COAL ASH IN ALASKA

OUR HEALTH, OUR RIGHT TO KNOW

A Report on Toxic Chemicals Found in Coal Combustion Waste in Alaska

February 2011

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"The writing is on the wall, the floor, the ceiling, everywhere... Arsenic, selenium and other pollutants from coal ash pose a toxic threat to drinking water, fish and wildlife populations, and our health."

- Lisa Evans, Earthjustice

Illustration: Joshua Herbolsheimer / Earthjustice

Coal lifecycle illustration is used courtesy of Earthjustice. More information at Earthjustice.org/energy.

Executive Summary

Weak Regulations & Irresponsible Disposal

In Alaska, coal-fired power plants generate tens of thousands of metric tons of waste each year, known as coal combustion wastes, of which a major component is coal ash. Coal ash throughout the nation has been found to contain concerning levels of toxic chemicals that pose serious risks to human health. There is no publicly available, up-to-date information on what is in Alaska's coal ash, and current regulations for coal ash are weaker than for household garbage. Nonetheless, Alaskans have been assured that our coal ash is a non-toxic substance that is safe to use throughout the community and at home—even in garden soil.

Local Contamination Concerns

This waste has been disposed of with virtually no restrictions for decades in Alaska's Interior. Power plants operated by Aurora Energy, LLC and the University of Alaska Fairbanks (UAF) use a contractor to dispose of their coal ash. Some of this waste is stockpiled at a landscaping company in the Fairbanks area. These coal ash stockpiles are located next to the Tanana Valley Farmer's Market and have proven to be a nuisance and hazard for the Market's vendors and customers. In June 2010, the landscaping company was notified of a violation of air pollution regulations after local residents submitted complaints about dust from the coal ash stockpiles blowing into the neighboring Farmer's Market.

Study Results

At the request of local residents concerned about coal ash contamination, a sampling project was conducted in the Fairbanks area in June 2010. This project aimed to determine the composition of coal ash in the Fairbanks region and whether it may be hazardous to health. Samples of coal ash from local power plants, waste disposal sites and reuse sites were found to contain a range of toxic heavy metals. In almost every case, the levels of toxic chemicals were found to be much higher than background soil samples from Fairbanks. In the coal ash samples, **levels of arsenic and vanadium were found at concentrations that may harm human health**. Two samples from the University of Alaska Fairbanks coal-fired power plant show **arsenic concentrations more than 100 times higher** than the standard for residential soils set by the Environmental Protection Agency (EPA). Lastly, **mercury was found at levels 70 times higher than background soils**, and at levels high enough to be a concern if inhaled in the form of windblown dust.

Health Effects

Adverse health effects associated with exposure to arsenic, vanadium, and mercury include cancer, neurological problems, and developmental defects.

Recommendations

Because the coal ash produced in Fairbanks contains higher levels of toxic chemicals than background soil, it should not be considered "inert" as is currently the case. Without regulatory improvements, the existing waste disposal and reuse practices in Alaska will continue indefinitely. **To protect our communities, we need coal ash to be regulated effectively as hazardous waste with safeguards for storage, handling, transport and disposal.** Allowing dangerous coal waste to be treated as harmless and inert will only lead to more unnecessary pollution and potential risks to human health.

