhaled into the respiratory tract, they are the most biologically threatening to humans. Particulates of this size are referred to as PM_{10} (Earthvision 2004).

Particulate matter comes from a variety of sources. Some particles are emitted directly from their sources such as smokestacks and cars. In other cases, gases such as sulfur oxide, sulfur dioxide, nitrogen dioxide, and volatile organic compounds interact with other compounds in the air to form particulate matter. As a result, the chemical and physical composition of particles varies widely.

"Coarse" particles are larger than 2.5 micrometers and generally come from sources such as vehicles traveling on unpaved roads, materials handling, crushing and grinding operations such as cement manufacturing, and combustion sources. Particles less than 2.5 micrometers (0.0004 inch) in diameter are known as "fine" particles. Fine particles result from fuel combustion in motor vehicles, power plants and industrial facilities, residential fireplaces, woodstoves, wildfires, and prescribed forest burning. Fine particles can also be formed in the atmosphere from gases such as sulfur dioxide and volatile organic compounds (Health 2004).

The primary cause of particulate matter in the Phoenix area comes from windblown dust from construction sites, road building activities, agricultural fields, unpaved parking lots and roads, disturbed vacant lots, and paved road dust. Research shows that winds in Phoenix generally blow from the east during the night and early morning hours, then reverse so they blow from the west during the afternoon. The winds from the west can approach 20 miles per hour in the afternoon during the warmer months.

This is in part related to Central Arizona terrain. The higher land areas or mountains to the east heat up and cool off faster than the valleys. This creates air movement toward the mountains during the day and toward the valleys at night.

From October through April, storm systems enter Arizona from the Pacific Ocean. The surface winds ahead of these cold fronts typically blow from the south or southwest and can be quite gusty, reaching up to 40 miles per hour. During the summer months of July through September, monsoon thunderstorms can cause strong surface winds, again 40 miles per hour or stronger. Downdrafts from the clouds can cause the winds to come from any direction, although south and southeast winds are common. These high wind conditions can increase the amount of particulate matter in the air (GABMP 2001).

Also contributing to higher levels of particulate matter in the Phoenix area are inversion layers which occur in the fall and winter months. An inversion layers is a region in the atmosphere where the temperature increases with height. The presence of an inversion creates a very stable atmosphere; when it occurs at the surface it leads to very little mixing and a trapping of pollutants in the lower atmosphere (NOAA 2004).

Chronic Health Effects of Particulate Matters (PM_{10} and $PM_{2.5}$)

Particulate matter less than 10 micrometers in size, including fine particles less than 2.5 micrometers, can penetrate deep into the lungs. On a smoggy day, one can inhale millions of particles in a single breath. Tens of millions of Americans live in areas that exceed the national health standards for particulates. In recent studies, exposure to particulate pollution - either alone or with other air pollutants - has been linked with premature death, difficult breathing, aggravated asthma, increased hospital admissions and emergency room visits, and increased respiratory symptoms in children. People most at risk from exposure to fine particulate matter are children, the elderly, and people with chronic respiratory problems.

In 1996, the Natural Resources Defense Council (NRDC) in Washington, D.C., published a report that applies the findings of a 1995 study by the American Cancer Society (ACS) and the Harvard Medical School to local data in 239 American cities, using death certificates and hospital admission information in conjunction with local air pollution measurements. The ACS study is the largest, most comprehensive long-term study in a growing international body of epidemiological evidence showing the adverse health effects of exposure to particulate pollution. The ACS reported that people living in cities with higher concentrations of airborne fine particles suffer an increased risk of premature death compared with people living in cleaner cities.

The NRDC report estimates that, of the almost one million adult deaths each year in the United States from cardiopulmonary causes, about 6.5% are attributable to particulate air pollution-that is, at current levels of pollution, approximately 64,000 premature deaths from particulates can be expected to take place nationally each year, more deaths than from AIDS and breast cancer combined. In many of the cities studied there were more deaths attributable to particulates (an annual estimated average of 939) than to automobile accidents. Lives on average are shortened by particulates by one to two years or more, with the more sensitive populations, including the elderly, children, and those with respiratory conditions, having their lives shortened by many years (GHASP 2004).

