COAL DUST IN ALASKA:
Hazards to Public Health

Community Air Quality Monitoring in Seward, AK

July 2014

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Alaska Community Action on Toxics

Global Community Monitor
empowering communities

Contents

Left: Air monitor mounted in Seward's Small Boat Harbor. Above: utility meter in Seward Small Boat Harbor coated in coal dust. Photos: Russ Maddox

Cover photo: Bjørn Olson, Ground Truth Trekking

Executive Summary

Residents of Seward, Alaska, have expressed concern for years about possible adverse health outcomes from coal dust blowing from the local coal export facility. These residents are concerned that the airborne particulate matter may pose a health threat, particularly to the elderly, children, and people with asthma and other chronic illnesses. The Alaska Railroad and Usibelli Coal Mine (the coal facility operators) have consistently dismissed these complaints and asserted that facility upgrades in 2007 resolved any past issues with fugitive coal dust. The facility operators also point to other potential sources of airborne particulate matter, such as glacier silt, and claim that coal is an insignificant contributor to the particulates in the air.

To address these concerns, citizen volunteers in Seward, Alaska conducted a year-long air quality monitoring project with assistance and training from Global Community Monitor (GCM), Alaska Community Action on Toxics (ACAT), and Resurrection Bay Conservation Alliance (RBCA). The goal of the project was to measure how much of the dust blowing around town is coal from the stockpiles and coal loading facility, and to analyze the potential toxicity of this coal dust. Monitoring consisted of placing two portable particulate monitors developed by the Lane County Air Pollution District and the US EPA at selected locations around Seward and Lowell Point. These devices collected all particulate matter in the air for a 24-hour period, and the filters were then analyzed for PM_{10}, $PM_{2.5}$, metals, crystalline silica, or carbon content.

The data indicate that coal makes up the majority of the dust captured in the air monitors, which demonstrates that the Seward Coal Loading Facility is a major contributor to airborne dust in Seward. Photos document coal dust coating a boat harbor utility meter and used oil collection center in the Small Boat Harbor. Concentrations of PM_{10} on some days exceeded the World Health Organization's recommended thresholds for impairing respiratory and cardiovascular health. Crystalline silica and elemental carbon exceeded levels associated with health risks on a few occasions as well. We recommend further monitoring of the populated areas adjacent to and downwind of the coal loading facility to obtain a more robust data set that would inform mitigation measures. These measures should include the best available technology to limit coal dust emissions from the facility and protect the health of Seward residents and visitors to the community.

A worker stands in a plume of coal dust, as coal pours into a ship at the Seward port. Citizen volunteers in Seward, Alaska conducted a year-long air quality monitoring project with assistance and training from Global Community Monitor (GCM), Alaska Community Action on Toxics (ACAT), and Resurrection Bay Conservation Alliance (RBCA). Photo: Bretwood Higman and Erin McKittrick, Ground Truth Trekking

Background

Numerous studies link exposure to airborne particulates (particularly $PM_{2.5}$, particulate matter smaller than 2.5 µm in diameter) with diabetes, asthma, pulmonary disease, cancer, stroke, heart disease, and cognitive disorders such as dementia.[1,2] Recent science shows that particulate matter can cause significant harm even at doses below regulatory standards. Researchers comparing the effects of air pollution on lung cancer and cardiovascular mortality reported that cardiovascular risk was evident starting at the lowest dose measured.[3] Children are particularly vulnerable to airborne particulate matter due to their smaller size, greater activity, and because their lungs and immune systems are still developing.[1,2] Exacerbated asthma is a common complaint in communities suffering from air pollution, and has been a particular concern of Seward parents.

In Seward, where Alaska coal is loaded onto ships bound for Japan, South Korea, and Chile, the coal loading facility has been emitting coal dust, directly affecting the quality of life and health for some in the Seward community. Residents observe that coal dust is blowing from storage piles and the export facility into nearby neighborhoods, schools, homes and boats. These residents are concerned that the airborne particulate matter may pose a health threat, particularly to the elderly, children, and people with asthma.[4] The Alaska Railroad and Usibelli Coal Mine (the coal facility operators) dismiss these complaints and assert that facility upgrades in 2007 resolved past issues with fugitive coal dust.[5] The facility operators also point to other potential sources of airborne particulate matter, such as glacial silt, and claim that coal is an insignificant contributor to the grit in the air.