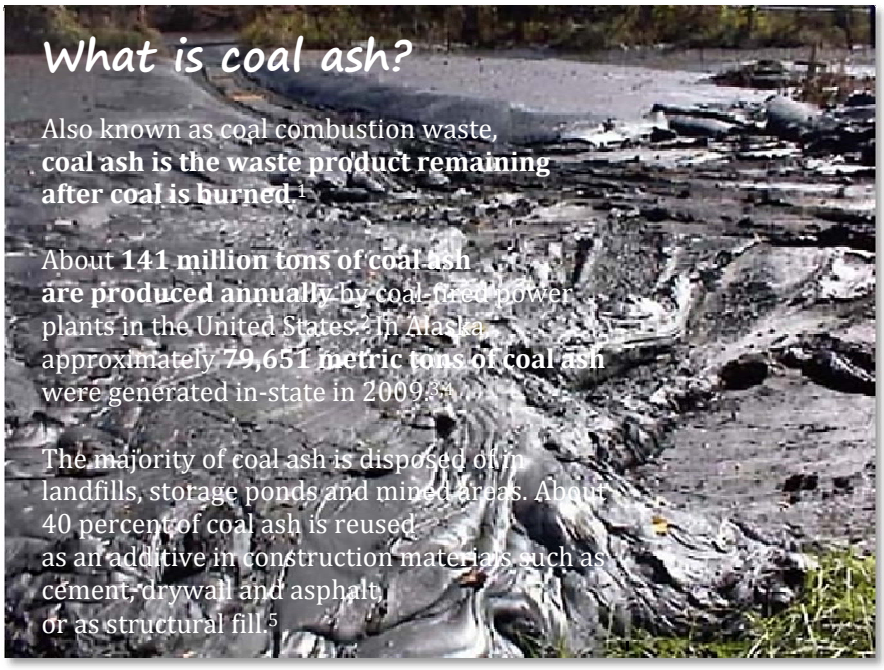
An Urgent Problem

Scrutiny has fallen on coal ash disposal practices across the nation since December 2008, when a coal ash slurry dam ruptured in Kingston, Tennessee, tragically burying nearby homes and poisoning the Emory and Clinch Rivers with heavy metals. The 40-acre pond spilled over one billion gallons of coal ash slurry into the neighboring river valley, covering 300 acres with thick, toxic sludge.

After the spill, water samples showed extremely high levels of toxic heavy metals, some hundreds of times higher than the allowable standard for drinking water.[6]

The spill in Tennessee has proven the catastrophic nature of unregulated coal ash disposal, and the public health threats of this practice are beginning to register across the nation.[6]

Coal ash is in our roads and driveways, under our homes, even in our gardens. For decades, coal ash has been disposed of with minimal restrictions, and reuse of coal ash in the community has been encouraged because of the sheer quantity of this material. Such widespread use of a hazardous material may pose serious health risks, yet there is no publicly available, up-to-date information on what is in Alaska's coal ash. Across the country, we are learning more and more about how hazardous coal ash may be to people's health. **Alaskans have a right to know about the hazards of coal ash** so we can take any necessary precautions to protect our health and quality of life.



Coal Ash in Alaska's Interior

Alaska currently has six coal-fired power plants, all located between Healy and Fairbanks in the Interior.[7] These power plants collectively produce 135.5 megawatts (MW) of electricity and range in size from 8 MW to 28.5 MW.[8] Four of Alaska's coal-fired power plants have designated coal ash landfills: three are on military bases and one is in Healy near Denali National Park. The remaining two coal-fired power plants are within the Fairbanks area and do not have designated coal ash disposal sites.[8]

The 28.5 MW Aurora Power Plant operated by Aurora Energy, LLC is situated on the banks of the Chena River in a residential area in downtown Fairbanks. Aurora uses a contractor to dispose of its coal ash. Some of Aurora's coal ash is used as fill in pits left over from peat and gravel mining within the Fairbanks area—in

Dumping steaming coal ash in Fairbanks, June 2010

some cases near wetlands, including Fairbanks' treasured Creamer's Field Migratory Waterfowl Refuge, an integral resting habitat for migratory waterfowl.[8]

Location of Aurora Power Plant, showing proximity to Chena River and residential areas

Fairbanks also has an 8 MW coal-fired power plant on the University of Alaska Fairbanks (UAF) campus, which produces 1 to 2 dump truck loads of coal ash daily. Until just a few years ago, this waste was used exclusively on campus as filler material for numerous construction projects such as roads, buildings, parking lots, and sports fields, and even for winter traction on icy roads and sidewalks. UAF also uses a contractor to dispose of its coal ash waste, much of which is stockpiled at a local landscaping company until it is used as fill in local areas such as public spaces, roads, and residential neighborhoods.[8]

The landscaping company was recently notified of a violation of air pollution regulations in reference to coal ash disposal. In June 2010, the Alaska Department of Environmental Conservation (ADEC) sent a compliance letter to College Peat & Landscaping, citing concerns about fugitive dust emissions from its property onto the neighboring Farmer's Market. ADEC's inspection showed "excessive dust coming from a coal ash pile that was uncovered and was spreading dust & ash all over the tables at the Farmer's Market." As the letter further noted, "Fugitive dust of coal ash creates a nuisance cloud of dust that covers the tables at the Farmer's Market and creates a health concern for the vendors and customers at the Farmer's Market." Local resident and Farmer's Market vendor Mary Zalar commented:

