

Ash Loading Test

May 2009

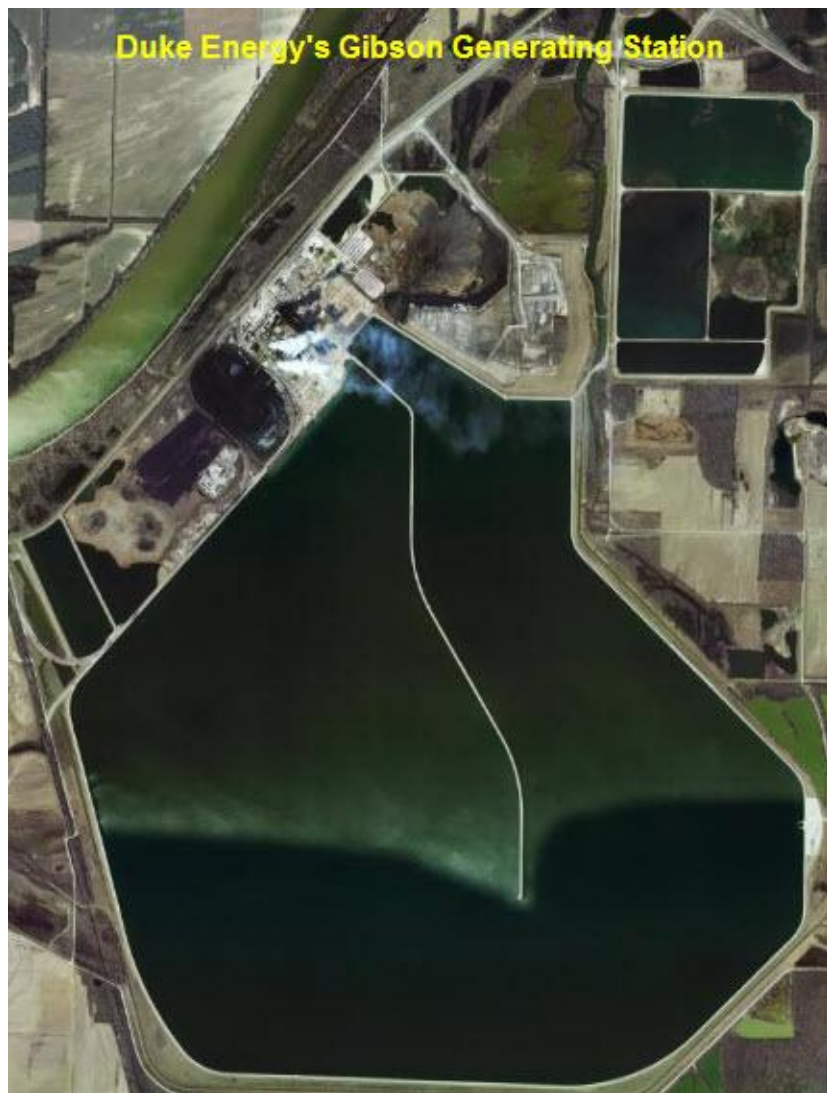
- TVA has begun a limited test of the removal of spilled fly ash from the Kingston site by rail.
- Permanent disposal plans for ash from the Kingston ash spill have not yet been made, but this test will ensure that TVA uses the best possible processes for loading, material containment, transportation and unloading of the ash.
- The ash-loading test is being coordinated with the federal Environmental Protection Agency and the Tennessee Department of Environment & Conservation. Those agencies also must approve TVA's final plans for off-site disposal.
- In the test, multiple companies will load, unload, and transport ash by rail to multiple, Class 1, state-regulated landfills outside the state of Tennessee over the next two weeks.
- Ash that has been dredged from the Emory River Channel and processed in the temporary storage area will be loaded into railcars using a backhoe.
- TVA will test multiple containment methods that will keep the ash within the railcars as it is safely transported to its final destination.
- Each landfill will be responsible for unloading the fly ash upon arrival, and the fly ash will be segregated from the other material stored there.
- TVA sent out a Request for Proposals in February, seeking bids from companies interested in the loading, transportation and storage of the fly ash.
- TVA will evaluate the test results before awarding final contracts. TVA expects to begin transportation of the ash to the selected locations this summer.

www.tva.com/kingston

Coming Clean: What the EPA Knows About the Dangers of Coal Ash

**A Summary of the United States Environmental Protection Agency's 2007 Human
and Ecological Risk Assessment of Coal Combustion Wastes**

**A Report by The Environmental Integrity Project and Earthjustice
May 2009**



Source: Google Earth Satellite Image (38° 21' 02.44" N, 87° 46' 03.02"W) (May 2009).

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The Environmental Integrity Project (<http://www.environmentalintegrity.org>) is a nonpartisan and nonprofit organization established in March 2002 to advocate for more effective enforcement of environmental laws. EIP was founded by Eric Schaeffer, who was director of the U.S. Environmental Protection Agency's Office of Regulatory Enforcement. He resigned in 2002 after publicly expressing his frustration with efforts of the Bush Administration to weaken enforcement of the Clean Air Act and other laws.

Earthjustice (<http://www.earthjustice.org>) is a non-profit public interest law firm dedicated to protecting the magnificent places, natural resources, and wildlife of this earth, and to defending the right of all people to a healthy environment. Earthjustice brings about far-reaching change by enforcing and strengthening environmental laws on behalf of hundreds of organizations, coalitions and communities.

Coming Clean: What the EPA Knows About the Dangers of Coal Ash

Each year, coal-fired power plants dispose of nearly 100 million tons of toxic fly ash, bottom ash, and scrubber sludge in wet ponds and landfills. Can living next to one of these dumpsites increase your risk of getting cancer or other diseases? The U.S. Environmental Protection Agency (EPA) thinks so, especially if you live near one of those wet ash ponds, or surface impoundments, that dot the landscape near large coal plants, the pond has no protective liner, and you get your drinking water from a well. According to a comprehensive but little known risk assessment released by the EPA in 2007, nearby residents have as much as a 1 in 50 chance of getting cancer from drinking water contaminated by arsenic, one of the most common, and most dangerous, pollutants from coal ash.ⁱ

And that's not all. That same risk assessment says that living near ash ponds increases the risk of damage to the liver, kidney, lungs and other organs as a result of being exposed to toxic metals like cadmium, cobalt, lead, and other pollutants at concentrations far above levels that are considered safe. In addition, the danger to wildlife and ecosystems is simply off the charts, with one contaminant—boron—expected to leach into the environment at levels *two thousand times* thresholds generally considered to be safe.

During the Bush Administration, the EPA made a concerted effort to delay the release of this information. A 2002 screening study, the precursor to the EPA's 2007 risk assessment, identified the same astronomical cancer risks and dangers to aquatic life from coal ash dumps, but it was not made public until *March 4, 2009*—seven years after its publication.ⁱⁱ Freedom of Information Act requests to EPA for the risk assessment data during the Bush Administration were denied or resulted in the production of documents with the cancer and noncancer risk estimates blacked out.

What were they hiding? This brief analysis from the Environmental Integrity Project and Earthjustice highlights key findings from the EPA's 2007 risk assessment, which was based on a detailed analysis of landfills and surface impoundments at 181 coal-fired power plants,ⁱⁱⁱ primarily identified by a 1995 survey by the Electric Power Research Institute.^{iv} Our analysis focuses on the 100 landfills and 110 surface impoundments examined by the EPA that lack effective composite (clay plus synthetic) liners to prevent leaks, since the EPA found unlined and clay-lined waste units present far greater risks to both human health and ecosystems. A complete list of the unlined or clay-lined waste disposal units examined in the EPA's risk assessment can be found in Attachments 1 (surface impoundments) and 2 (landfills).

The EPA's study estimated risks based on a number of factors, including waste characteristics, the type of disposal (e.g., wet pond or "dry" landfill), whether sites were lined, local hydrogeological information, and tests measuring the leaching potential of various pollutants. The assessment was based on predicted exposures of human populations, vegetation, and wildlife to toxic metals that migrate from groundwater contaminated by disposal sites. The human health risks that are discussed below result

from exposure to contaminated drinking water. The study estimates risk associated with classes of disposal sites (e.g. ash ponds) rather than specific facilities.

While the EPA's risk assessment model attempts to make the best use of available data, EPA acknowledges that it is based on assumptions that may lead to underestimation or overestimation of risk. For example, at a given site, the actual exposure of nearby residents to contaminated drinking water may be higher or lower than EPA's model assumed. The study does not consider the risk from additional pathways of exposure, e.g., from the direct discharge of pollutants to surface waters through pipes or ditches, contaminated soils, or fugitive dust from uncovered ash sites. For a more complete explanation of the EPA's methodology and limitations, including a discussion of likely underestimation of risks, see Appendix B.

The EPA's study found that the type of disposal (wet or dry) and whether or not disposal sites have protective composite liners^v to prevent leaking have a dramatic effect on risk. Surface impoundments (wet ponds) consistently show the highest risks, especially if they are unlined. The attached tables identify the size and location of ponds and landfills that are unlined or lined only with clay. Because the data were gathered in the mid-1990s, it is possible that some of the listed dump sites are no longer in use. The EPA study warns, however, that peak pollution from ash ponds can occur long after the waste is placed and is likely to result in peak exposures approximately 78 to 105 years after the ponds first began operation—thus “retired” sites still pose very significant threats.^{vi} Lastly, these tables represent only the units that were captured in the EPA's survey in the risk assessment. The number of unlined and clay-lined ash ponds and landfills currently in operation in the United States is likely to be at least *double* the number of units represented in the tables.^{vii} In fact, the EPA's latest estimate of the number of coal ash waste ponds has recently increased 40% (from 300 to 427 units), based on information recently submitted by 61 utilities in response to the EPA's March 2009 information request letters.^{viii}

Health Risks: Waste Ponds that Mix Coal Combustion Waste and Coal Refuse

A summary of the EPA's assessment of health risks from coal ash ponds can be found in Table A. Seventy of the ash ponds assessed by the EPA's assessment mix both coal ash and other types of coal refuse (e.g., the waste coal produced from coal handling and preparation operations prior to combustion^{ix}), and this category of pond was found to be the most hazardous (see Attachment 1 for a list of these sites). For example, the EPA estimated that up to 1 in 50 nearby residents could get cancer from exposure to arsenic leaking into drinking water wells from unlined waste ponds that mix ash with coal refuse. Arsenic has been found to cause multiple forms of cancer, including cancer of the liver, kidney, lung, and bladder, and an increased incidence of skin cancer in populations consuming drinking water high in inorganic arsenic.^x For context, the Agency typically considers cancer risk to be unacceptable when environmental exposures result in more than one additional cancer per 100,000 people.^{xi} Consequently, a lifetime cancer risk of 1 in 50 represents a risk 2000 times the EPA's regulatory goals.