Coal loading equipment in Seward, Alaska. Photo: Russ Maddox

Seward Coal Loading Facility

The Seward Coal Loading Facility (SCLF) is the southern terminus of the Alaska Railroad. It is located adjacent to the cruise ship terminal, the Seward Small Boat Harbor, and a number of homes and businesses. The facility receives up to five trains per week of coal from the Usibelli Coal Mine near Healy and unloads this coal onto stockpiles. The uncovered coal stockpiles contain up to 95,000 tons of coal. The facility also loads coal from the stockpile onto large coal ships (with capacities of 45,000 to 75,000 tons) bound for Asian coal markets.[6] In 2007 and 2008, the Alaska Department of Environmental Conservation (DEC) cited the Alaska Railroad for air quality violations after numerous complaints from Seward residents about blowing coal dust. Three consultants hired by the Alaska Railroad recommended extensive dust control measures such as limiting the stockpile height to 20 feet, ceasing operations in winds over 20 mph, installing mist or water spray systems, and suspending operations during winter months when temperatures are too cold to operate water-based systems. One consultant measured significant coal dust accumulation inside a nearby Alaska Vocational Technical College (AVTEC) campus building and recommended installing HEPA filters in the building to protect the building users.[7] Another key recommendation was to upgrade and put to use the existing baghouse systems that had been installed in 1983 and never used.[8,9] These recommendations were largely ignored by the SCLF and the Alaska Railroad which made minimal upgrades to the equipment only partially mitigating the fugitive dust problem. Complaints from residents have continued.[10]

A History of Community Concern

This is not the first air quality monitoring effort to address the SCLF coal dust issue in the 25 years that the facility has operated. At the request of concerned citizens and the City of Seward, the DEC conducted ambient air quality monitoring for PM_{10} from January 2011 through May 2012. (PM_{10} refers to particulate matter (PM) consisting of particles that are less than 10 micrometers in diameter—thinner than a human hair.) The DEC protocol included measurements of PM_{10} concentration in the air every six days, regardless of wind or other weather conditions. The average of these measurements is assumed to represent the conditions on all other days. The DEC found PM_{10} concentrations averaging 11μg/m^3 (11 micrograms of PM_{10} per cubic meter of air), with the highest single-day measurement of 54 μg/m^3. These measurements are well below the Environmental Protection Agency (EPA) National Ambient Air Quality Standard (NAAQS) of 150 μg/m^3, so DEC concluded that Seward has good air quality[11] and declined to investigate further into the source or the composition of the dust in the air.

The DEC's conclusion failed to reassure some Seward residents.[12] They pointed out the variable and extreme weather patterns and wanted to know what they are exposed to on windy days when they could see, smell, taste and feel clouds of dark-colored particles. Ambient air quality measurements assess the overall long-term air quality of a region, but are not designed to identify spikes in pollution levels such as variable output from point sources or changes in wind speed. The DEC study measured only PM_{10}, and not $PM_{2.5}$ (particles smaller than 2.5 micrometers in diameter), and not the elemental composition of the particles. Smaller particulates, the $PM_{2.5}$, pose more of a health hazard than the PM_{10} size, because the smaller particles penetrate deeper into the lungs, and some can even be small enough to move directly into the blood stream from the lungs, or pass from the nasal passages into the brain via the olfactory nerve.[13] Coal is known to contain toxic heavy metals, such as arsenic, mercury and selenium that are linked to cancer and neurological disorders.[1, 14] Silica is another naturally-occurring component of coal; some coals contain a crystalline silica (quartz) content of greater than 5% w/w.[15] Inhalation exposure to relatively low concentrations of crystalline silica significantly increases the likelihood of serious pulmonary diseases.[16]

Coal dust from coal stockpiles blows in winter winds in Seward. Photo: Russ Maddox

Citizen Air Quality Monitoring Project

Ongoing community concern about coal dust spurred a citizen air quality monitoring project that collected air quality samples from February 2012 through April 2013. Volunteers from the community carried out the sampling, with assistance and training from Global Community Monitor (GCM), Alaska Community Action on Toxics (ACAT), and Resurrection Bay Conservation Alliance (RBCA). The goal of this project was to measure how much of the dust in the air of the community of Seward is coal dust from the stockpiles and loading facility, and to analyze the dust's potential toxicity. This study complements the information provided by the DEC ambient PM_{10} monitoring by measuring smaller particles ($PM_{2.5}$), and analyzing the particles for carbon content (to indicate coal), toxic metals, and silica.

The aim of the study was to answer these questions:

1) Is the particulate matter in the air a health hazard, particularly on windy days?
2) What proportion of the particulate matter is attributable to the coal loading facility?

Methods

Several Seward residents volunteered to attend a training workshop led by Global Community Monitor and Alaska Community Action on Toxics, selected monitoring locations around Seward and Lowell Point, and then carried out all sampling activities. For each sampling event, trained volunteers placed two portable particulate air monitors (Airmetrics MiniVol Portable Air Samplers) at the designated locations. Most of the samples were collected from a site in the Seward Small Boat Harbor, which is within a quarter of a mile downwind of the coal loading facility. The other sites were located at residences in Seward and at Lowell Point.