> *"Last spring, while selling our handcrafted wood bowls at our local Farmer's Market, a strong north wind blew coal ash into the market from where it is stored on adjacent property. Our product was coated with a very obnoxious, persistent and pervasive black ash that was difficult to remove. My concern increased when I discovered there is no regular testing or regulation of the disposal of coal ash in our community. Coal ash from our power plants is certainly a nuisance and possibly a toxic hazard."*

Location of Farmer's Market, showing proximity and size of neighboring coal ash landfill

Coal ash waste from Alaska's power plants has been disposed of with virtually no restrictions for decades in the Interior. In the Lower 48, investigations of unlined coal ash landfills and fill sites such as these have revealed widespread groundwater contamination from toxic chemicals in coal ash. Nationwide, recent improvements in air emissions controls for coal-fired power plants inadvertently redirected and concentrated dangerous chemicals into the solid waste stream, making coal ash even more toxic. Alaskans

have been repeatedly assured by industry and regulatory agencies that coal ash is a non-toxic substance that is safe to use throughout the community and at home—even in garden soil. However, most of these claims stem from a testing method that measures the leachability of solid waste, a method that has proven to be unreliable and inaccurate when applied to coal ash.[9]

Garden planted in front of coal ash loading bay at UAF coal-fired power plant, June 2010

Photo: Pam Miller, Northern Alaska Environmental Center

Our Health, Our Right to Know

There is a need for current, reliable and relevant information on what is in Alaska's coal ash and how it may affect our health. Alaskans have a right to know about the coal ash being used in our communities. Informed and empowered citizens can take action to protect our health and call for safe disposal practices that prioritize healthy communities, such as responsible handling, lined landfills and covered dry sites.

Emissions from UAF coal-fired power plant

Coal Ash Sampling Project

In June 2010, at the request of local residents, a sampling project was conducted in the Fairbanks area in an effort to determine the composition of Alaska's coal ash and whether it may be hazardous to public health. Researchers collected samples from sources of coal ash (UAF Power Plant, Aurora Power Plant, and a residential-type coal-burning stove) and sites with disposed and reused coal ash, such as residential fill piles and road surfacing areas of concern to local citizens. A soil sample was also collected to serve as a reference point. All samples were collected following quality control and quality assurance methods established by Brooks Rand Labs. The samples were analyzed for a range of metals *(see Appendix for a description of methods)*.