The EPA also predicts that these unlined ash ponds can increase the risk of other “noncancer” health effects, such as damage to vital organs like the liver and kidneys and, in the case of lead, damage to the central nervous system. The agency has set maximum contaminant levels (“MCLs”) under the Safe Drinking Water Act to limit exposure to hazardous pollutants. But according to the EPA, unlined waste ponds that mix ash and coal refuse will result in exposures up to 9 times the federal standard for lead, a deadly neurotoxin that can damage the central nervous system, especially in young children.

Table A: Surface Impoundments: Highest Health Risks (Groundwater to Drinking Water)

Chemical	90th Percentile HQ or Cancer Risk Value ^{1 2}		Potential health Risks
	Unlined Units	Clay-Lined Units	
Conventional CCW			
Arsenic (cancer risk)	1 in 500	1 in 1,111	Nausea; Vomiting; Diarrhea; Cardiovascular Effects; Encephalopathy; Dermal Effects; Peripheral Neuropathy; Skin, Bladder & Lung cancer
Nitrate/nitrite (MCL)	20	10	Methemoglobinemia, infants are particularly vulnerable
Molybdenum	8	5	Fatigue; Headaches; Joint Pains
Boron	7	4	Stomach, Intestines, Kidneys, Liver and Brain Damage; Death; Negative Effects on Male Reproduction
Selenium	2	1	Dizziness; Fatigue; Respiratory Effects; Selenosis (Hair Loss; Nail Brittleness; Neurological Abnormalities)
Lead (MCL)	3	0.7	Learning Disabilities; Kidney, Blood, and Nerve Damage; Children are especially vulnerable to Lead exposure

Codisposed CCW and Coal Refuse			
Arsenic (cancer risk)	1 in 50	1 in 143	Nausea; Vomiting; Diarrhea; Cardiovascular Effects; Encephalopathy; Dermal Effects; Peripheral Neuropathy; Skin, Bladder & Lung cancer
Cadmium	9	3	Diarrhea; Stomach Pains; Severe Vomiting; Bone Fracture; Reproductive Effects; Nerve Damage; Immune System Damage; Psychological Disorders
Cobalt	8	3	Vomiting and Nausea; Vision Problems; Heart Problems; Thyroid Damage
Lead (MCL)	9	1	Learning Disabilities; Kidney, Blood, and Nerve Damage; Children are especially vulnerable to Lead exposure
Molybdenum	3	2	Fatigue; Headaches; Joint Pains

Sources: U.S. Env'tl. Prot. Agency (EPA), Human and Ecological Risk Assessment of Coal Combustion Wastes (released as part of a Notice of Data Availability) (Aug. 6, 2007) (draft), Table 4-7, Page 4-14 (does not include data on composite-lined units); and U.S. Department of Health and Human Services, Agency for Toxic Substances & Disease Registry, "Frequently Asked Questions About Contaminants Found at Hazardous Waste Sites" <<http://www.atsdr.cdc.gov/toxfaq.html>>.

¹ Values are HQs for all chemicals except arsenic; arsenic values are cancer risk.

² The Hazard Quotient (HQ) is the ratio of the exposure estimate (dose of contaminants) to a "no adverse effects level" considered to reflect a "safe" environmental concentration or dose.

For other toxic metals, like cadmium and cobalt, a hazard quotient (“HQ”) is used to define the concentration of a pollutant that is generally assumed to be “safe.” In other words, the HQ is the level at which the pollutant presents no “noncancer” health risks. The EPA estimates that unlined ponds that mix ash and coal refuse will result in exposures up to:

- Nine times the HQ, or “safe” level for cadmium, which can result in kidney disease and fragile bones.^{xiii} The U.S. Department of Health and Human Services has determined that cadmium is a human carcinogen.^{xiii}
- Eight times the HQ for cobalt, which can result in damage to the lung and heart and cause dermatitis. Liver and kidney effects have also been observed in animals exposed to high levels of cobalt.^{xiv}

Clay-lined ponds that mix coal ash and refuse appear to pose less risk, although the smaller number of sites evaluated make extrapolation difficult. Clay-lined impoundments were estimated to result in exposures up to 3 times above the HQ, or “safe” threshold, for cadmium and cobalt. The estimated cancer risk from clay-lined impoundments remains very high, however, and was estimated at 1 in 143 for nearby residents exposed to contaminated drinking water.

Attachment 1 lists the location, size, and ownership of the unlined and clay-lined ponds that mix ash and coal refuse that were evaluated in the EPA’s risk assessment. North Carolina and Tennessee each have eight of these impoundments, while Illinois has seven and Kentucky has six. Southern Company utilities own or operate twelve sites, while ten each are owned or operated by Tennessee Valley Authority or Duke utilities. Again, these ponds represent only a portion of the universe of unlined and clay-lined ash ponds currently operating throughout the United States.

Health Risks: Ash Ponds Containing Only Coal Combustion Waste

Forty of the coal ash ponds studied by the EPA contained only coal combustion waste. Unlined sites present a lower but still very substantial arsenic cancer risk to nearby residents of about 1 in 500 and about 1 in 1000 for clay-lined sites. These risks are 200 times and 100 times, respectively, greater than the EPA’s regulatory goals for limiting cancer risk.

In addition, the risk of other diseases is high:

- Unlined ponds are predicted to result in drinking water exposures of nitrate/nitrites at up to 20 times the “maximum contaminant levels” established under the Safe Drinking Water Act; even clay-lined sites are expected to exceed those limits by a factor of ten. Nitrates/nitrites are associated with methemoglobinemia (“blue baby syndrome”), which decreases the ability of the blood to transport oxygen, a condition that can

cause death in infants.^{xv} Lead levels in drinking water are predicted to reach up to 3 times the federal limit.

- Exposure to boron leached from unlined ponds is expected to exceed the HQ, or “safe” level, by up to a factor of eight, and by up to a factor of four for clay-lined ponds. High levels of boron have been linked to serious ailments of multiple organs, including the stomach, kidney, liver and brain.^{xvi} The study also showed high levels of molybdenum, which can lead to mineral imbalances, anemia and developmental problems.^{xvii}
- Five of the unlined ash ponds evaluated in the EPA study containing only coal combustion waste are in North Carolina; three each are in Michigan, Ohio, and West Virginia.

Health Risks: Landfills

The EPA’s risk assessment predicted that coal ash landfills posed less risk to human health than coal ash ponds. Still, the EPA determined that the cancer risk from exposure to arsenic is as high as 50 times the agency’s regulatory goals. The EPA found the risk to be 1 in 2000 from exposure to arsenic in drinking water for residents living near unlined landfills containing coal ash and coal refuse. The study also found that unlined landfills would result in thallium exposures at 3 times the “no risk” threshold. Exposure to high levels of thallium over a short time can lead to vomiting, diarrhea, temporary hair loss, and effects on the nervous system, lungs, heart, liver, and kidneys, and even death.^{xviii} Animal data suggest that the male reproductive system may be susceptible to damage by low levels of thallium.^{xix} In addition, the EPA found clay-lined and unlined landfills pose elevated risks from exposure to antimony and molybdenum. A list of unlined landfills can be found in Attachment 2.

The study’s conclusions concerning coal ash landfills may have significantly underestimated risk. In fact, the EPA’s list of actual damage cases includes numerous examples of landfills that have poisoned drinking water and surface water.^{xx} For example, drinking water wells surrounding a “dry landfill” in Anne Arundel County, Maryland were found to exceed federal drinking water standards for several toxic metals, including arsenic, cadmium, thallium, beryllium, aluminum and manganese. The contaminants were traced to leachate from the landfill, and Constellation Energy paid \$54 million to settle a lawsuit brought by nearby residents.^{xxi} In addition, a northern Indiana town has become a Superfund site due to the leaching of chemicals from a partially unlined coal ash landfill.^{xxii}

Table B: Landfills: Highest Health Risks (Groundwater to Drinking Water)			
	90th Percentile HQ or Cancer Risk Value^{1 2}		
Chemical	Unlined Units	Clay-Lined Units	Potential Health Risks
<i>Conventional CCW</i>			
Arsenic (cancer risk)	1 in 2,500	1 in 5,000	Nausea; Vomiting; Diarrhea; Cardiovascular Effects; Encephalopathy; Dermal Effects; Peripheral Neuropathy; Skin, Bladder & Lung Cancer
Thallium	3	2	Stomach Pains; Nerve Damage; Joint Pains; Vision Damage; Fatigue; Headaches
Antimony	2	0.8	Eye Irritation; Hair Loss; Lung Damage; Heart and Fertility Problems. Liver and Blood Damage; Skin Irritation
<i>Codisposed CCW and Coal Refuse</i>			
Arsenic (cancer risk)	1 in 2,000	1 in 5,000	Nausea; Vomiting; Diarrhea; Cardiovascular Effects; Encephalopathy; Dermal Effects; Peripheral Neuropathy; Skin, Bladder & Lung cancer
Thallium	2	1	Stomach Pains; Nerve Damage; Joint Pains; Vision Damage; Fatigue; Headaches
Molybdenum	2	0.6	Fatigue; Headaches; Joint Pains

Sources: U.S. Env'tl. Prot. Agency (EPA), Human and Ecological Risk Assessment of Coal Combustion Wastes (released as part of a Notice of Data Availability) (Aug. 6, 2007) (draft). Table 4-5, Page 4-12 (does not include data on composite-lined units); and U.S. Department of Health and Human Services, Agency for Toxic Substances & Disease Registry, "Frequently Asked Questions About Contaminants Found at Hazardous Waste Sites" <<http://www.atsdr.cdc.gov/toxfaq.html>>.

¹ Values are HQs for all chemicals except arsenic; arsenic values are cancer risk.

² The Hazard Quotient (HQ) is the ratio of the exposure estimate (dose of contaminants) to a "no adverse effects level" considered to reflect a "safe" environmental concentration or dose.

Ecological Risks:

The EPA’s study also found very substantial risk from coal ash disposal to aquatic ecosystems and the wildlife they support. The EPA evaluated these ecological risks for both landfills and ponds, but the report does not distinguish risks based on whether liners are in use, or whether ash is commingled with coal refuse. Predicted exposures are compared to ecological hazard quotients for specific pollutants, e.g., concentrations that are thought to be safe for aquatic life.