A study conducted by Pope, Thurston and Krewski (2002) tracked people over a period of time and controlled extensively for individual risk factors. They compared data on particulate and gaseous air pollution with data on the cause of death among 500,000 people followed for 16 years by the American Cancer Society. After compensating for risk factors, as well as possible regional differences, the researchers found that every 10-microgram increase in fine particles per cubic meter of air produces a 6 percent increase in the risk of death by cardiopulmonary disease, and 8 percent for lung cancer. This is similar to the risk faced by those with long-term exposure to second-hand smoke (HOUSE 2004).

Asthma among children has more than doubled in America over the past 20 years. Asthma is a priority for attention because it is the most common chronic disease in children and is the most frequent chronic childhood disease in Arizona. Children’s asthma rates are higher in Arizona than in most states, but the reasons for this are not known. The Arizona Respiratory Center of the University of Arizona estimates that anywhere between 12% and 25% of Arizona children have the disease.

It is not known what causes the onset of asthma, but it appears that asthma is the result of complex interactions between genes and the environment with both playing equal roles. Because asthma triggers are better understood than the causes of asthma, much of the focus is on the reduction of the triggers of asthma. Outdoor air pollutants and biological agents contribute to asthma. Outdoor air pollutants that are known to trigger asthma episodes are ozone and particulate matter. Air pollution may also act synergistically with other environmental factors to make asthma worse.

Children may be especially susceptible to adverse respiratory effects of exposure to fine-diameter particulate matter ($PM_{2.5}$) emitted from diesel engines. Nearly 94% of diesel particulates have diameters less than 2.5 microns. These smaller particles are able to penetrate children's narrower airways reaching deeply into the lungs. Fine particles from diesel exhaust aggravate respiratory illnesses such as asthma and bronchitis. Recent research indicates that diesel exhaust may increase the frequency and severity of asthma episodes and may lead to inflammation of the airways that can cause or worsen asthma (ADHS 2003).

The particulate matter levels for PM_{10} and $PM_{2.5}$ measured at Bethune School were below the National Ambient Air Quality Guidelines. However, the levels measured are comparable to levels measured in other parts of the Phoenix metro area. These levels are below the National Ambient Air Quality Standards and do not pose apparent public health hazards.

Scientific studies, as discussed above, have determined that particulate matter, especially the fine particles, may cause significant health problems including premature death, respiratory related hospital admissions and emergency room visits, aggravated asthma, chronic bronchitis, and decreased lung function. Some sensitive populations, including the elderly, children, and those with chronic respiratory conditions may experience adverse health effects below the National Ambient Air Quality Standards.

Particulate Matter Metals – Arsenic and Cadmium

The exposure for the inhalation pathway was calculated for arsenic and cadmium as follows:

$$CDI = \frac{(OAC)(IR)(ET)(EF)(ED)(CF)}{(BW)(AT)}$$

Variable		Units	Value	Arsenic	Cadmium
CDI	Chronic daily intake	Milligrams per kilogram per day (mg/kg-day)	Site-specific	0.0000004	0.0000020
OAC	Air concentration Outdoors	Milligrams per cubic meter (mg/m^3)	Site-specific	0.0000014	0.0000073
IR	Inhalation rate	Cubic meters per day (m^3/day)	20		
ET	Exposure Time	Hours / day	24		
EF	Exposure Frequency	Days / year	350		
CF	Conversion factor	1day / 24 hours	1/24(0.04)		
ED	Exposure Duration	Years	30		
BW	Body Weight	Kilograms	70		
AT	Averaging Time	Days	10950		

Arsenic

Arsenic was identified as a contaminant of concern as it exceeded the Arizona Ambient Air Quality Guidelines and the ATSDR comparison value. Inhalation exposure to inorganic arsenic in air at copper smelters is associated with increased risks of lung cancer in occupational settings. However, scientific literature does not support associations between lung cancer and exposure to airborne arsenic in residential settings.

Mean levels of arsenic in ambient air in U.S. cities (0.02-0.03 $\mu g/m^3$). The annual level of arsenic in ambient air at Bethune School was 0.00138 $\mu g/m^3$ (ATSDR 2001).

The ATSDR has not established a minimum risk level (MRL) for inhalation of arsenic. The U.S. Environmental Protection Agency has not established a reference concentration (RfC) for inhalation exposures (USEPA 2004b).

No observed adverse effect levels (NOAEL) are the highest tested doses of a substance that has been reported to have no harmful or adverse health effects on people or animals. The no observed adverse effect level (NOAEL) identified by the ATSDR Toxicological Profile for Arsenic is 0.0008 mg/kg per day. This level is based on the effects of arsenic on the incidence of Blackfoot disease and dermal lesions in residents of Taiwan exposed to high levels of arsenic in well water. The chronic daily intake calculated for arsenic is well below the identified no observed adverse effect level.