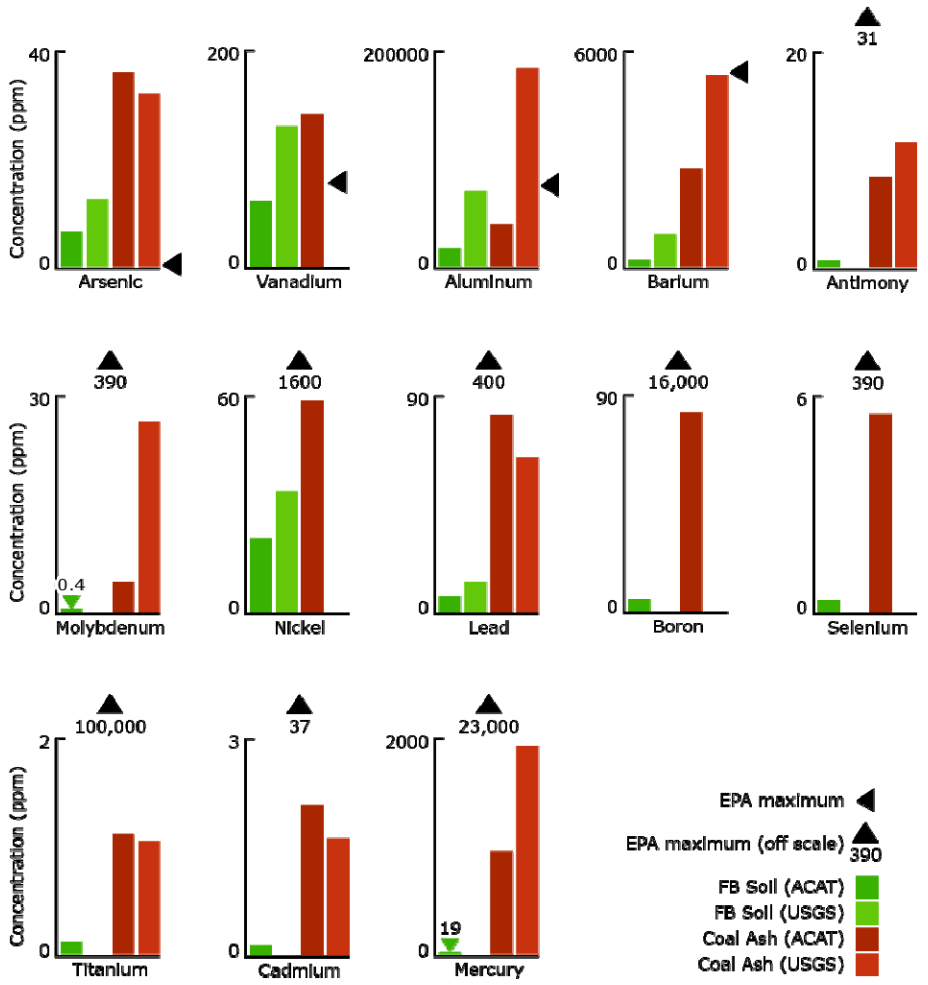
Results

Numerous toxic elements were found in coal ash, and all of them were at higher levels than background soil *(Figure 1)*. **Levels of arsenic and vanadium are present at concentrations that may harm human health**. All of the coal ash samples contained detectable levels of the elements aluminum, antimony, arsenic, barium, cadmium, cobalt, chromium, manganese, mercury, nickel, thallium, uranium, vanadium, and zinc. Boron, beryllium, molybdenum, and selenium were detectable in a majority of ash samples. Many of the toxicants found in coal ash from Fairbanks were present at relatively low concentrations. Most were well below the EPA's preliminary remediation goals (PRGs) for contaminants in residential soils.[12]

Arsenic

Previous research has suggested that although coal ash contains numerous toxic constituents, arsenic is often the primary threat to human health and the environment. This appears to be the case with the coal ash samples from Fairbanks as well. All of the coal ash samples show arsenic concentrations above the PRG for arsenic in residential soils *(Figure 2)*. Two coal ash

Figure 1 - Concentrations of chemicals in soil and coal ash from Fairbanks

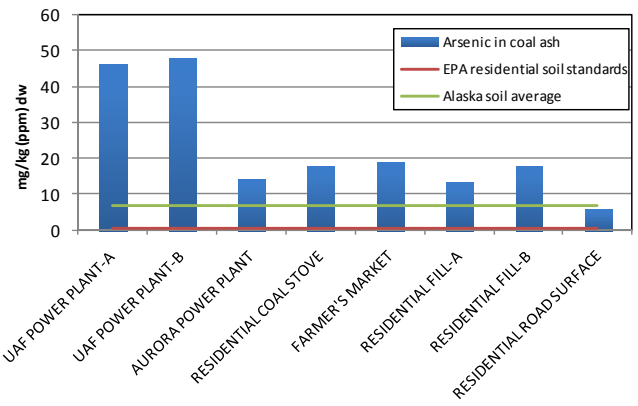


Not shown are elements where little difference between coal ash and soil was observed (Be, Co, Cr, Mn, Ur, and Zn).

Data sources: The soil and coal ash data labeled as ACAT came from this study. The ACAT coal ash bar is the average of the three power plant samples. The "FB Soil (USGS)" data came from a 1988 USGS survey of Alaskan soils.[10] The "Coal Ash (USGS)" data came from a recent USGS examination of coal ash in Healy (using the same source coal as what is burned in Fairbanks).[11]

samples from the UAF Power Plant show arsenic concentrations of 46.5 and 48 ppm (parts per million, or milligrams per kilogram), more than 100 times the PRG for arsenic. Additionally, there have been ongoing concerns about high levels of Arsenic in drinking water in the Fairbanks area.[13,14] The source of these concentrations is unknown, but may be due to the geochemistry of the region.

Figure 2 - Arsenic in Coal Ash



Arsenic is a naturally occurring element that is poisonous – in fact, arsenic is well-known for its use in rat poison and other pesticides. Arsenic is acutely toxic at high concentrations (typically considered greater than 300 ppb), and health effects have also been documented from exposure to low to moderate arsenic concentrations (10–100 ppb). In a community with arsenic concentrations of 14–166 ppb in drinking water, researchers found increased mortality from hypertensive heart diseases in women and men, and increased mortality from nephritis, nephrosis and prostate cancer in men.[15] Another study found that average arsenic levels of 11 ppb in well water were associated with increased mortality from circulatory system diseases, cerebrovascular diseases, diabetes mellitus, and kidney diseases in males and females.[16]