The results are eye-opening:

- Ash ponds are predicted to leak boron into surface waters at concentrations up to 2000 times higher than levels estimated to be safe for aquatic life (2000 times the HQ). Even landfills will release boron at levels 200 times above the HQ, or safe level, according to the EPA.
- Based on predicted exposures to river otters, lead from ash ponds will reach surface waters at concentrations 20 times higher than the HQ, or safe level, while arsenic and selenium concentrations will be 10 times higher. Selenium is particularly dangerous in aquatic environments because even a very small amount can rapidly attain levels that are toxic to fish and wildlife because of rapid bioaccumulation in food chains and resultant dietary exposure.^{xxiii}
- Toxic metals can also be embedded in the sediment at the bottom of rivers or lakes, where they can be very difficult to remove, and poison plants and bottom feeding fish. The EPA’s study predicts lead leached from surface impoundments will reach levels that are 200 times higher than levels considered harmless, while arsenic will exceed the safe threshold by 100 times. Arsenic and lead from landfills are also expected to contaminate sediments at levels several times above “no risk” thresholds.

Chemical	90th Percentile HQ¹	Pathway	Receptor
Boron	2000	direct contact	aquatic biota
Lead	20	ingestion	river otter
Arsenic	10	direct contact	aquatic biota
Selenium	10	direct contact	aquatic biota
Cobalt	5	direct contact	aquatic biota
Barium	2	direct contact	aquatic biota
Cadmium	1	direct contact	aquatic biota

Source: U.S. Env'tl. Prot. Agency (EPA), Human and Ecological Risk Assessment of Coal Combustion Wastes (released as part of a Notice of Data Availability) (Aug. 6, 2007) (draft), Table 4-14, Page 4-22.

¹The Hazard Quotient (HQ) is the ratio of the exposure estimate to an effects concentration considered to represent a "safe" environmental concentration or dose. Values greater than 1 are indicative of risk to human health.

Table D: Surface Impoundments: Highest Ecological Risk (Groundwater to Sediment)			
Chemical	90th Percentile HQ¹	Pathway	Receptor
Lead	200	ingestion	spotted sandpiper
Arsenic	100	ingestion	spotted sandpiper
Cadmium	20	direct contact	sediment biota

Source: U.S. Env'tl. Prot. Agency (EPA), Human and Ecological Risk Assessment of Coal Combustion Wastes (released as part of a Notice of Data Availability) (Aug. 6, 2007) (draft), Table 4-15, Page 4-23.

¹The Hazard Quotient (HQ) is the ratio of the exposure estimate to an effects concentration considered to represent a "safe" environmental concentration or dose. Values greater than 1 are indicative of risk to human health.

Table E: Landfills: Highest Ecological Risk (Groundwater to Surface Water)			
Chemical	90th Percentile HQ¹	Pathway	Receptor
Boron	200	direct contact	aquatic biota
Lead	4	ingestion	river otter
Selenium	1	direct contact	aquatic biota

Source: U.S. Env'tl. Prot. Agency (EPA), Human and Ecological Risk Assessment of Coal Combustion Wastes (released as part of a Notice of Data Availability) (Aug. 6, 2007) (draft), Table 4-14, Page 4-22.

¹The Hazard Quotient (HQ) is the ratio of the exposure estimate to an effects concentration considered to represent a "safe" environmental concentration or dose. Values greater than 1 are indicative of risk to human health.

Conclusion

The EPA's 2007 risk assessment shows that the disposal of coal ash, especially in unlined ponds, results in alarmingly high risks of cancer and diseases of the heart, lung, liver, stomach and other organs and can seriously harm aquatic ecosystems and wildlife near disposal sites. These risks are driven by exposure to toxic metals that leach from groundwater into drinking water, surface waters and sediment. Some of the sites evaluated by the EPA may no longer be "active," but the Agency has warned that contamination from coal ash ponds will not peak until about 78 to 105 years *after* waste is dumped, while peak exposure from landfills may occur after even longer periods of time.

For too long, the federal government and power industry have left the public in the dark as to the risks presented by the voluminous toxic waste they produce. Even as recently as December 2008, after the 1 billion gallon spill from its Kingston Power Plant, the Tennessee Valley Authority claimed that coal ash posed little risk to human health or the environment. The EPA's 2007 risk assessment, nevertheless, brings the real threats to light.

Given what the Agency already knows, ash ponds must be phased out—and cleaned out—within five years, to keep their toxic cargo from building up and jeopardizing the health of nearby residents, poisoning wildlife, and contaminating rivers

and streams. So called “dry landfills”—especially those that are unlined—also pose unacceptable risks, and ought to be regulated as hazardous waste disposal sites.

There is some good news. The EPA’s evaluation shows that the use of composite liners (double liners composed of clay and synthetic barriers) significantly reduces risk by decreasing the amount of toxins that leak out of ash and into groundwater. These composite liners ought to be required at dry landfills, along with leak detection and monitoring systems to identify and capture any leachate that does escape. On March 2, 2009, 109 public interest organizations recommended that the EPA require these measures, as well as other safeguards, in a letter to EPA Administrator Lisa Jackson.^{xxiv}

The EPA’s risk assessment clearly establishes that unlined coal ash disposal sites—wet and dry—are hazardous to human health and the environment, posing unacceptably high cancer and noncancer risks to those living nearby and poisoning aquatic life of adjacent water bodies with bioaccumulative poisons. We hope the new leadership at the EPA will act on that knowledge before it is too late.

Appendix A. Coal Combustion Waste Constituents: Health and Environmental Effects

Some of the most hazardous constituents in coal combustion waste include:

Arsenic:

Ingesting arsenic, even in low doses, through drinking water or by eating fish in which arsenic has bioaccumulated, “can cause nausea, vomiting, decreased production of red and white blood cells, abnormal heart rhythm, damage to blood vessels, and a sensation of ‘pins and needles’ in hands and feet.”^{xxv} Freshwater plants and bivalves have been shown to accumulate arsenic,^{xxvi} whereby it enters the food supply for fish, other wildlife, and humans. The toxicity of arsenic in the environment is impacted by a number of factors, including temperature, pH, phosphate concentration, and other parameters.^{xxvii} Arsenic is ranked #1 on the Agency for Toxic Substances and Disease Registry’s (ATSDR) 2007 Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Priority List of Hazardous Substances, which determines contaminant rankings based on a combination of their frequency, toxicity, and potential for exposure at National Priorities List (NPL) sites.^{xxviii}

Boron:

“Exposure to large amounts of boron (about 30 grams of boric acid) over short periods of time can affect the stomach, intestines, liver, kidney and brain and can eventually lead to death.”^{xxix} Boron can also bioaccumulate in plants, and is therefore ingested in fruits and vegetables as well as in drinking water.^{xxx} Boron is also known to be highly toxic to plants and algae, inhibiting growth, protein content, chlorophyll content and photosynthesis.^{xxxi} Chronic exposure to low levels of contamination can impair development in fish, notably the rainbow trout.^{xxxii}

Cadmium:

The Centers for Disease Control’s (CDC) Third National Report Spotlight on Cadmium states that, “exposure to low levels of cadmium in air, food [and]... water over time may build up cadmium in the kidneys and may cause kidney disease,” and that long-term effects of cadmium exposure also include fragile bones.^{xxxiii} Moreover, the U.S. Department of Health and Human Services and the International Agency for Research on Cancer have determined that cadmium and cadmium compounds are known human carcinogens and EPA has determined that cadmium is a probable human carcinogen.^{xxxiv} Cadmium exposure can occur through ingestion of contaminated drinking water or by eating aquatic organisms in which cadmium has accumulated.^{xxxv} Exposure to cadmium is moderately to highly toxic to aquatic plants, invertebrates, and fish.^{xxxvi} Environmental toxicity of cadmium is highly variable depending on hardness, pH, temperature, and other parameters.^{xxxvii} Cadmium is listed 7th on the 2007 CERCLA Priority List of Hazardous Substances.

Cobalt:

Exposure to high levels of cobalt can result in lung and heart effects and dermatitis.^{xxxviii} Liver and kidney damage are also possible.^{xxxix} Moreover, cobalt from CCW is

especially dangerous to human health in the environment when co-disposed with coal refuse because its mobility increases under more acidic conditions.^{xi} Cobalt has been found to inhibit the growth of photosynthetic microorganisms and can be toxic to fish, notably the rainbow trout.^{xii} Cobalt ranks 49th on the 2007 CERCLA Priority List of Hazardous Substances.

Lead:

The detrimental health effects of lead are well known. “No safe blood level has been identified” for lead,^{xlii} making it one of the most toxic constituents of coal waste. Because children absorb lead more easily than adults, “lead levels of 10 micrograms or more in a deciliter of blood can damage ability to learn.”^{xliii} At blood levels greater than or equal to 25 micrograms per deciliter, lead exposure can cause damage to the kidneys, blood and nervous system.^{xliv} “At very high levels, lead poisoning can cause mental retardation, coma, convulsions or death.”^{xlv} Lead ranks second after arsenic on the 2007 CERCLA Priority List of Hazardous Substances.

Molybdenum:

The American Cancer Society warns that “symptoms of too much molybdenum include tiredness, dizziness, rashes, low white blood cell counts, and anemia. High molybdenum levels are also linked to gout.”^{xlvi} The Environmental Working Group also links molybdenum ingestion to reproductive and fertility complications.^{xlvii}

Nitrates/Nitrites:

Studies show that “short term exposure to nitrate levels above the MCL can cause serious illness and even death, especially in infants,” because nitrate converts to nitrite in the body, which oxidizes the iron in blood hemoglobin to the point that it cannot carry oxygen.^{xlviii} Symptoms of “blue baby syndrome,” as the condition is commonly known, include shortness of breath and bluish skin. Moreover, long term exposure to contaminant levels above the MCL may cause “dieresis, increased starchy deposits, and hemorrhaging of the spleen.”^{xlix} The environmental effects of nitrate are well known; adding large quantities of limiting nutrients to rivers and streams contributes to algal blooms and decreased oxygen concentrations that choke out wildlife and ultimately contribute to downstream water impairment, the most devastating of which is the gulf coast “dead zone.”

Selenium:

Short term oral exposure to high concentrations of selenium causes nausea, vomiting, and diarrhea, while chronic exposure to “mildly excessive” concentrations can lead to selenosis, a condition resulting in brittle hair, deformed nails and numbness in the limbs.¹ Selenium causes respiratory and liver damage in animals and may affect reproduction in farm animals.ⁱⁱ Moreover, because selenium bioaccumulates in plants, farm animals are particularly susceptible to toxic effects from selenium ingestion.ⁱⁱⁱ Selenium ranks 147th out of 275 toxic constituents on the 2007 CERCLA Priority List of Hazardous Substances.