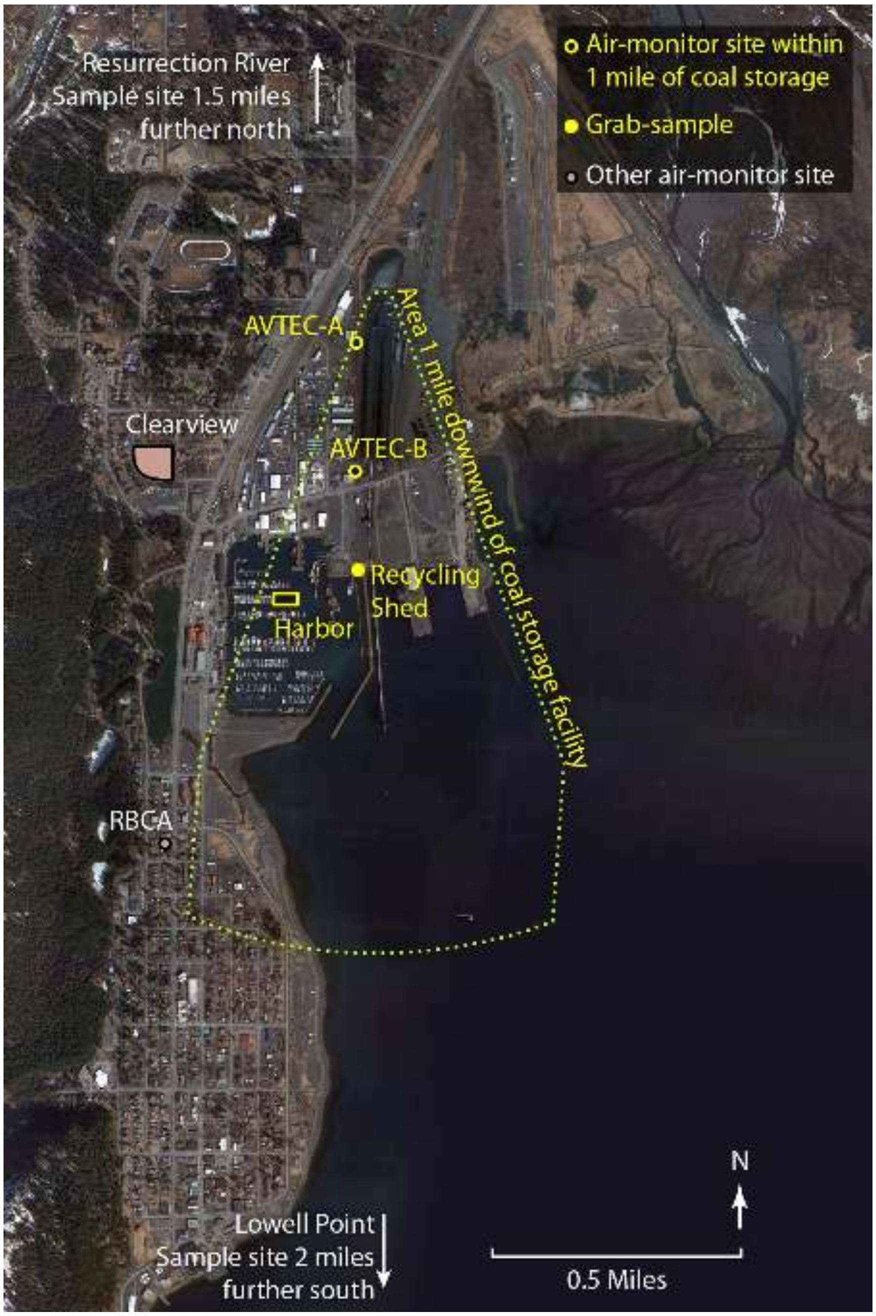

Figure 1. Map of Seward, Alaska with approximate air monitoring locations. Specific residential locations are not given to protect the privacy of volunteers. Winds were predominantly from the north during sampling times, so the boat harbor and nearby neighborhood were identified as being typically within one mile downwind.

For each sample, the air filter device collected particulate matter suspended in the air for a 24-hour period. The filters were then sent to three independent laboratories, Bureau Veritas, Chemoptix and ChesterLab, for analysis. In accordance with the "hotspots" monitoring model used by Global Community Monitor,[17] sampling days were chosen based on weather and coal facility activity. To capture events when wind-blown dust was at its worst, volunteers deployed filter devices downwind of the coal facility on windy days without rainfall or snow, in most cases when the coal was being actively loaded or unloaded.