When arsenic exposure is chronic, it is known to cause multiple forms of cancer as well as neurological problems and diseases of the blood.[17] People with long-term exposure to arsenic levels higher than the maximum contaminant level (set by the EPA for national drinking water standards) may experience skin damage, problems with the circulatory system, and increased risk of cancer.[18]

Research by the EPA found that **people living close to coal ash disposal ponds may have a higher risk of cancer due to arsenic exposure.** In some cases, this risk was as high as one in 50 people, which is 2,000 times higher than EPA's "acceptable" cancer risk of 1 in 100,000.[19] This statistic only takes into account the risk of cancer from arsenic exposure in drinking water. According to an EPA risk assessment of communities in the Lower 48, living near a coal ash pond is significantly **more dangerous than smoking a pack of cigarettes a day** due to arsenic contamination in water.

What are PRGs?

Preliminary remediation goals (PRG) are a set of standards created to aid in the cleanup of contaminated sites. The EPA attempts to get contaminants below their PRGs when remediating contaminated sites. There are many other standards with which to compare, but the EPA region 9 PRGs are fairly comprehensive in that they encompass almost all of the toxic chemicals of concern in coal ash. The presence of a toxicant at a concentration below its PRG does not necessarily deem it safe, although the likelihood of toxic exposure is lower.

Sampling Locations

(all samples collected in Fairbanks unless otherwise noted)

UAF Power Plant –A & B (2 samples)

UAF coal ash loading bay

Sampled material

Posted warning sign

Aurora Power Plant

Aurora coal ash loading bay, located downtown on 1st Avenue between State St & Cleary St

Coal-burning stove (Ester, AK)

Common residential coal-burning stove

Residential fill material –
A (fine grain) & B (coarse grain)

Residential driveway off Farmer's Loop Rd

Residential road surface

Midnight Sun St, near Creamer's Field

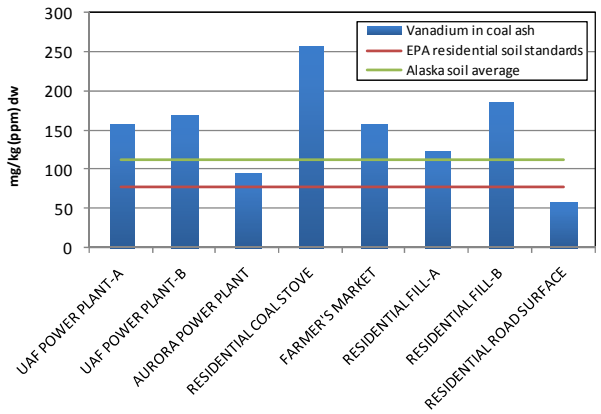
Tanana Valley Farmer's Market

Unidentified bags of waste dumped in Farmer's Market parking lot

Vanadium

The other element found consistently above its PRG in coal ash samples is vanadium *(Figure 3)*. Exposure to vanadium in the air has been associated with lung damage at high levels, and the compound vanadium pentoxide has been classified as a possible human carcinogen (cancer-causing agent) based on evidence of lung cancer in exposed mice.[20] Ingestion of vanadium has been linked to decreases in red blood cells, increased blood pressure and mild neurological effects in animals.[20] Studies on prenatal exposure in animals found that vanadium can decrease growth and increase the occurrence of birth defects.[20] Vanadium is known to accumulate in plants, soils and many aquatic species, although its potential to accumulate in mammals is fairly low.[21]

Figure 3 – Vanadium in Coal Ash



Mercury

Mercury is released in significant quantities from coal-fired powered power plants via air emissions and coal ash. When elemental mercury is released into soil and water, microscopic organisms may convert it into methylmercury, a form of mercury that builds up in the bodies of fish, marine mammals, wildlife, and people and concentrates up the food web.[22,23,24,25,26]

In this project, mercury was found in coal ash at up to 70 times the level in background soil. While this level is still below the PRG for mercury in residential soils, emerging science suggests that **there is no "safe" level of mercury exposure**.[27] Additionally, because coal ash particles are so fine, they are much more likely to become windblown, which creates another potential route of exposure by inhalation. The EPA limits for airborne exposure to mercury are much lower than those for residential soils.[12]

Mercury is a potent neurotoxin that is known to cause a variety of adverse health effects on the brain and central nervous system.[22,28,29,30,31] Mercury is a known mutagen (an agent that changes, or mutates, genetic material), a known teratogen (an agent that disrupts fetal or embryonic development) and a suspected carcinogen (an agent that causes cancer).[32] While the EPA has not classified elemental mercury as a human carcinogen, it has determined that methylmercury is a possible human carcinogen.[33,34,35]

Developing fetuses and children are particularly vulnerable to harm from mercury exposure, which may lead to permanent impairment of the developing central nervous system, as well as lung and kidney damage.[36,37,38]

"Coal ash toxics have the potential to injure all of the major organ systems, damage physical health and development, and even contribute to mortality."