Appendix B. Methodology and Limitations

EPA's Methodology

In order to evaluate the risks posed by coal combustion waste (CCW) to individuals who live near landfills and surface impoundments used for CCW disposal, the EPA compiled a database of 41 “constituents of concern in CCW” in 2002 and 2003.^{liii} The database includes waste concentration data from three types of waste samples: landfill leachate analyses; porewater analyses from surface impoundments and landfills, and analyses of whole waste samples.^{liv} In order to determine which constituents were potentially hazardous enough to warrant a full-scale analysis, the EPA first engaged in Hazard Identification to select only those constituents with human health or ecological benchmarks and then conducted Constituent Screening to compare health-based benchmarks with conservative estimates of exposure concentrations to screen out constituents and exposure pathways that posed no significant concern.^{lv} The remaining 21 CCW constituents and 3 exposure pathways not screened out were then evaluated in a Full-Scale Monte Carlo Risk Analysis.^{lvi}

The full-scale analysis modeled risks based on surveyed characteristics from 181 CCW disposal sites^{lvii} using a site-based probabilistic approach that provided a distribution of risks for each receptor by allowing for variability of some factors. The EPA modeled two waste management options, surface impoundments and landfills, as well as three liner conditions, unlined, clay-lined, and composite-lined.^{lviii} It also modeled three waste types, conventional CCW, FBC wastes, and codisposed CCWs and coal refuse.^{lix} The site-based approach allowed for modeling of different factors such as waste management practices, environmental settings (e.g. hydrogeology, climate, and hydrology), and groundwater ingestion scenarios. Notably, to estimate the release of constituents from waste management units (WMUs), the EPA used a survey conducted by the Electric Power Research Institute (EPRI) in 1995 to determine size, design (including liner characteristics), and locations of onsite CCW landfills,^{lx} which does not take into account disposal that has continued at these sites or the reality that there are often long lead times before peak pollution events.

In order to determine probabilistic risks, the EPA used a Monte Carlo simulation, by which many model input parameter values were varied over 10,000 iterations of the model per waste management scenario to yield a statistical distribution of exposures and risks.^{lxi} Probabilistic risks were then evaluated at the 50th and 90th percentiles. A risk or hazard estimate at the 90th percentile, which the EPA used as the high end of the risk distribution, represents the scenario in the statistical distribution at which 90% of probabilistic exposure scenarios pose lower risks and 10% pose equal or higher risks than that value.

The Risk Assessment analyzed exposures and risks to determine which CCW disposal scenarios and environmental conditions were above applicable risk criteria.^{lxii} The EPA adopted a risk criteria factor of 10^{-5} for excess cancer risks and a hazard quotient (HQ) of greater than 1 for noncancer effects to human and ecological receptors.

HQ is the ratio of the likely exposure concentration to the highest concentration at which there are no observable adverse effects.^{lxiii} To determine the “HQ” for non-cancer health effects, the EPA compares the exposure concentration (mg/kg/day) to the ATSDR’s Minimal Risk Level (MRL) or the EPA’s Reference Dose (RfD), which quantifies the level of an exposure to a chemical at which no adverse health effects will occur. Thus: $HQ = \text{Exposure concentration (mg/kg/day)} / \text{MRL or RfD}$. Accordingly, an HQ of 1 represents the highest concentration of likely exposure at which there are no observable adverse effects. Likewise, an HQ of 3 means that the maximum concentration of likely exposure is three times the concentration at which there are no observable adverse effects. However, although there is a positive correlation between HQ and harm, it is not necessarily a 1:1 ratio. For example, at an HQ of 3, the concentration of likely exposure is three times higher than the no observable adverse effects limit, but the increased risk of harm cannot be definitively said to be greater than or less than 300%.

Limitations of EPA’s Risk Assessment

EPA conducted a peer review of its 2007 risk assessment in 2008, calling on five scientists from a variety of disciplines.^{lxiv} Some scientists alleged that the assessment overestimated risk, and others claimed that it was an underestimation. For example, one scientist stated that the ecological database and benchmarks used to calculate the ecological HQs were overly conservative and that the model used to calculate the transport of contaminants overestimated the movement of some pollutants.^{lxv} Another scientist indicated that the assessment would be improved by the inclusion of more data revealing the actual location of drinking water wells near ash ponds and landfills.^{lxvi}

On the other hand, significant criticisms alleging underestimation of risk by the scientists chosen by the EPA to review the assessment included: (1) the failure of the EPA to assess how coal ash pollutants interact with each other to increase risk to human health and aquatic organisms;^{lxvii} (2) the EPA’s failure to consider critical exposure pathways including direct exposure to the slurried wastes in impoundments and direct exposure to the effluent from impoundments discharged offsite;^{lxviii} (3) the EPA’s failure to consider the inhalation pathway for human health risks;^{lxix} (4) the EPA’s failure to assess the true time of exposure to contaminants in landfills and surface impoundments from the date of deposition until removal of wastes;^{lxx} (5) the EPA’s failure to assess multiple exposure pathways for humans and ecological receptors;^{lxxi} (6) the EPA’s failure to employ data that reflects the actual concentration of pollutants in waste pond water and landfill leachate;^{lxxii} (7) the EPA’s failure to consider the likelihood of liner failure at landfills and impoundments;^{lxxiii} (8) the EPA’s failure to consider the disposal of coal ash in landfills below the water table and to consider the limits of the clay and composite liners currently in use at most waste units;^{lxxiv} (9) the EPA’s failure to consider the impact of exposure of infants and children to coal ash contaminants;^{lxxv} and (10) the EPA’s failure to consider additional coal ash contaminants that commonly leach from coal ash.^{lxxvi}

In addition, in public comments, additional scientists criticized the model the EPA used as the basis for groundwater modeling in its risk assessment, EPACMTP, for its

propensity to significantly *underestimate* risks from a variety of factors.^{lxxvii} Among the many shortcomings of EPACMTP is that it “cannot simulate scenarios where the waste is disposed within the underlying aquifer,” despite the frequent disposal of CCW in landfills within the saturated zone and despite the fact that such disposal below the water table expedites leaching of contaminants from the waste.^{lxxviii} In addition, EPACMTP cannot account for multiple or changing leachate compositions, nor can it simulate instances where leachate alters the properties of the receiving aquifer, such as how pH and Eh can impact the mobility of many CCW contaminants.^{lxxix}

In fact, EPA acknowledged that there were uncertainties it could not explicitly address, resulting in an *underestimation* of many risks. For example, because porewater data was unavailable to determine leachate from CCW landfills, EPA relied on Toxicity Characteristic Leaching Procedure (TCLP) analyses, which underestimated risks from selenium, which EPA recognizes is a frequent cause of CCW damage cases.^{lxxx} Also, the high number of nondetect values for mercury in CCW leachate from landfills and surface impoundments and for antimony and thallium in surface impoundments likely means the EPA *significantly* underestimated risks to human health and ecological receptors.^{lxxxii} In addition, the EPA admits that it failed to estimate risk for terrestrial amphibians despite damage cases indicating risk to these amphibians from exposure to selenium, failed to address impacts on endangered species, critical habitats, or managed lands, and failed to analyze synergistic or additive risks of being exposed to multiple constituents or by multiple pathways, all of which will result in an understatement of risk.

Perhaps the most critical limitation in the EPA’s 2007 Risk Assessment was that it failed to “address direct releases to surface water, which are permitted under the National Pollutant Discharge Elimination System (NPDES) of the Clean Water Act.”^{lxxxiii} One of the EPA’s peer reviewers commented that the risk assessment “grossly underestimates risks from surface impoundments to humans and the environment” because of this deficiency.^{lxxxiii} By not addressing “direct releases to surface water,” the EPA has also failed to address unpermitted discharges to surface water, the precise scenario that occurred at TVA’s Kingston plant in December of 2008. By not addressing the effects of major discharges like those that occurred at TVA’s Kingston plant or any less dramatic discharges of that nature, EPA clearly, and significantly, underestimated the risks CCW can pose.