The air levels of arsenic detected at Bethune School are well below levels that would cause adverse health effects. The air samples were obtained from the monitor located on the roof of the school, which does not necessarily indicate that children attending this school would be exposed to the arsenic concentrations at the rooftop level.

The Arizona Department of Health Services concludes that the concentrations of arsenic in the ambient are near the school pose no apparent public health hazard. For the general population, food is the primary source of arsenic exposure; inhalation exposure is generally negligible by comparison (ADEQ 2004c).

Table 3. Estimated Chronic Daily Intake of Arsenic from Ambient Air

	Exposure Route	**Chronic daily intake (mg/kg per day)**	**No Observed Adverse Effect Level (NOAEL) (mg/kg per day)**	**Exceeds the NOAEL**
Arsenic	Inhalation	0.0000004	0.0008	No

Cadmium

Most cadmium used in the United States today is obtained as a by-product from the mining of lead and copper ores. Cadmium is used to manufacture pigments and batteries and in the metal-plating industries. Air cadmium levels are generally low in U.S. cities, ranging from .0001 to 0.040 micrograms per cubic meter of air.

In humans, food and cigarette smoke are the main sources of exposure. Cadmium is found in small amounts in fruit and vegetables and in larger amounts in leafy vegetables and potatoes, shellfish, and meats. Milk, dairy products, eggs, beef, and fish usually contain < 0.01 milligrams per kilogram (parts per billion) cadmium, while higher concentrations 0.01 – 0.10 milligrams per kilogram are typically found in vegetables, fruits, and grains (USEPA 2004c).

Cadmium was present above the ATSDR's comparison value for chronic exposures. ATSDR's comparison value for cadmium in air is 0.0006 micrograms per cubic meter of air. The inhalation dose is estimated at 0.000004 mg/kg per day. An inhalation Minimal Risk Level (MRL) has not been established for cadmium. The U.S. Environmental Protection Agency has not established a reference concentration (RfC) for inhalation exposures.

Table 4. Estimated Chronic Daily Intake of Cadmium from Ambient Air

	Exposure Route	**Chronic daily intake (mg/kg per day)**	**No Observed Adverse Effect Level (NOAEL) (mg/kg per day)**	**Exceeds the NOAEL**
Cadmium	Inhalation	0.000002	0.0021	No

No observed adverse effect levels (NOAEL) are the highest tested doses of a substance that has been reported to have no harmful or adverse health effects on people or animals. The no observed adverse effect level (NOAEL) identified by the ATSDR Toxicological Profile for Cadmium is 0.0021 mg/kg per day. This level is based on the effects of cadmium on kidney function. The chronic daily intake calculated for cadmium is well below the NOAEL level of 0.0021 mg/kg per day.

The air samples were obtained from the monitor located on the roof of the school, which does not necessarily indicate that children attending this school would be exposed to the arsenic concentrations at the rooftop level. The Arizona Department of Health Services concludes that the concentrations of arsenic in the ambient are near the school are do not pose any apparent public health hazard.

<u>Excess Lifetime Cancer Risks from Arsenic and Cadmium</u>

Estimates of estimated lifetime cancer risk were developed by evaluating potential exposure pathways, estimating exposure concentrations and intake, and combining exposure estimates with toxicology information (USEPA 1991). The lifetime cancer risk is calculated as follows:

$$\text{Risk} = \text{Cancer Inhalation Unit Risk } (1/\mu g/m^3) \times \text{Concentration } (\mu g/m^3)$$

where:

Risk = a unitless probability of an individual developing cancer;
Unit Risk = Dose averaged over 70 years ($1/\mu g/m^3$) (USEPA 2005); and
Concentration = Predicted air concentration ($\mu g/m^3$).

Table 5 summarizes estimated lifetime cancer risk using annual air concentrations for arsenic and cadmium. Cancer inhalation unit risk is the upper-bound excess lifetime cancer risk estimated to result from continuous exposure to a compound at a concentration 1 μg/m^3 in air. The unit risk values are developed by the US Environmental Protection Agency after careful and detailed analyses of data regarding the potential cancer potency of a compound.