The laboratory analyses selected for the samples were periodically shifted based on the results from previous samples and information needs. In spring and fall of 2012, PM_{10} samples were collected so as to directly compare our particulate matter (PM) counts with the ADEC ambient air monitoring results. These samples were also analyzed for toxic metals and silica. The results showed that the silica concentrations were high enough to be a health concern, but the metal concentrations were not. For the next round of sampling, in spring 2013, $PM_{2.5}$ samples were collected as well as PM_{10}, because the smaller particles pose a greater health risk. These samples were also analyzed for both inorganic and organic carbon content. Organic carbon indicates the proportion of coal in the dust as coal is the only significant local source of organic carbon.

The analysis of air samples includes 34 filtered air samples collected over 24-hour periods between March 23rd, 2012 and April 15th, 2013; the vast majority of these were collected within Seward Harbor. Of these 34 filtered air samples, 20 samples were analyzed by X-ray fluorescence (XRF) for a suite of metals and other elements; 15 samples were analyzed by gravimetry for fine particulate matter (PM_{10}) concentrations; 5 samples were analyzed by gravimetry for very fine particulate matter ($PM_{2.5}$) concentrations; 7 samples were analyzed by flame ionization detection for organic carbon (OC) and elemental carbon (EC); and 7 samples were analyzed by microscopy for levels of crystalline silica (quartz). Most air samples were analyzed for more than one parameter.

Volunteers collecting air samples noted wind speed and direction at the beginning and end of each 24-hour sampling period and recorded observations about the nature of activities occurring during the sampling period at the SCLF. Data for wind speed and direction was obtained from the National Oceanic and Atmospheric Administration, which has historical meteorological data for wind speeds and direction from Seward airport, located within one-half mile of the SCLF.[18]

The air samples were compared to grab samples of three types of solid material collected on November 30th, 2012. The grab samples were sediment from a nearby river bed (glacial silt), a chunk of coal from the SCLF, and dust that accumulated on the surface of a tank inside a three sided structure (recycling shed) near the harbor. This structure faces south, and so creates a wind eddy capturing airborne dust in north winds. The material samples were analyzed for organic carbon and elements using the same methods (flame ionization and XRF, respectively) used for the air samples.

Chemoptix Laboratory analyzed reference samples of riverbed sediment and coal for their content and compared those results to dust collected on surfaces in the Harbor and dust on the filters in two cases. The dust on two filters were analyzed by high-magnification episcopic brightfield and darkfield light microscopy for the presence of coal particles.

Top: Air monitor mounted at RBCA office. Middle: Recycling shed near the harbor with open south wall creating an eddy effect that deposits coal dust inside whenever the wind blows from the north. Bottom: Surface of white recycled oil and antifreeze collection tank inside shed. Photos: Russ Maddox