Endnotes

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- ⁱ U.S. Env'tl. Prot. Agency (EPA), Human and Ecological Risk Assessment of Coal Combustion Wastes (released as part of a Notice of Data Availability) (Aug. 6, 2007) (draft) (hereinafter EPA Risk Assessment).
- ⁱⁱ Constituent Screening for Coal Combustion Wastes, prepared for EPA, Office of Solid Waste, by RTI, Contract No. 68-W-98-085 (Oct. 2002), Docket No. EP-HQ-RCRA-2006-0796-0470 (posted at www.regulations.gov on Mar. 4, 2009).
- ⁱⁱⁱ EPA Risk Assessment, *supra* note i, at appendix B-10. For a table detailing CCW plants with onsite landfills and surface impoundments modeled in EPA's full-scale analysis, *see id.* at 2-8, tbl. 2-4.
- ^{iv} *Id.* at 3-1 (citing Electric Power Research Institute (EPRI), Coal Combustion By-Products and Low Volume Wastes Comanagement Survey (June 1997)). For a complete list of CCW Disposal Sites (Plants) modeled, *see id.* at Appendix B-1-1.
- ^v EPA defines "composite" liners as a system that combines a plastic (e.g., high-density polyethylene (HDPE) membrane) over either geosynthetic or natural clays. *Id.* at B-3.
- ^{vi} *Id.* at 4-7 to 4-8.
- ^{vii} Final Regulatory Determination on Wastes from the Combustion of Fossil Fuels, 65 Fed. Reg. 32,214 (Env'tl. Prot. Agency, May 22, 2000) at 32,216.
- ^{viii} Statement of Barry Breen, Assistant Administrator, Office of Resource Conservation, US EPA before the Subcommittee on Environment and Water Resources, House Committee on Transportation and Infrastructure, April 30, 2009.
- ^{ix} Coal refuse is the waste coal produced from coal handling, crushing, and sizing operations, and tends to have a high sulfur content and low pH from high amounts of sulfide minerals (like pyrite). Coal refuse includes "combined ash and coal gob," "combined ash and coal refuse," and "combined bottom ash and pyrites." EPA Risk Assessment, *supra* note i, at 1-5, fn. 4.
- ^x EPA, Integrated Risk Information System (IRIS), Arsenic (CASRN 7440-38-2). http://cfpub.epa.gov/ncea/iris/index.cfm?fuseaction=iris.showQuickView&substance_nmbr=0278.
- ^{xi} EPA Risk Assessment, *supra* note 1, at 4-1.
- ^{xii} Agency for Toxic Substances and Disease Registry (ATSDR), ToxFaqs for Cadmium, <http://www.atsdr.cdc.gov/tfacts5.html#bookmark05>.
- ^{xiii} *Id.*
- ^{xiv} ATSDR, ToxFaqs for Cobalt. <http://www.atsdr.cdc.gov/tfacts33.html>.
- ^{xv} Consumer Fact Sheet on Nitrates/Nitrites, EPA Office of Groundwater and Drinking Water, available at <http://www.epa.gov/OGWDW/dwh/c-ioc/nitrates.html>. See also EPA, Integrated Risk Information System, <http://www.epa.gov/iris/subst/0076.htm> (nitrate) and <http://www.epa.gov/iris/subst/0078.htm> (nitrite).
- ^{xvi} ATSDR, ToxFaqs for Boron, <http://www.atsdr.cdc.gov/tfacts26.html#bookmark05>.
- ^{xvii} EPA, Integrated Risk Information System, Molybdenum (CASRN 7439-98-7), <http://www.epa.gov/iris/subst/0425.htm>.
- ^{xviii} ATSDR, ToxFaqs for Thallium, <http://www.atsdr.cdc.gov/tfacts54.html>.
- ^{xix} *Id.*
- ^{xx} EPA, Coal Combustion Waste Damage Case Assessments, available at www.regulations.gov, Document ID EPA-HQ-RCRA-2006-0796-0015 (July 9, 2007).
- ^{xxi} Brendan Kearney, Judge Approves \$54M Fly-Ash Suit Settlement, Maryland Daily Record, Dec. 30, 2008, <http://www.envirovaluation.org/index.php/2009/01/12/judge-approves-54m-fly-ash-suit-settleme>.
- ^{xxii} EPA, Pines Ground Water Plume Site, <http://www.epa.gov/region5/sites/pines/> (last visited May 5, 2009). See also "Not in My Lifetime: The Fight for Clean Water in Town of Pines, Indiana," Clean Air Task Force, 2004, <http://www.catf.us/publications/view/23>.
- ^{xxiii} Dennis A. Lemly, Aquatic Selenium Pollution is a Global Environmental Safety Issue, 59 *Ecotoxicology and Environmental Safety* 44, at 44 (2004), available at <http://www.treesearch.fs.fed.us/pubs/7293>.
- ^{xxiv} Letter from Environmental Integrity Project, Earthjustice, and others to Lisa Jackson, U.S. EPA Administrator (Mar. 2, 2009), available at <http://www.environmentalintegrity.org/pub607.cfm>.
- ^{xxv} ATSDR, ToxFaqs, available at www.atsdr.cdc.gov/tfacts2.html.

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- ^{xxvi} World Health Organization International Programme on Chemical Safety INCHEM: Environmental Health Criteria for Arsenic (IPCS INCHEM EHC), [available at http://www.inchem.org/documents/ehc/ehc/ehc224.htm#5.1.8](http://www.inchem.org/documents/ehc/ehc/ehc224.htm#5.1.8).
- ^{xxvii} Id.
- ^{xxviii} ATSDR, 2007 CERCLA Priority List of Hazardous Substances, [available at www.atsdr.cdc.gov/cercla/07list.html](http://www.atsdr.cdc.gov/cercla/07list.html).
- ^{xxix} ATSDR Public Health Statement, [available at www.atsdr.cdc.gov/toxprofiles/phs26.html](http://www.atsdr.cdc.gov/toxprofiles/phs26.html)
- ^{xxx} United Nations Environment Program, International Program on Chemical Safety and Environmental Health Criteria, [available at www.inchem.org/documents/ehc/ehc/ehc204.htm#SectionNumber:5.2](http://www.inchem.org/documents/ehc/ehc/ehc204.htm#SectionNumber:5.2).
- ^{xxxi} IPCS INCHEM EHC for Boron, [available at http://www.inchem.org/documents/ehc/ehc/ehc204.htm#PartNumber:9](http://www.inchem.org/documents/ehc/ehc/ehc204.htm#PartNumber:9).
- ^{xxxii} Id.
- ^{xxxiii} Centers for Disease Control and Prevention (CDC), Third National Report Spotlight on Cadmium, [available at www.cdc.gov/exposurereport/pdf/factsheet_cadmium.pdf](http://www.cdc.gov/exposurereport/pdf/factsheet_cadmium.pdf).
- ^{xxxiv} ATSDR Public Health Statement, [available at www.atsdr.cdc.gov/toxprofiles/phs5.html](http://www.atsdr.cdc.gov/toxprofiles/phs5.html).
- ^{xxxv} Id.
- ^{xxxvi} IPCS INCHEM EHC for Cadmium, [available at http://www.inchem.org/documents/ehc/ehc/ehc135.htm#PartNumber:6](http://www.inchem.org/documents/ehc/ehc/ehc135.htm#PartNumber:6).
- ^{xxxvii} Id.
- ^{xxxviii} ATSDR, ToxFAQs for Cobalt, [available at www.atsdr.cdc.gov/tfacts33.html](http://www.atsdr.cdc.gov/tfacts33.html).
- ^{xxxix} Id.
- ^{xl} ATSDR Public Health Statement, [available at http://www.atsdr.cdc.gov/toxprofiles/phs33.html](http://www.atsdr.cdc.gov/toxprofiles/phs33.html).
- ^{xli} IPCS INCHEM, Concise International Chemical Assessment Document 69, Cobalt, at chpt. 10, [available at http://www.inchem.org/documents/cicads/cicads/cicad69.htm#10.0](http://www.inchem.org/documents/cicads/cicads/cicad69.htm#10.0).
- ^{xlii} CDC, Third National Report on Human Exposure to Environmental Chemicals: Spotlight on Lead, [available at www.cdc.gov/exposurereport/pdf/factsheet_lead.pdf](http://www.cdc.gov/exposurereport/pdf/factsheet_lead.pdf).
- ^{xliii} Id.
- ^{xliv} Id.
- ^{xlv} Id.
- ^{xlvi} American Cancer Society, Making Treatment Decisions, Molybdenum, www.cancer.org/docroot/ETO/content/ETO_5_3x_Molybdenum.asp.
- ^{xlvii} Environmental Working Group, Chemical Index, Molybdenum, www.ewg.org/chemindex/chemicals/23518.
- ^{xlviii} Eugene R. Weiner, Applications of Environmental Chemistry 228 (2000).
- ^{xlix} Id.
- ^l ATSDR Public Health Statement, [available at www.atsdr.cdc.gov/toxprofiles/phs92.html](http://www.atsdr.cdc.gov/toxprofiles/phs92.html); ATSDR ToxFAQs, [available at www.atsdr.cdc.gov/tfacts92.html](http://www.atsdr.cdc.gov/tfacts92.html).
- ^{li} IPCS INCHEM EHC for Selenium, [available at http://www.inchem.org/documents/ehc/ehc/ehc58.htm#SubSectionNumber:1.1.5](http://www.inchem.org/documents/ehc/ehc/ehc58.htm#SubSectionNumber:1.1.5).
- ^{lii} Id. at <http://www.inchem.org/documents/ehc/ehc/ehc58.htm#SubSectionNumber:7.1.1>.
- ^{liii} EPA Risk Assessment, *supra* note 1, at A-2.
- ^{liv} Id. The data used to create the database included waste characterization data from its 1999 Report to Congress (“RTC”), public comments from the RTC and the May 22, 2000 Final Regulatory Determination, data available to EPA after the comment period for the Final Regulatory Determination, and data identified in literature searches. *See id.* at A-1-1 for the complete list of data sources used in the 2003 CCW constituent database.
- ^{lv} EPA Risk Assessment, *supra* note 1, at A-6.
- ^{lvi} Id. at ES-3.
- ^{lvii} Id. at B-10.
- ^{lviii} Id. at 1-5.
- ^{lix} Id. Coal refuse is defined as “waste coal produced from coal handling, crushing, and sizing operations, and tends to have a high sulfur content and low pH from high amounts of sulfide minerals (like pyrite),” and includes “combined ash and coal gob,” “combined ash and coal refuse,” and “combined bottom ash and pyrites.” *See id.* at 1-5 &n.4.
- ^{lx} Id. at 1-2.

^{lxi} Id. at 4-1.

^{lxii} Id. at 6-1.

^{lxiii} See EPA Superfund Glossary, available at www.epa.gov/region5superfund/ecology/html/glossary.html#hazard.

^{lxiv} Peer Review of “Draft Human and Ecological Risk Assessment of Coal Combustion Wastes,” EPA-HQ-RCRA-2006-0796-0467 (Sept. 25, 2008), available at www.regulations.gov.

^{lxv} Id. See comments of Nicolas Basta, Ph.D., Ohio State University, at 4 and 8.

^{lxvi} Id. See comments of Charles Harvey, Ph.D., Massachusetts Institute of Technology, at 1.

^{lxvii} Id. See comments of Charles Harvey, Ph.D., Massachusetts Institute of Technology, at 4, William Hopkins, Ph.D. Virginia Polytechnic Institute and State University, at 6 (hereinafter Peer Review comments).

^{lxviii} Id. See Comments of William Hopkins at 2–3.

^{lxix} Id. See Comments of William Hopkins at 6.

^{lxx} Id. See Comments of William Hopkins at 7.

^{lxxi} Id. See Comments of William Hopkins at 8.

^{lxxii} Id. See Comments of William Hopkins at 9, R. Kerry Rowe, Ph.D., at 4, and Donna J. Vorhees, Sc.D., at 6.

^{lxxiii} Id. See Comments of R. Kerry Rowe at 6.

^{lxxiv} Id. See Comments of R. Kerry Rowe at 9.

^{lxxv} Id. See Comments of Donna J. Vorhees, Sc.D., The Science Collaborative, at 2.

^{lxxvi} Id. See Comments of Donna J. Vorhees, Sc.D., The Science Collaborative, at 3, and R. Kerry Rowe at 6.

^{lxxvii} See, e.g., Letter from Charles H. Norris, P.G. and Mark A. Hutson, P.G. to Stephen Johnson, EPA Administrator, Re: Docket ID No. EPA-HQ-RCRA-2006-0796, Feb. 11, 2008, at Document ID EPA-HQ-RCRA-2006-0796-0446.2, at 2.

^{lxxviii} Id. at 2, 4.