- Physicians for Social Responsibility, 2010

Protect Our Communities

Alaska's coal ash contains concerning levels of hazardous chemicals that are a potential threat to the health of Alaskan communities. Now is the time to take action on the local, statewide and national levels to prevent continued pollution from toxic chemicals in our communities. We cannot afford higher cancer rates and other harmful health effects that may come from improper disposal of coal ash. To protect the health of our communities, we need to consider proper disposal of coal ash through the frame of public health. Better oversight and enforcement by the EPA and ADEC are necessary to ensure that our communities are protected from the hazards of coal ash.

"In April 2010, we found out that coal ash was being used as filler on an uphill adjacent lot in our subdivision. The ash is 330 feet from our three-year-old well and even closer to our garden. We should not be the ones to have to pay to have toxic waste removed from our neighbor's property uphill of ours. The fact that dumping this waste is allowed and not illegal is just wrong."

- Ron Yarnell, Fairbanks resident

Regulating Coal Ash

Current regulations for coal ash do not prioritize human health or the environment. Based on the definition in the Resource Conservation and Recovery Act (RCRA), coal ash is not currently considered a hazardous waste. Instead, it is considered a solid waste and primarily regulated by individual states. In a 1999 review of coal ash regulations, the EPA found that just over half of coal ash waste landfills are lined to prevent leaching and less than half have systems in place to collect the toxic substances that leach out.[39] In a review of 89 coal ash ponds nationwide, the EPA determined that 80% were either a proven environmental hazard or a potential environmental hazard, based on ground and surface water contamination.[40] These improper waste disposal and reuse practices in Alaska and across the nation will continue indefinitely without regulatory improvement in handling and disposal practices.

To protect our communities, we need coal ash to be regulated effectively as hazardous waste with safeguards for storage, handling, transport and disposal.[41]

Allowing dangerous coal waste to be treated as harmless and inert will only lead to more unnecessary pollution and risks to human health.

Toxic chemicals found at high levels in Fairbanks coal ash samples, and possible health effects

Arsenic:
- Cancer, multiple forms
- Neurological problems
- Circulatory system effects
- Blood diseases
- Skin damage

Vanadium:
- Lung damage and other respiratory problems
- Blood diseases
- Classified as possible human carcinogen
- Developmental effects
- Birth defects

Recommendations

Simple solutions can put public health first while still meeting Alaska's energy needs. More research is needed to measure levels of these chemicals in soils, drinking water and other potential exposure routes. Alaska also needs accurate leach testing of the coal ash that has been improperly disposed of in our communities. Handling coal ash more safely will prevent undue harm. Physicians for Social Responsibility recommends the following precautionary measures:[6]

- Preventive hazard design in storage and disposal facilities include engineered composite liner systems, leachate collection systems, long-term ground water monitoring, and corrective action (cleanup standards) if these systems fail.
- Phase out disposal of coal ash in mined areas and unprotected landfills, and disposal of coal ash in areas where it may impact surface or ground water.
- Independent research and assessments of coal ash recycling and reuse to ensure that toxic chemicals do not migrate from coal ash at levels dangerous to human health or the environment during the material's full lifecycle.
- Analysis of impacts of uncontained use of coal ash, such as in agriculture, in anti-skid material on roads, and in unlined and unmonitored fills.
- Research on possible health effects from coal ash on workers exposed to ash at disposal facilities, construction projects and manufacturing plants.
- Enforceable safeguards that protect the health and environment of all citizens equally and effectively.

Appendix: Analytical Methods

Samples were collected and analyzed using the highest quality control and quality assurance protocols. Samples were analyzed for a suite of metals, including total mercury (Hg), aluminum (Al), arsenic (As), boron (B), barium (Ba), beryllium (Be), cadmium (Cd), cobalt (Co), chromium (Cr), manganese (Mn), molybdenum (Mo), nickel (Ni), lead (Pb), antimony (Sb), selenium (Se), thallium (Tl), uranium (U), vanadium (V), zinc (Zn), and chlorine (Cl), as well as a modification of the toxicity characteristic leaching procedure (TCLP). Analyses were performed by Brooks Rand Labs, specializing in analytical services with a focus on ultra-trace level metals analysis and metals speciation. All samples were received, prepared, analyzed, and stored according to Brooks Rand Labs standard operating procedures and EPA methodology. Details about analytical methods are available upon request.