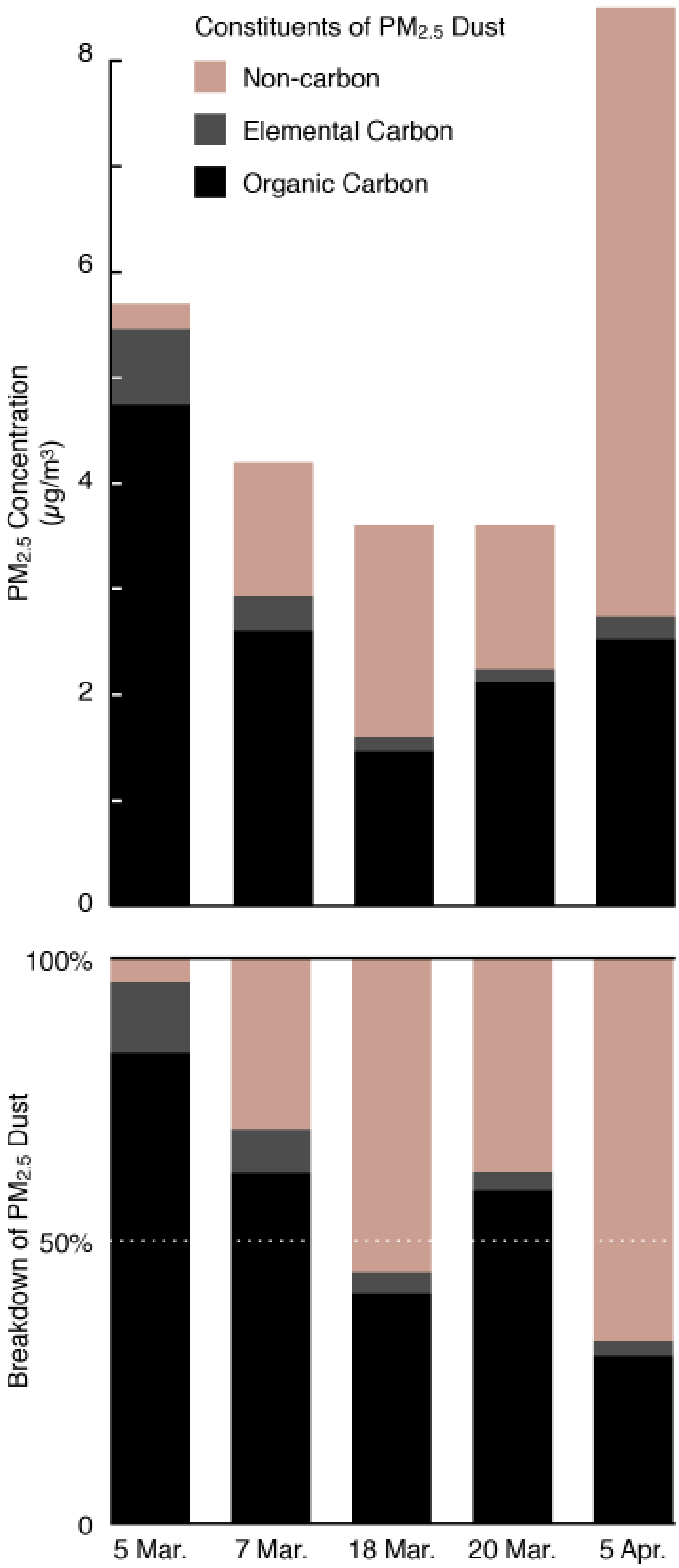

Figure 2. Constituents of $PM_{2.5}$ captured in air filters. The high carbon content and the high percentage of organic carbon indicate the presence of coal in the airborne particulate matter. Microscopy of the samples also showed coal particles and confirmed the air filter results.

Results

The Seward Air Monitoring Project included analysis of both solid materials and filtered air samples. The analysis of the solid materials for organic carbon and elemental analysis confirmed that the river bed sediment contains very little carbon whereas coal is predominantly carbon. The river bed sample contained only 1.1% carbon (11,000 ug/g), whereas the sample of coal was 63.75% carbon (637,500 ug/g). The sample of dust collected on the surface of a tank near the SCLF also has a fairly high carbon content of 37.0% (370,300 ug/g).

Chemoptix lab analyzed reference samples of riverbed sediment and coal for their content and compared those results to dust collected on surfaces in the Harbor and dust on the filters in two cases. The dust on two filters were analyzed by high-magnification episcopic brightfield and darkfield light microscopy for the presence of coal particles. Particles morphologically consistent with coal dust were seen in the samples.

Carbon in Air Samples

Over a period of time in late winter/early spring of 2013, five side-by-side samples were collected at Seward Harbor, providing concurrent measurements of total carbon (as determined by flame ionization detection); and $PM_{2.5}$ (as determined by gravimetry). Total carbon in these samples averaged 3.0 ug/m^3. $PM_{2.5}$ in the side-by-side samples averaged 5.2 ug/m^3. Thus, the average ratio of total carbon:$PM_{2.5}$ in these samples was 60.8% carbon content by mass.

Elemental Carbon (EC) and Organic Carbon (OC)

Elemental carbon concentrations averaged 0.43 ug/m^3 and ranged from a low of 0.12 ug/m^3 to a high of 1.08 ug/m^3 . Organic carbon concentrations averaged 2.70 ug/m^3 and ranged from a low of 1.47 ug/m^3 to a high of 4.75 ug/m^3. Most of the total carbon in the air samples was organic carbon, again indicating the presence of coal as a significant component of the airborne fine particulate matter.

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

Concentrations of $PM_{2.5}$ averaged 5.2 ug/m³, and ranged from a low of 3.6 ug/m³ to a high of 8.5 ug/m³. Concentrations of PM_{10} averaged 13.2 ug/m³, ranging from a low of 3.6 ug/m³ to a high of 27.2 ug/m³. Concentrations of PM_{10} were not different, on average, for days when loading/unloading activities were occurring compared to days when no loading/unloading was occurring. However, only a very small number of samples (four) were collected on days when the contemporaneous observations indicated no loading/unloading was occurring. For two of these samples, the coal loading facility workers apparently decided that conditions were too windy for loading/unloading operations to occur. Coal stockpiles, another potential dust source, were also present on days with no active operations.

Silicon and Crystalline Silica

Concentrations of silicon averaged 0.854 ug/m³, but were quite variable, ranging from a low of 0.01 ug/m³ to a high of 3.43 ug/m³. Concentrations of crystalline silica averaged 2.22 ug/m³, ranging from a low of below the detection limit to a high of 5.03 ug/m³. Seven of the filtered air samples analyzed by XRF for silicon content were also analyzed by microscopy for crystalline silica. A comparison of these analyses confirmed that the silicon on the samples was nearly all in the form of crystalline silica.