^{lxxix} Id. at 2, 3.

^{lxxx} See, e.g., EPA Risk Assessment, supra note 1, at ES-11 (stating that “available data for landfills were mainly Toxicity Characteristic Leaching Procedure (TCLP) analyses, which may not be representative of actual CCW leachate. . . . This suggests that selenium risks may be *underestimated*, which is consistent with selenium as a cause for CCW damage cases”) (emphasis added).

^{lxxxii} See EPA Risk Assessment, supra note 1, at ES-11. For example, exposure to antimony, even at very low levels, causes significant health effects, and one type of antimony, antimony trioxide, is a possible carcinogen. See Appendix A. In addition, EPA has classified mercury as a possible carcinogen, and mercury has also been linked to nervous system, brain, and lung damage and been deemed extremely harmful to children and fetuses. See Appendix A. Thallium bioaccumulates in plants and animals and has been linked to numerous human health effects including hair loss, damage to lungs, heart, liver, and kidneys, and death. See Appendix A.

^{lxxxii} EPA Risk Assessment, supra note 1, at 1-3.

^{lxxxiii} Peer Review comments, supra note lxvii. Comments of William Hopkins at 2 (emphasis added).



TVA Statement
Earth Justice Draft Report on Coal Combustion By-Product Storage
May 7, 2009

The safety of the public and our employees is TVA's top priority in all our operations. TVA and our employees and power plants have been part of the Valley region's communities for 75 years, and we take very seriously our responsibility for safe operations.

To generate electricity for the 9 million people of the Tennessee Valley region, we use a diverse generating mix, including coal, nuclear, natural gas, hydroelectric dams and renewable energy. About half of our nation's electricity supply comes from coal, and TVA's supply is similar. And like utilities nationwide, we must manage the ash that is a by-product of coal-fired power production.

A report issued today by some environmental groups includes allegations about the U.S. Environmental Protection Agency's draft "2007 Human and Ecological Risk Assessment from Coal Combustion Wastes." EPA has sought public comment on its draft and received significant comments. EPA has not issued its final assessment. We look forward to that final assessment from EPA, and we will work with regulatory authorities and others to address any issues.

Meanwhile, TVA is complying with all environmental rules and regulations in all of its operations and in the storage of coal combustion by-products. We will continue to support research and development efforts to characterize and manage coal combustion by-products.

We also continue to work toward our goal of reducing TVA's environmental footprint by having 50 percent of our power supply from clean and renewable energy sources by 2020.

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Attachment - Surface Impoundments and Landfills Analyzed in EP,

WMU Type	Plant	Utility Name	County	State	Area (acres)
SI	James H Miller Jr.	Alabama Power Co.	Jefferson	AL	200
SI	Greene County	Alabama Power Co.	Walker	AL	480
SI	Widows Creek	Tennessee Valley Authority	Jackson	AL	222
SI	Gadsden	Alabama Power Co.	Etowah	AL	60
SI	Gorgas	Alabama Power Co.	Walker	AL	1,500
SI	Gorgas	Alabama Power Co.	Walker	AL	283
SI	Gorgas	Alabama Power Co.	Walker	AL	250
SI	Barry	Alabama Power Co.	Mobile	AL	63
SI	Widows Creek	Tennessee Valley Authority	Jackson	AL	110
SI	Flint Creek	Southwestern Electric Power Co.	Benton	AR	36
LF	Flint Creek	Southwestern Electric Power Co.	Benton	AR	40
SI	Cholla	Arizona Public Service Co.	Navajo	AZ	171
LF	Springerville	Tucson Electric Power Co	Apache	AZ	57
LF	St Johns River Power	JEA	Duval	FL	129
LF	Stanton Energy Ctr.	Orlando Utilities Comm.	Orange	FL	312
LF	C D McIntosh Jr.	Lakeland, City of	Polk	FL	26
LF	Crist	Gulf Power Co.	Escambia	FL	12
SI	Wansley	Georgia Power Co.	Heard	GA	43
LF	Bowen	Georgia Power Co.	Bartow	GA	26
LF	Bowen	Georgia Power Co.	Bartow	GA	25
SI	Hammond	Georgia Power Co.	Floyd	GA	56
SI	Harlee Branch	Georgia Power Co.	Putnam	GA	324
SI	Harlee Branch	Georgia Power Co.	Putnam	GA	203
SI	Jack McDoNough	Georgia Power Co.	Cobb	GA	73
SI	Kraft	Savannah Electric & Power Co	Chatham	GA	60
SI	Scherer	Georgia Power Co.	Monroe	GA	490
SI	Wansley	Georgia Power Co.	Heard	GA	330
LF	Arkwright	Georgia Power Co.	Bibb	GA	54
SI	Louisa	MidAmerican Energy Co.	Louisa	IA	30

SI	Lansing	Interstate Power Co.	Allamakee	IA	15
LF	Muscatine Plant #1	Muscatine, City of	Muscatine	IA	36
SI	Council Bluffs	MidAmerican Energy Co.	Pottawattamie	IA	200
LF	Neal North	MidAmerican Energy Co.	Woodbury	IA	200
LF	Neal South	MidAmerican Energy Co.	Woodbury	IA	150
SI	Neal North	MidAmerican Energy Co.	Woodbury	IA	150
LF	Duck Creek	Central IlliNois Light Co.	Fulton	IL	21
LF	Dallman	Springfield, City of	Sangamon	IL	22
LF	Marion	Southern IlliNois Power Coop	Williamson	IL	38
SI	Crawford	Commonwealth Edison Co.	Cook	IL	25
SI	Will County	Commonwealth Edison Co.	Will	IL	60
LF	Waukegan	Commonwealth Edison Co.	Lake	IL	60
SI	Dallman	Springfield, City of	Sangamon	IL	417
LF	Marion	Southern IlliNois Power Coop	Williamson	IL	105
LF	Newton	Central IlliNois Pub Serv. Co.	Jasper	IL	309
SI	Baldwin	IlliNois Power Co.	Randolph	IL	107
SI	E D Edwards	Central IlliNois Light Co.	Peoria	IL	145
SI	Hennepin	IlliNois Power Co.	Putnam	IL	150
SI	Joliet 29	Commonwealth Edison Co.	Will	IL	63
SI	Vermilion	IlliNois Power Co.	Vermilion	IL	43
SI	Petersburg	Indianapolis Power & Light Co.	Pike	IN	250
LF	A B Brown	Southern Indiana Gas & Elec. Co.	Posey	IN	176
LF	Gibson	PSI Energy, Inc.	Gibson	IN	85
SI	R Gallagher	PSI Energy, Inc.	Floyd	IN	170
SI	Warrick	Southern Indiana Gas & Elec. Co.	Warrick	IN	140
SI	Petersburg	Indianapolis Power & Light Co.	Pike	IN	157
LF	Merom	Hoosier Energy R E C, Inc.	Sullivan	IN	65
LF	R M Schahfer	Northern Indiana Pub. Serv. Co.	Jasper	IN	200
SI	Cayuga	PSI Energy, Inc.	Vermillion	IN	280
SI	F B Culley	Southern Indiana Gas & Elec. Co.	Warrick	IN	82
SI	Frank E Ratts	Hoosier Energy R E C, Inc.	Pike	IN	39
SI	Gibson	PSI Energy, Inc.	Gibson	IN	875
SI	R M Schahfer	Northern Indiana Pub. Serv. Co.	Jasper	IN	80

SI	Wabash River	PSI Energy, Inc.	Vigo	IN	120
LF	GeNoa	PSI Energy, Inc.	Gibson	IN	100
LF	Lawrence EC	KPL Western Resources Co.	Douglas	KS	825
LF	Lawrence EC	KPL Western Resources Co.	Douglas	KS	30
LF	Lawrence EC	KPL Western Resources Co.	Douglas	KS	22
LF	Tecumseh EC	KPL Western Resources Co.	Shawnee	KS	540
LF	Holcomb	Sunflower Electric Power Corp.	Finney	KS	8
SI	Trimble County	Louisville Gas & Electric Co.	Trimble	KY	115
SI	E W Brown	Kentucky Utilities Co.	Mercer	KY	84
SI	E W Brown	Kentucky Utilities Co.	Mercer	KY	33
SI	Paradise	Tennessee Valley Authority	Muhlenberg	KY	200
SI	Tyrone	Kentucky Utilities Co.	Woodford	KY	6
SI	Big Sandy	Kentucky Power Co.	Lawrence	KY	115
SI	Dale	East Kentucky Power Coop, Inc.	Clark	KY	115
SI	Green River	Kentucky Utilities Co.	Muhlenberg	KY	36
SI	Shawnee	Tennessee Valley Authority	McCracken	KY	180
SI	Tyrone	Kentucky Utilities Co.	Woodford	KY	8
SI	Tyrone	Kentucky Utilities Co.	Woodford	KY	5
LF	Dolet Hills	CLECO Corporation	De Soto	LA	109
SI	Big Cajun 2	Cajun Electric Power Coop, Inc.	Pointe Coupee	LA	241
SI	Rodemacher	CLECO Corporation	Rapides	LA	109
SI	Rodemacher	CLECO Corporation	Rapides	LA	36
SI	Dolet Hills	CLECO Corporation	De Soto	LA	66
LF	C P Crane	Baltimore Gas & Electric Co.	Baltimore City	MD	35
LF	Dickerson	Potomac Electric Power Co.	Montgomery	MD	206
LF	Brandon Shores	Baltimore Gas & Electric Co.	Anne Arundel	MD	246
LF	Chalk Point	Potomac Electric Power Co.	Prince Georges	MD	596
LF	Morgantown	Potomac Electric Power Co.	Charles	MD	212
SI	Eckert Station	Lansing, City of	Ingham	MI	151
SI	J R Whiting	Consumers Energy Co.	Monroe	MI	6
SI	Monroe	Detroit Edison Co.	Monroe	MI	400
LF	Eckert Station	Lansing, City of	Ingham	MI	174
LF	Presque Isle	Wisconsin Electric Power Co.	Marquette	MI	292