References

[1] Celik M, Donbak L, Unal F, Yuzbasioglu D, Aksoy H, Yilmaz S. 2007. Cytogenic damage in workers from a coal-fired power plant. *Mutation Research*, 627: 158-163.

[2] United States Environmental Protection Agency (US EPA), Office of Resource Conservation & Recovery (ORCR). 2010, 30 April. Regulatory Impact Analysis for EPA's Proposed RCRA Regulation of Coal Combustion Residues (CCR) Generated by the Electric Utility Industry. Available: www.regulations.gov/search/Regs/home.html#documentDetail?R=0900006480ae5d01.

[3] Usibelli Coal Mine, Inc. 2010, February 12. Coal Reserves and Market Update (presentation). Available: www.arcticminers.org/presentations/Steve_Denton.pdf.

[4] Alaska Department of Natural Resources, Alaska Department of Environmental Conservation. 2010, July 21. Alaska Resource Overview (presentation). Available: www.jogmec.go.jp/mric_web/koenkai/100721/briefing_100721_1.pdf.

[5] American Coal Ash Association. 2008. CCP report. Available: http://acaa.affiniscape.com/associations/8003/files/2008_ACAA_CCP_Survey_Report_FINAL_100509.pdf

[6] Gottlieb B, Gilbert SG, Evans LG. 2010, September. *Coal Ash: The Toxic Threat to Our Health and Environment.* Physicians for Social Responsibility, Earthjustice. Available: www.psr.org/resources/coal-ash-the-toxic-threat-to-our-health-and-environment.html.

[7] Ground Truth Trekking. 2009, Dec 19. Coal Power in Alaska. Available: http://groundtruthtrekking.org/WildResource/Issues/AlaskaCoalPower.html [Accessed 22 February, 2010].

[8] Maddox R. 2010, June. Dirty Coal Waste Disposal in Alaska. Sierra Club Alaska.

[9] United States Environmental Protection Agency (US EPA). July 2008. Characterization of Coal Combustion Residuals from Electric Utilities Using Wet Scrubbers for Multi-Pollutant Control; EPA–600/R–08/077. Available: www.epa.gov/nrmrl/pubs/600r08077/600r08077.pdf.

[10] Gough LP, Peard JL, Severson RC, Shacklette HT, Tompkins ML, Stewart KC, et al. 1984. Chemical analyses of soils and other surficial materials. Open-File Report 84-423. Alaska: U.S. Geological Survey. Available: http://pubs.usgs.gov/of/1984/of84-423/of84-423.pdf.

[11] Communication with Alaska Department of Natural Resources. 2010, March 5.

[12] US EPA. 2004, October. Region 9 PRG Table. Available: www.epa.gov/region9/superfund/prg/files/04prgtable.pdf.

[13] Northern Alaska Environmental Center. 2010, June. Fairbanks, AK.

[14] United States Geological Survey (USGS). 2001, November. Ground-Water Studies in Fairbanks, Alaska—A Better Understanding of Some of the United States' Highest Natural Arsenic Concentrations. Available: http://pubs.usgs.gov/fs/fs-0111-01/fs-0111-01.pdf [Accessed September 10, 2010].

[15] Lewis DR, Southwick JW, Ouellet-Hellstrom R, Rench J, Calderon RL. 1999, May. Drinking water arsenic in Utah: A cohort mortality study. *Environmental Health Perspectives* 107(5): 359–365.

[16] Meliker JR, Wahl RL, Cameron LL, Nriagu JO. 2007. Arsenic in drinking water and cerebrovascular disease, diabetes mellitus, and kidney disease in Michigan: A standardized mortality ratio analysis. *Environmental Health* 6:4. Available: http://www.ehjournal.net/content/6/1/4.

[17] Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for Arsenic. Available: www.atsdr.cdc.gov/ToxProfiles/tp.asp?id=22&tid=3.

[18] US EPA. 2009, May. National Primary Drinking Water Regulations. Available: http://water.epa.gov/drink/contaminants/index.cfm [Accessed August 13, 2010].