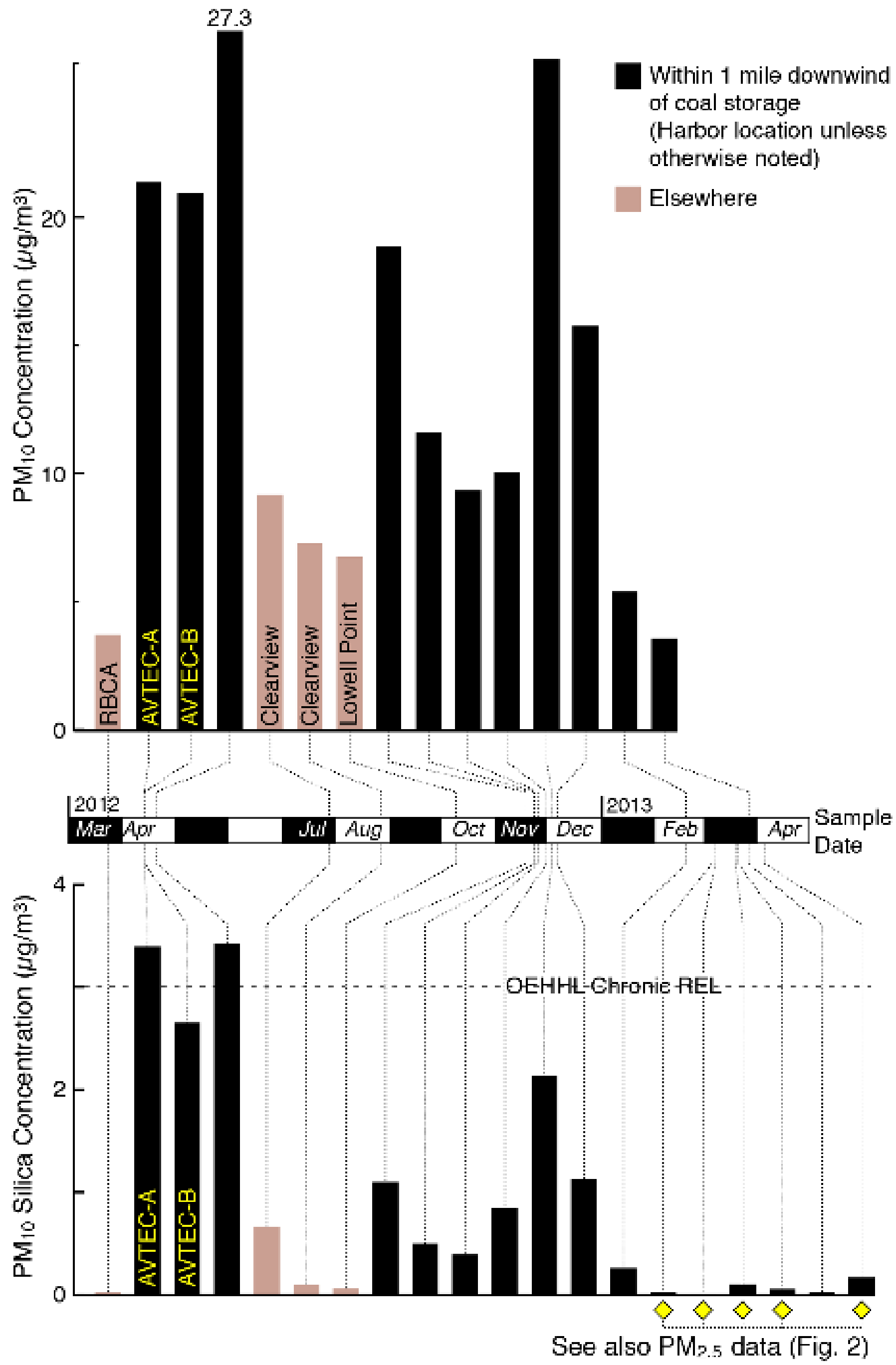

Figure 3. Concentrations of PM_{10} and silica captured in air filters. Silicon concentrations in samples captured by air filters. The Reference Exposure Level (REL) is the concentration below which no measurable negative health effects would be expected based on epidemiological studies of crystalline silica.