Table 5. Estimated Excess Cancer Risk from Airborne Arsenic and Cadmium

Chemical	Annual Ambient Air Concentration (μg/m^3)[a]	Cancer Inhalation Unit Risk[b] 1/(μg/m^3)	Excess Lifetime Cancer Risk[c]
Arsenic	0.00138	0.0043	0.000006
Cadmium	0.00728	0.0018	0.00001
	Total Excess Lifetime Cancer Risk		**0.00002**

[a] μg/m^3: micrograms per cubic meter of air
[b] Source: USEPA 2005
[c] Excess Lifetime Cancer Risk = Average Air Concentration X Unit Risk

The estimated upper-bound excess cancer risk estimate of 0.00002 or two-in-one-hundred-thousand represents the increased risk of developing cancer. This estimate was calculated by multiplying average predicted contaminant concentrations by the Unit Risk.

There is general (although not unanimous) consensus among the scientific and regulatory communities on what level of estimated excess cancer risk is acceptable. An increased lifetime cancer risk of one in one million or less is generally considered negligible. According to the United States Environmental Protection Agency National Contingency Plan and subsequent guidance, an estimate of excess cancer risk between one in a million to less and one in ten thousand is within a range of acceptable risk (USEPA 1990, 1991). Risks greater than one in ten thousand do not necessarily pose a significant cancer risk, but require additional in-depth analysis in order to draw conclusions about potential cancer risk.

The upper-bound estimated risk from the annual ambient concentrations is within the range of acceptable risk and poses no apparent public health hazard.

Child Health Concerns

The ATSDR's Child Health Initiative recognizes that the unique vulnerabilities of infants and children demand special emphasis in communities faced with contaminants in air. Children are more likely to be exposed because they play outdoors. Children's' developing body systems can sustain permanent damage if toxic exposures occur during critical growth stages. Children breathe a greater volume of air relative to body weight, resulting in a higher burden of pollutants.

Furthermore, children, even those without pre-existing illness or chronic conditions, are susceptible to air pollution because their lungs are still developing, and they are often engaged in vigorous outdoor activities, making them more sensitive to pollution than healthy adults. Studies have shown that in children, particulate pollution is associated with increased episodes of coughing and difficulty breathing, and decreased lung function. Children, particularly those with asthma, likely were among the most affected persons. These health effects can result in school absences and limitations in normal childhood activities.

Conclusion

The levels of particulate matter (PM_{10} or $PM_{2.5}$) are below the National Ambient Air Quality Standards set by the U.S. Environmental Protection Agency. These levels are below the standards and pose no apparent public health hazards.

The levels of particulates are within permitted limits, however the inhalation of particulates may cause respiratory irritation, aggravate mucous membranes, and create discomfort in those people already prone to respiratory disease. Scientific studies have determined that particulate matter, especially the fine particles, may cause significant health problems including premature death, respiratory related hospital admissions and emergency room visits, aggravated asthma, chronic bronchitis, and decreased lung function.

The levels of arsenic and cadmium measured, while exceeding the Arizona Ambient Annual Air Guidelines, pose no apparent public health hazards. The total excess lifetime cancer risk due to arsenic and cadmium is estimated at 2 in 100,000 which is within the acceptable range of risk of one in 10,000 to one in one million.

Recommendations

Implement a School Bus Idle Reduction program to reduce particulate emissions in the South Phoenix school districts.

Public Health Action Plan

1. The Arizona Department of Health Services will continue to review and evaluate air monitoring data from all air monitoring sites located in the Phoenix metropolitan area as the data becomes available from the Arizona Department of Environmental Quality.

2. The Arizona Department of Health Services will provide this report to Mary McLeod Bethune School and the South Phoenix Toxics Reduction Project.

3. The Arizona Department of Health Services will coordinate with the Arizona Department of Environmental Quality and the U.S. Environmental Protection Agency to implement the School Bus Idle Reduction program to reduce particulate emissions in the South Phoenix school districts.

4. The Arizona Department of Health Services will participate in a Diesel Emissions Workshop scheduled this summer. The U.S. Environmental Protection Agency Region 9 will sponsor the workshop as part of a Pollution Prevention effort in Maricopa County.

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CERTIFICATION

The Arizona Department of Health Services, under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR), prepared this Mary McLeod Bethune School and South Phoenix Air Monitoring health consultation. It was prepared in accordance with approved methodology and procedures existing at the time.

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The Division of Health Assessment and Consultation has reviewed this health consultation and concurs with its findings.

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ATSDR