[19] US EPA. 2007. Human and Ecological Risk Assessment of Coal Combustion Wastes (draft). Available: www.earthjustice.org/sites/default/files/library/reports/epa-coal-combustion-waste-risk-assessment.pdf.

[20] ATSDR. 2009. Toxicological Profile for Vanadium. Available: www.atsdr.cdc.gov/toxprofiles/tp58.pdf.

[21] Irwin, RJ. 1997. Environmental contaminants encyclopedia: Vanadium Entry. National Park Service. Available: www.nature.nps.gov/hazardssafety/toxic/vanadium.pdf.

[22] Etzel RA, Balk SJ, eds. 2003. *Pediatric Environmental Health*. 2nd ed. Elk Grove Village, IL: American Academy of Pediatrics.

[23] United States Centers for Disease Control and Prevention (CDC). May 2009. *Mercury*. Available: www.cdc.gov/ExposureReport/pdf/factsheet_mercury.pdf.

[24] United States Centers for Disease Control and Prevention (CDC). 2009. *Fourth National Report on Human Exposure to Environmental Chemicals*. Atlanta, GA: CDC.

[25] MacGregor A. 1975. Analysis of control methods: Mercury and cadmium pollution. *Environmental Health Perspectives* 12, 137–148.

[26] Mahaffey KR. 1999. Methylmercury: A new look at the risks. *Public Health Reports* 114(5), 396–399, (402–413).

[27] United Nations Environment Programme (UNEP). UNEP Annual Report 2007. Available: www.unep.org/PDF/AnnualReport/2007/AnnualReport2007_en_web.pdf [Accessed April 8, 2010].

[28] Gilbert SG. 2008. Scientific Consensus Statement on Environmental Agents Associated with Neurodevelopmental Disorders. Developed by the Collaborative on Health and the Environment's Learning and Developmental Disabilities Initiative. Available: www.iceh.org/pdfs/LDDI/LDDIStatement.pdf.

[29] Collaborative on Health and the Environment. CHE toxicant and disease database. Available: http://database.healthandenvironment.org/index.cfm.

[30] Jaffe KM, Shurtleff DB, Robertson WO. 1983. Survival after acute mercury vapor poisoning. *American Journal of Diseases of Children 137*:749-751.

[31] Johansson C, Castoldi AF, Onishchenko N, Manzo L, Vahter M, Ceccatelli S. 2007. Neurobehavioural and molecular changes induced by methylmercury exposure during development. *Neurotoxicity Research* 11(3,4):241-260.

[32] Eisler R. 2004. Mercury hazards from gold mining to humans, plants, and animals. *Reviews of Environmental Contamination & Toxicology* 181: 139-198.

[33] US EPA. Integrated Risk Information System (IRIS). 2008, January 10. Mercury, elemental (CASRN 7439-97-6). Available: http://www.epa.gov/iris/subst/0370.htm.

[34] ATSDR. 1999. ToxFAQs for Mercury. Available: www.atsdr.cdc.gov/tfacts46.html.

[35] US EPA. Integrated Risk Information System (IRIS). 2008, January 10. Methylmercury (MeHg) (CASRN 22967-92-6). Available: www.epa.gov/iris/subst/0073.htm.

[36] Gilbert SG, Grant-Webster S. 1995. Neurobehavioral effects of developmental methylmercury exposure. *Environmental Health Perspectives* 103(S6): 135-142.

[37] Counter SA, Buchanan LH. 2004. Mercury exposure in children: A review. *Toxicology and Applied Pharmacology* 15;198(2):209-30.

[38] Rice DC. 1995. Neurotoxicity of lead, methylmercury, and PCBs in relation to the Great Lakes. *Environmental Health Perspectives* 103(S9):71-87.

[39] US EPA. 1999. Technical Background Document for the Report to Congress on Remaining Wastes from Fossil Fuel Combustion: Existing State Regulatory Controls. Available: www.epa.gov/osw/nonhaz/industrial/special/fossil/ffc2_396.pdf.

[40] US EPA. Office of Solid Waste Management. 2007. Coal Combustion Waste Damage Case Assessments. Available: www.publicintegrity.org/assets/pdf/CoalAsh-Doc1.pdf.

[41] Earthjustice, Environmental Integrity Project, Natural Resources Defense Council, Sierra Club, Southern Environmental Law Center. 2010, May. EPA Coal Ash Proposed Rule: Summary.

Protecting Health, Assuring Justice

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