The data support the conclusion that:

- **Coal dust is migrating from the SCLF to offsite locations.**
- **PM_{10} concentrations are at times high enough to cause health problems in vulnerable populations.**

Discussion

The data support a conclusion that coal dust is migrating from the SCLF to offsite locations. The sample of riverbed sediment was 1% carbon, whereas the sample of dust collected from the tank surface at the Harbor recycling center was 37% carbon, and the solid sample of coal was 64% carbon. Carbon has a relatively low naturally occurring abundance in the earth's crust of 0.1-0.2%. Our results from the riverbed grab sample were consistent with other studies showing that outdoor dust (fine-borne particles removed from the earth's surface as a result of wind erosion) typically has a negligible carbon content.[19] Nearly all of the total carbon was organic carbon, which is indicative of a coal source, rather than elemental carbon, which is associated with hydrocarbon combustion. Based on this comparison, more than half of the dust accumulating on a surface downwind of the SCLF appears to be coal dust.

The data support a conclusion that total carbon is highly enriched in air samples collected in Seward Harbor. The percentage of carbon in five $PM_{2.5}$ samples collected concurrently in Seward Harbor averaged 60.8. In comparison, the carbon content in particulate air samples elsewhere in the United States are typically far lower. For example, the air quality measurements at industrial coal ports in Wilmington and Dover, Delaware measured just 16% carbon content.[20] Coal dust is principally carbon[21] (see results above). Thus, coal dust emissions from the SCLF appear to make a large contribution to overall particulate matter levels in Seward Harbor. This result appears to be consistent with boat owners' observations and their concerns about coal dust accumulation on their vessels.

Particulate matter

There is a robust association between health effects and ambient levels of particulate matter, regardless of the composition of the particulates. Particle size has been shown to be a determining factor; very small (fine) particles exert disproportionately more health effects than do larger particles. According to the U.S. Environmental Protection Agency (EPA):

> "Particles less than 10 micrometers in diameter (PM_{10}) pose a health concern because they can be inhaled into and accumulate in the respiratory system. Particles less than 2.5 micrometers in diameter ($PM_{2.5}$) are referred to as "fine" particles and are believed to pose the largest health risks. Because of their small size (less than one-seventh the average width of a human hair), fine particles can lodge deeply into the lungs.
>
> "Health studies have shown a significant association between exposure to fine particles and premature mortality. Other important effects include aggravation of respiratory and cardiovascular disease (as indicated by increased hospital admissions, emergency room visits, absences from school or work, and restricted activity days), lung disease, decreased lung function, asthma attacks, and certain cardiovascular problems such as heart attacks and cardiac arrhythmia. Individuals particularly sensitive to fine particle exposure include older adults, people with heart and lung disease, and children."[22]

"Short-term exposure to particle pollution can kill...Deaths can occur on the very day that particle levels are high, or within one to two months afterward…[T]hese are deaths that would not have occurred if the air were cleaner."

– American Lung Association

Other studies also attribute acute negative health outcomes, such as myocardial infarction, stroke, and hospitalizations for asthma, with only short-term exposure to increased particulate matter. The Scientific Statement of the American Heart Association concludes that short term (a few hours to weeks) exposure to $PM_{2.5}$ can trigger both fatal and nonfatal cardiovascular disease–related events. Chronic exposure increases the risk of fatal cardiovascular disease and reduces life expectancy by months to years.[23] The American Lung Association (ALA) is even more direct, stating that "short-term exposure to particle pollution can kill…Deaths can occur on the very day that particle levels are high, or within one to two months afterward…[T]hese are deaths that would not have occurred if the air were cleaner."[24] The ALA "State of the Air" report also cites large-scale studies that found strong associations between particulate exposure (both short and long-term) and exacerbated asthma, decreased lung function even in healthy adults, stunted lung development in children, and increased respiratory illnesses.

The U.S. EPA and the World Health Organization (WHO) have both adopted health-based air quality standards for exposure to particulate matter to reduce both acute and chronic effects of exposure to particulates. The EPA standard for annual exposure to $PM_{2.5}$ was lowered from 15 to 12 μg/m^3 in January 2013. The EPA 24-hour standard remains at 35 μg/m^3, despite controversy over health effects of short-term exposure.[1,2] The WHO recommendation of 10 μg/m^3 is slightly more restrictive, and is tempered by the explanation: "The risk for various outcomes has been shown to increase with exposure and there is little evidence to suggest a threshold below which no adverse health effects would be anticipated."[25] The WHO risk assessment further explains that no completely safe level of exposure has been proven, but statistical uncertainty limits the reliability of results at low particulate concentrations. To date, no research has established a lower limit of safe exposure for fine particulate matter, i.e. a concentration below which no negative health outcome would be expected.