SI	J H Campbell	Consumers Energy Co.	Ottawa	MI	267
LF	Monroe	Detroit Edison Co.	Monroe	MI	400
SI	Syl Laskin	Minnesota Power, Inc.	St Louis	MN	75
LF	Hoot Lake	Otter Tail Power Co.	Otter Tail	MN	72
SI	Blue Valley	Independence, City of	Jackson	MO	23
SI	Meramec	Union Electric Co.	St Louis	MO	61
LF	Victor J Daniel Jr	Mississippi Power Co.	Jackson	MS	49
SI	Jack Watson	Mississippi Power Co.	Harrison	MS	100
LF	Colstrip	Montana Power Co.	Rosebud	MT	9
SI	Cliffside	Duke Power Co.	Cleveland	NC	82
SI	Asheville	Carolina Power & Light Co.	Buncombe	NC	140
SI	Cape Fear	Carolina Power & Light Co.	Chatham	NC	60
SI	Mayo	Carolina Power & Light Co.	Person	NC	65
SI	Mayo	Carolina Power & Light Co.	Person	NC	30
SI	Riverbend	Duke Power Co.	Gaston	NC	143
LF	Belews Creek	Duke Power Co.	Stokes	NC	315
LF	Marshall	Duke Power Co.	Catawba	NC	110
LF	Roxboro	Carolina Power & Light Co.	Person	NC	55
SI	Belews Creek	Duke Power Co.	Stokes	NC	512
SI	Buck	Duke Power Co.	Rowan	NC	90
SI	Dan River	Duke Power Co.	Rockingham	NC	72
SI	G G Allen	Duke Power Co.	Gaston	NC	210
SI	L V Sutton	Carolina Power & Light Co.	New HaNover	NC	162
SI	Lee	Carolina Power & Light Co.	Wayne	NC	35
SI	Marshall	Duke Power Co.	Catawba	NC	340
SI	W H Weatherspoon	Carolina Power & Light Co.	Robeson	NC	26
LF	Leland Olds	Basin Electric Power Coop	Mercer	ND	37
LF	Coal Creek	Coop Power Assn.	McLean	ND	70
LF	Milton R Young	Minnkota Power Coop, Inc.	Oliver	ND	80
LF	Antelope Valley	Basin Electric Power Coop	Mercer	ND	27
LF	Leland Olds	Basin Electric Power Coop	Mercer	ND	20
LF	Sheldon	Nebraska Public Power District	Lancaster	NE	9
LF	Nebraska City	Omaha Public Power District	Otoe	NE	17

LF	North Omaha	Omaha Public Power District	Douglas	NE	13
LF	Lon Wright	Fremont, City of	Dodge	NE	Not Reported
LF	Mohave	Southern California Edison Co.	Clark	NV	250
LF	Reid Gardner	Nevada Power Co.	Clark	NV	113
LF	Dunkirk	Niagara Mohawk Power Corp.	Chautauqua	NY	12
LF	Richard Gorsuch	American Mun. Power-Ohio, Inc.	Washington	OH	Not Reported
LF	Conesville	Columbus Southern Power Co.	Coshocton	OH	300
LF	Gen J M Gavin	Ohio Power Co.	Gallia	OH	99
LF	Miami Fort	Cincinnati Gas & Electric Co.	Hamilton	OH	80
SI	Killen Station	Dayton Power & Light Co.	Adams	OH	Not Reported
SI	Cardinal	Cardinal Operating Co.	Jefferson	OH	123
SI	J M Stuart	Dayton Power & Light Co.	Adams	OH	88
SI	Walter C Beckjord	Cincinnati Gas & Electric Co.	Clermont	OH	Not Reported
LF	Bay Shore	Toledo Edison Co.	Lucas	OH	85
LF	Walter C Beckjord	Cincinnati Gas & Electric Co.	Clermont	OH	14
SI	Gen J M Gavin	Ohio Power Co.	Gallia	OH	300
LF	Conesville	Columbus Southern Power Co.	Coshocton	OH	100
LF	Muskogee	Oklahoma Gas & Electric Co.	Muskogee	OK	36
SI	Hugo	Western Farmers Elec. Coop, Inc.	Choctaw	OK	151
LF	Hugo	Western Farmers Elec. Coop, Inc.	Choctaw	OK	40
LF	Hunter	Western Farmers Elec. Coop, Inc.	Choctaw	OK	280
LF	Northeastern	Public Service Co. of Oklahoma	Rogers	OK	69
LF	Mitchell - PA	West Penn Power Co.	Washington	PA	70
LF	Shawville	GPU Service Corporation	Clearfield	PA	68
LF	Hatfield's Ferry	West Penn Power Co.	Greene	PA	20
LF	Keystone	GPU Service Corporation	Armstrong	PA	155
LF	Portland	Metropolitan Edison Co.	Northampton	PA	15
LF	Cross	South Carolina Pub Serv. Auth.	Berkeley	SC	60
LF	Cross	South Carolina Pub Serv. Auth.	Berkeley	SC	320
SI	H B Robinson	Carolina Power & Light Co.	Darlington	SC	30
SI	W S Lee	Duke Power Co.	Anderson	SC	41
LF	Cross	South Carolina Pub Serv. Auth.	Berkeley	SC	230
LF	Cross	South Carolina Pub Serv. Auth.	Berkeley	SC	30

LF	Cross	South Carolina Pub Serv. Auth.	Berkeley	SC	30
LF	Ben French	Black Hills Corp.	Pennington	SD	5
LF	Big Stone	Otter Tail Power Co.	Grant	SD	3
LF	Big Stone	Otter Tail Power Co.	Grant	SD	106
LF	John Sevier	Tennessee Valley Authority	Hawkins	TN	51
SI	Allen	Tennessee Valley Authority	Shelby	TN	85
SI	Cumberland	Tennessee Valley Authority	Stewart	TN	295
SI	Bull Run	Tennessee Valley Authority	Anderson	TN	41
SI	Cumberland	Tennessee Valley Authority	Stewart	TN	75
SI	Gallatin	Tennessee Valley Authority	Sumner	TN	341
SI	John Sevier	Tennessee Valley Authority	Hawkins	TN	105
SI	John Sevier	Tennessee Valley Authority	Hawkins	TN	57
SI	Johnsonville	Tennessee Valley Authority	Humphreys	TN	91
SI	Kingston	Tennessee Valley Authority	Roane	TN	275
SI	Kingston	Tennessee Valley Authority	Roane	TN	41
LF	W A Parish	Houston Lighting & Power Co.	Fort Bend	TX	29
SI	Fayette Power Prj.	Lower Colorado River Authority	Fayette	TX	190
LF	Martin Lake	Texas Utilities Electric Co.	Rusk	TX	290
LF	Sandow	Texas Utilities Electric Co.	Milam	TX	125
SI	Coleto Creek	Central Power & Light Co.	Goliad	TX	315
SI	Oklaunion	West Texas Utilities Co.	Wilbarger	TX	291
SI	Oklaunion	West Texas Utilities Co.	Wilbarger	TX	19
SI	Oklaunion	West Texas Utilities Co.	Wilbarger	TX	11
SI	Sandow	Texas Utilities Electric Co.	Milam	TX	45
LF	Sandow	Texas Utilities Electric Co.	Milam	TX	48
LF	Huntington	PacifiCorp	Emery	UT	70
LF	Intermountain	Los Angeles, City of	Millard	UT	339
LF	Carbon	PacifiCorp	Carbon	UT	12
SI	Possum Point	Virginia Electric & Power Co.	Prince William	VA	56
LF	Port Washington	Wisconsin Electric Power Co.	Ozaukee	WI	300
LF	South Oak Creek	Wisconsin Electric Power Co.	Milwaukee	WI	45
LF	Valley	Wisconsin Electric Power Co.	Milwaukee	WI	16
LF	Bay Front	Northern States Power Co.	Ashland	WI	10

LF	South Oak Creek	Wisconsin Electric Power Co.	Milwaukee	WI	130
LF	Weston	Wisconsin Public Service Corp.	Marathon	WI	18
LF	Edgewater	Wisconsin Power & Light Co.	Sheboygan	WI	25
LF	John E Amos	Appalachian Power Co.	Putnam	WV	200
LF	Mt Storm	Virginia Electric & Power Co.	Grant	WV	900
SI	Harrison	MoNongahela Power Co.	Harrison	WV	300
SI	John E Amos	Appalachian Power Co.	Putnam	WV	100
SI	John E Amos	Appalachian Power Co.	Putnam	WV	10
LF	Fort Martin	MoNongahela Power Co.	MoNongalia	WV	17
SI	Mitchell - WV	Ohio Power Co.	Marshall	WV	Not Reported
LF	Dave Johnston	PacifiCorp	Converse	WY	45
SI	Laramie R Station	Basin Electric Power Coop	Platte	WY	11
LF	Jim Bridger	PacifiCorp	Sweetwater	WY	120
SI	Jim Bridger	PacifiCorp	Sweetwater	WY	140
SI	Jim Bridger	PacifiCorp	Sweetwater	WY	125
LF	Jim Bridger	PacifiCorp	Sweetwater	WY	241

Source: U.S. EPA, Office of Solid Waste. Human Ecological Risk Assessment of Coal Combustion Wastes. Attachments B-1 &

A Risk Assessment (Unlined and Clay-Lined)

Capacity (cubic yards)	Waste Type	Liner Type	Leachate Collection System	Groundwater Monitoring
5,500,000	Ash	Clay	No	Yes
5,000,000	Ash	Clay	No	No
12,400,000	Ash	Clay	No	Yes
484,000	Ash and Coal Waste	Clay	No	No
15,000,000	Ash and Coal Waste	Clay	No	No
24,100,000	Ash and Coal Waste	Clay	No	No
Not Reported	Ash and Coal Waste	Clay	No	No
1,900,000	Ash and Coal Waste	No Liner	No	No
3,500,000	Ash and Coal Waste	No Liner	No	Yes
Not Reported	Ash and Coal Waste	No Liner	No	No
1,508,250	Ash and Coal Waste	No Liner	No	Yes
2,600,000	Ash	No Liner	Yes	Yes
6,400,000	Ash	No Liner	No	Yes
Not Reported	Ash and Coal Waste	Clay	Yes	Yes
Not Reported	Ash	No Liner	No	Yes
Not Reported	Ash and Coal Waste	No Liner	No	Yes
Not Reported	Ash and Coal Waste	No Liner	Yes	Yes
Not Reported	Ash	No Liner	No	No
406,971	Ash	No Liner	No	Yes
491,400	Ash	No Liner	No	No
576,256	Ash and Coal Waste	No Liner	No	No
7,898,277	Ash and Coal Waste	No Liner	No	No
7,634,000	Ash and Coal Waste	No Liner	No	No
1,531,893	Ash and Coal Waste	No Liner	No	No
Not Reported	Ash and Coal Waste	No Liner	No	No
22,262,030	Ash and Coal Waste	No Liner	No	No
18,712,850	Ash and Coal Waste	No Liner	No	No
415,907	Ash and Coal Waste	No Liner	Yes	Yes
500,000	Ash	Clay	No	Yes