The $PM_{2.5}$ concentrations measured in Seward approached but did not exceed the EPA and WHO standards. Particulate matter concentrations below the EPA's National Ambient Air Quality Standards (NAAQS) or any other regulatory standards mean that no laws or regulations have been violated; but does not mean that no health risk exists. Children and those with chronic health problems may be at particular risk from exposure to fine particulate matter in Seward. Given the low number of data points for this parameter, there might have been other significant short-term increases in particulate exposure that were not measured. We recommend continued monitoring of fine particulate matter in Seward before health concerns can be ruled out.

The PM_{10} concentrations measured on several days in both this study and the DEC ambient monitoring were below EPA standards but exceeded WHO recommendations and the State of California standards of 20 μg/m^3. The data support the conclusion that PM_{10} concentrations are at times high enough to cause health problems in vulnerable populations (people with asthma and other chronic illnesses, children and the elderly), which bolsters the case for mitigation and increased air particulate monitoring in specific locations.

Elemental carbon (EC)

During one 24-hour period (April 14th-15th) the EC concentration was above that associated with an excess risk of cardiovascular and respiratory hospitalizations on the day of exposure (1.081 ug/m^3 versus 0.836 ug/m^3).[26] On this particular date, winds were blowing from the N-NW (that is, toward the harbor from the SCLF). Vehicle exhaust, primarily diesel exhaust, is the predominant source of elemental carbon (EC) in ambient air. Elemental carbon concentrations above 1 microgram per cubic meter (μg/m^3) indicate an area impacted by diesel engine emissions.[27] Concentrations of EC above 1.36 μg/m^3 for a 24-hour period are associated with an excess risk of cardiovascular mortality two and three days after the exposure.[28] Concentrations of EC above 0.838 μg/m^3 for a 24-hour period are associated with an excess risk of cardiovascular and respiratory hospitalizations on the day of exposure.[29] The SCLF loading typically include diesel-powered heavy equipment, so these operations are a likely source of the airborne EC particulates.

Crystalline silica

The silica content of coal dust is a well-known occupational health hazard. The data support a conclusion that crystalline silica may pose a health risk to persons exposed over a long-term to air in the vicinity of the harbor. Silicon concentrations averaged 0.86 ug/m^3 and on two occasions were as high as 3.4 ug/m^3. The data suggest that nearly all of this silicon is in the form of crystalline silica, which is a much stronger respiratory irritant than amorphous silica.

According to the California Office of Environmental Health Hazard Assessment (OEHHA):

> "Inhalation of crystalline silica initially causes respiratory irritation and an inflammatory reaction in the lungs (e.g., Vallyathan et al., 1995). Acute exposures to high concentrations cause cough, shortness of breath, and pulmonary alve-

> **"Chronic levels of silica dust that do not cause disabling silicosis may cause the development of chronic bronchitis, emphysema, and/or small airways disease that can lead to airflow obstruction, even in the absence of radiological silicosis."**
>
> **—California OEHHA**

olar lipoproteinosis (acute silicosis)…. In a report on the hazards of exposure to crystalline silica, the American Thoracic Society (1997) stated: "Studies from many different work environments suggest that exposure to working environments contaminated by silica at dust levels that appear not to cause [silicosis] can cause chronic airflow limitation and/or mucus hypersecretion and/or pathologic emphysema." Hnizdo and Vallyathan (2003) also concluded that "chronic levels of silica dust that do not cause disabling silicosis may cause the development of chronic bronchitis, emphysema, and/or small airways disease that can lead to airflow obstruction, even in the absence of radiological silicosis." Fibrotic lesions associated with crystalline silica have also been found at autopsy in the lungs of granite workers who lacked radiological evidence of silicosis. …The internal process can continue after external exposure ends."[30]

On the basis of epidemiological studies, the OEHHA derived an inhalation chronic reference exposure level (REL) for silica - a level below which no adverse effects due to prolonged exposure would be expected in the general public - of only 3.0 μg/m^3.[31] Crystalline silica levels in Seward Harbor exceeded this REL on at least two occasions measured by this study. These exposure spikes indicate a need for more consistent monitoring downwind of the SCLF and mitigation measures to prevent exposures.

Conclusion

This air quality monitoring project compared the elemental constituent profile of airborne dust with both coal and rock from a local source. The data indicate that coal makes up the majority of the dust captured in the air monitors, which demonstrates that the Seward Coal Loading Facility is a major contributor to airborne dust in Seward. Photos document coal dust coating a boat harbor utility meter and used oil collection center in the Small Boat Harbor. Concentrations of PM_{10} on some days exceeded the World Health Organization's recommended thresholds for impairing respiratory and cardiovascular health. Crystalline silica and elemental carbon exceeded levels associated with health risks on a few occasions as well. We recommend further monitoring of the populated areas adjacent to and downwind of the coal loading facility to obtain a more robust data set that would inform mitigation measures. These measures should include the best available technology to limit coal dust emissions from the facility and protect the health of Seward

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