Not Reported	Ash	Clay	No	Yes
2,000,000	Ash	Clay	Yes	Yes
Not Reported	Ash	No Liner	Yes	Yes
Not Reported	Ash	No Liner	No	No
Not Reported	Ash	No Liner	No	No
Not Reported	Ash and Coal Waste	No Liner	No	No
1,500,000	Ash	Clay	No	Yes
1,800,000	Ash	Clay	No	No
1,000,000	Ash	Clay	Yes	Yes
642,000	Ash and Coal Waste	Clay	No	No
599,256	Ash and Coal Waste	Clay	No	Yes
4,000,000	Ash and Coal Waste	Clay	Yes	Yes
3,800,000	Ash	No Liner	No	Yes
2,200,000	Ash	No Liner	No	Yes
Not Reported	Ash	No Liner	No	Yes
4,000,000	Ash and Coal Waste	No Liner	No	No
11,000,000	Ash and Coal Waste	No Liner	Yes	No
3,460,600	Ash and Coal Waste	No Liner	No	Yes
1,012,000	Ash and Coal Waste	No Liner	No	No
8,100,000	Ash and Coal Waste	No Liner	No	Yes
19,750,000	Ash	Clay	No	Yes
10,360,000	Ash	Clay	Yes	Yes
20,000,000	Ash	Clay	No	Yes
20,000,000	Ash and Coal Waste	Clay	No	No
4,500,000	Ash and Coal Waste	Clay	No	No
Not Reported	Ash	No Liner	No	No
8,500,000	Ash	No Liner	No	Yes
17,200,000	Ash	No Liner	No	Yes
25,000,000	Ash and Coal Waste	No Liner	No	No
2,600,000	Ash and Coal Waste	No Liner	No	Yes
1,250,000	Ash and Coal Waste	No Liner	No	No
55,000,000	Ash and Coal Waste	No Liner	No	No
1,030,000	Ash and Coal Waste	No Liner	No	No

14,000,000	Ash and Coal Waste	No Liner	No	No
Not Reported	Ash and Coal Waste	No Liner	No	Yes
34,300,000	Ash	Clay	No	Yes
1,000,000	Ash	Clay	No	Yes
1,360,000	Ash	Clay	No	Yes
Not Reported	Ash	Clay	No	Yes
Not Reported	Ash	No Liner	No	Yes
6,856,667	Ash	Clay	No	Yes
2,710,000	Ash	No Liner	No Data	No Data
1,000,000	Ash	No Liner	No Data	No Data
5,000,000	Ash	No Liner	No	No
351,699	Ash	No Liner	No	No
12,052,100	Ash and Coal Waste	No Liner	No	Yes
7,408,274	Ash and Coal Waste	No Liner	No	Yes
2,331,219	Ash and Coal Waste	No Liner	No	No
5,810,000	Ash and Coal Waste	No Liner	No	Yes
500,123	Ash and Coal Waste	No Liner	No	No
327,500	Ash and Coal Waste	No Liner	No	No
8,500,000	Ash	Clay	Yes	Yes
4,990,003	Ash	Clay	No	No
2,500,000	Ash	Clay	No	Yes
1,200,000	Ash	Clay	No	Yes
850,000	Ash and Coal Waste	No Liner	Yes	Yes
800,000	Ash	No Liner	No	Yes
12,600,000	Ash	No Liner	Yes	Yes
5,600,000	Ash and Coal Waste	No Liner	No	Yes
4,634,000	Ash and Coal Waste	No Liner	No	No
7,700,000	Ash and Coal Waste	No Liner	Yes	Yes
7,200,000	Ash	No Liner	No	No
140,000	Ash	No Liner	No	No
15,000,000	Ash	No Liner	No	No
6,460,000	Ash	No Liner	No	Yes
14,200,000	Ash	No Liner	No	Yes

6,900,000	Ash and Coal Waste	No Liner	No	Yes
20,000,000	Ash and Coal Waste	No Liner	No	No
726,000	Ash and Coal Waste	No Liner	No	Yes
800,000	Ash and Coal Waste	No Liner	No	Yes
372,000	Ash and Coal Waste	Clay	No Data	No Data
591,200	Ash and Coal Waste	No Liner	No	No
Not Reported	Ash	Clay	Yes	No
Not Reported	Ash	No Liner	No	No
Not Reported	Ash	No Liner	No	Yes
2,200,000	Ash	Clay	No	No
3,200,000	Ash	No Liner	No	No
2,300,000	Ash	No Liner	No	Yes
2,400,000	Ash	No Liner	No	No
185,000	Ash	No Liner	No	Yes
3,200,000	Ash	No Liner	No	No
14,000,000	Ash	No Liner	No	No
7,826,000	Ash	No Liner	No	Yes
4,165,000	Ash	No Liner	No	Yes
2,200,000	Ash and Coal Waste	No Liner	Yes	Yes
4,840,000	Ash and Coal Waste	No Liner	No	Yes
2,097,000	Ash and Coal Waste	No Liner	Yes	Yes
6,545,000	Ash and Coal Waste	No Liner	No	No
7,696,000	Ash and Coal Waste	No Liner	No	No
1,936,000	Ash and Coal Waste	No Liner	No	No
19,689,000	Ash and Coal Waste	No Liner	No	No
1,200,000	Ash and Coal Waste	No Liner	No	Yes
1,800,000	Ash	Clay	Yes	Yes
4,700,000	Ash	Clay	No	Yes
6,500,000	Ash	Clay	No	Yes
3,500,000	Ash	No Liner	Yes	Yes
458,000	Ash and Coal Waste	No Liner	No	Yes
375,000	Ash	Clay	No	Yes
600,000	Ash and Coal Waste	Clay	No	No

105,000	Ash and Coal Waste	Clay	No	No
170,000	Ash	No Liner	No	Yes
21,500,000	Ash	No Liner	No	Yes
4,520,000	Ash	No Liner	No	Yes
1,126,080	Ash	Clay	Yes	Yes
3,003,600	Ash	Clay	Yes	Yes
10,000,000	Ash	Clay	No	No
12,000,000	Ash	Clay	Yes	Yes
4,000,000	Ash	Clay	Yes	Yes
99,935	Ash and Coal Waste	Clay	No	Yes
8,437,500	Ash	No Liner	No	No
8,357,000	Ash	No Liner	No	Yes
2,000,000	Ash	No Liner	No	No
Not Reported	Ash	No Liner	No	Yes
1,000,000	Ash	No Liner	No	Yes
30,000,000	Ash and Coal Waste	No Liner	No	No
2,500,000	Ash and Coal Waste	No Liner	Yes	Yes
1,247,112	Ash	Clay	No	Yes
Not Reported	Ash and Coal Waste	Clay	No	No
4,000,000	Ash	No Liner	No	No
12,000,000	Ash	No Liner	No	No
3,185,190	Ash	No Liner	No	Yes
5,600,000	Ash	No Liner	Yes	Yes
8,000,000	Ash	No Liner	Yes	Yes
790,000	Ash and Coal Waste	No Liner	Yes	Yes
22,663,120	Ash and Coal Waste	No Liner	Yes	Yes
2,200,000	Ash and Coal Waste	No Liner	No	Yes
Not Reported	Ash and Coal Waste	Clay	No	Yes
Not Reported	Ash	No Liner	No	Yes
Not Reported	Ash and Coal Waste	No Liner	No	No
1,634,000	Ash and Coal Waste	No Liner	No	Yes
Not Reported	Ash and Coal Waste	No Liner	Yes	Yes
Not Reported	Ash and Coal Waste	No Liner	No	Yes

Not Reported	Ash and Coal Waste	No Liner	No	Yes
Not Reported	Ash	Clay	No	Yes
80,000	Ash	Clay	No	No
8,000,000	Ash	No Liner	No	No
4,800,000	Ash	Clay	No	Yes
1,500,000	Ash	No Liner	No Data	No Data
9,500,000	Ash	No Liner	No	Yes
650,000	Ash and Coal Waste	No Liner	No	No
1,750,000	Ash and Coal Waste	No Liner	No	Yes
4,300,000	Ash and Coal Waste	No Liner	No	Yes
7,000,000	Ash and Coal Waste	No Liner	No	Yes
1,600,000	Ash and Coal Waste	No Liner	No	Yes
2,900,000	Ash and Coal Waste	No Liner	No	Yes
8,900,000	Ash and Coal Waste	No Liner	No	Yes
11,000,000	Ash and Coal Waste	No Liner	No	Yes
Not Reported	Ash	Clay	No	Yes
4,351,644	Ash	Clay	No	No
30,000,000	Ash	Clay	No	Yes
1,300,000	Ash	Clay	No	Yes
Not Reported	Ash and Coal Waste	Clay	No	Yes
6,056,820	Ash	No Liner	No	No
718,060	Ash	No Liner	No	No
408,940	Ash and Coal Waste	No Liner	No	No
1,351,973	Ash and Coal Waste	No Liner	No	No
903,467	Ash and Coal Waste	No Liner	No	No
11,400,000	Ash	No Liner	Yes	No
17,800,000	Ash	No Liner	No	Yes
Not Reported	Ash and Coal Waste	No Liner	No	No
Not Reported	Ash and Coal Waste	No Liner	No	No
1,900,000	Ash and Coal Waste	Clay	No	Yes
4,050,000	Ash and Coal Waste	Clay	Yes	Yes
534,000	Ash and Coal Waste	Clay	No	Yes
350,000	Ash	No Liner	No	Yes

4,600,000	Ash	No Liner	No	Yes
600,000	Ash	No Liner	No	Yes
1,655,700	Ash and Coal Waste	No Liner	No	Yes
14,000,000	Ash and Coal Waste	Clay	Yes	Yes
8,800,000	Ash and Coal Waste	Clay	Yes	Yes
28,000,000	Ash	No Liner	No	Yes
13,000,000	Ash	No Liner	No	No
3,078,000	Ash	No Liner	No	No
1,900,000	Ash	No Liner	Yes	Yes
12,030,000	Ash and Coal Waste	No Liner	No	No
296,100	Ash	Clay	Yes	Yes
464,156	Ash and Coal Waste	Clay	No	Yes
7,940,941	Ash	No Liner	No	Yes
3,400,000	Ash and Coal Waste	No Liner	No	Yes
6,500,000	Ash and Coal Waste	No Liner	No	Yes
24,000,000	Ash and Coal Waste	No Liner	Yes	Yes

t B-2. August 6, 2007.