Out of Control:
Mounting Damages From Coal Ash Waste Sites

2010

Thirty-one New Damage Cases of Contamination from Improperly Disposed Coal Combustion Waste

Environmental Integrity Project and Earthjustice

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EXECUTIVE SUMMARY

Coal-fired power plants generate nearly 140 million tons of fly ash, scrubber sludge, and other combustion wastes every year.[i] These wastes contain some of the earth's most deadly pollutants, including arsenic, cadmium, lead, selenium, and other toxic metals that can cause cancer and neurological harm in humans and poison fish. This report brings to light 31 coal combustion waste sites that are known to have contaminated groundwater, wetlands, creeks, or rivers in 14 states: Delaware, Florida, Illinois, Indiana, Maryland, Michigan, Montana, Nevada, New Mexico, North Carolina, South Carolina, Tennessee, Pennsylvania, and West Virginia. The data presented below and in the attached report were compiled from monitoring data and other information in the files of state agencies.

At 15 of the 31 sites, contamination has already migrated off the power plant property (off-site) at levels that exceed drinking water or surface water quality standards. The remaining 16 show evidence of severe on-site pollution (see Table 1 and Summary). Because off-site monitoring data at 14 of these 16 sites were not available, damage may be more severe and widespread than indicated in this report.

Based on similar criteria, the United States Environmental Protection Agency (EPA) has already identified 71 coal combustion waste damage cases, 23 of which are known to have caused off-site contamination.[ii] The 31 new damage cases identified in this report bring the total number of damaged sites to more than 100, with still more to be investigated.

The damaged sites include several high hazard ash ponds, but are not limited to the type of impoundments that received so much attention after the disastrous spill at the Tennessee Valley Authority's Kingston plant at the end of 2008. No fewer than 11 of the contaminated sites documented in this report involve so-called "dry landfills," and two involve "structural fills" that were advertised as "beneficial reuse" of coal ash. Nor are these damage incidents confined to the remote past, as monitoring at many sites shows that contamination has actually increased within the last several years, and 25 of the 31 facilities are still active disposal sites. In addition, at several sites, the dumping was initiated within the last two decades.

This kind of damage could easily have been prevented with sensible safeguards such as phasing out leak-prone ash ponds and requiring the use of synthetic liners and leachate collection systems. Yet, incredibly, ash and other coal combustion wastes are not subject to any federal regulations. The EPA promised to close this loophole by proposing new standards before the end of 2009. Instead, the EPA's draft rule is stalled at the Office of Management and Budget, where an avalanche of lobbyists hope it will stay buried.

But the data are overwhelming: these unregulated sites present a clear and present danger to public health and the environment. If law and science are to guide our most important environmental decisions, as EPA Administrator Lisa Jackson has promised, we need to regulate these hazards before damage to health and water becomes even more severe and widespread.

Persistent and Deadly Pollutants

Many of the pollutants found in the waters underneath or adjacent to these sites are carcinogens, neurotoxins, or are deadly to fish and other aquatic life. Arsenic, a potent human carcinogen, has been found in excess of MCLs or water quality criteria at 21 of the 31 sites, at levels as high as *145 times* the federal drinking water standard (see Table 1). Arsenic causes multiple forms of cancer, including cancer of the liver, kidney, lung, bladder, and skin.[iii] Lead, a deadly neurotoxin that can damage the central nervous system, especially in young children, was found at 9 sites at up to 10 times the federal safe level. Selenium, a chemical deadly to fish at very low levels, is found in excess of MCLs or water quality criteria at 7 sites, exceeding federal water quality criteria at one West Virginia stream by more than 9.5 times.

While it is unlikely that humans have actually been exposed at the very highest levels at most of the sites identified in this study, the EPA has indicated that ash dumps significantly increase risks to both people and wildlife. For example, EPA's 2007 risk assessment estimated that up to 1 in 50 residents living near certain wet ash ponds could get cancer due to drinking water contaminated with arsenic.[iv] This represents a risk 2000 times the EPA's regulatory goal.

The data also show extremely high levels of other contaminants, such as sulfates and boron. High sulfate concentrations make water undrinkable, and an EPA health advisory warns that ingestion of boron above 3 milligrams per liter can sicken small children. Sulfate levels at some sites are up to 24 times the EPA's "secondary" standards for drinking water, while boron concentrations have been many times the EPA's health advisory. The utility industry has suggested that because the federal government has not identified sulfates or boron as "primary" pollutants, they don't count for purposes of identifying damage cases. These distinctions offer little comfort to citizens like the members of a Moose Lodge in Montana made sick by drinking water laced with boron from the Colstrip ash pit.

Off-site Damage: Polluted Groundwater

Monitoring data for 8 of the disposal facilities identified in this report show significant pollution has migrated off-site into the underlying aquifer in excess of MCLs. At the following coal ash dump sites contaminated groundwater has traveled beyond site boundaries: Big Bend Station (Florida), Gibson Power Plant (Indiana), Karn and Weadock Generating Facility (Michigan), Colstrip Power Plant (Montana), Swift Creek Landfill (North Carolina), Reid Gardner Generating Facility (Nevada), Orion's Phillips Power Plant (Pennsylvania), and Trans Ash Inc.'s CCW Landfill (Tennessee). Several of the other sites with limited data may also have polluted groundwater moving off-site.

Four of these facilities — Colstrip, Gibson, Phillips, and Trans Ash — polluted drinking water wells at levels above health advisories and drinking water standards for boron (Gibson and Colstrip), manganese (Gibson), mercury (Trans Ash), sulfate (Colstrip), and total dissolved solids (Colstrip and Phillips). Contamination from the Colstrip site sickened people, forced the closure of the drinking water well at a nearby Moose Lodge, and triggered a $25 million settlement with affected residents. At the Gibson site in Indiana, Duke Energy is supplying bottled water to residents of East Mt. Carmel. Contamination of several municipal drinking supply wells from ash at the Phillips site ruined residents' hot water heaters, which some residents had to replace every year for several years, and forced closure of the plant's ash pond. Lastly, near the Trans Ash Landfill in Tennessee, a new water supply was piped to a resident after mercury levels in her well were measured at more than 5 times the drinking water standard.

Off-site groundwater downgradient of 4 additional ash sites have exceeded primary drinking water standards for thallium (Big Bend), arsenic (Karn/Weadock, Swift Creek, and Reid Gardner) and lead (Swift Creek). Exceedances can be severe; off-site arsenic levels in ash-contaminated groundwater near the Reid Gardner Generating Facility were measured at 31 times the EPA drinking water standard.

Off-site Damage: Polluted Surface Water

At least 8 coal ash dumps cited in this report polluted wetlands, creeks, and rivers. According to publicly available monitoring data, off-site contaminant levels at 7 sites were above federal or state water quality criteria: Indian River Power Plant (Delaware), Brandywine Coal Ash Landfill (Maryland), Four Corners Power Plant (New Mexico), Seward Generating Station (Pennsylvania), Wateree Station (South Carolina), Mitchell Generating Station (West Virginia), and John Amos Power Plant (West Virginia).

For example, groundwater from the Brandywine Landfill in Maryland discharges to adjacent Mataponi Creek and cadmium levels frequently exceed thresholds established to protect aquatic life. An on-site well at the landfill recorded cadmium concentrations up to 100 times the drinking water standard. At the Four Corners Power Plant, boron and selenium concentrations downstream from the plant's coal ash ponds are much higher than upstream levels and lead concentrations are almost 50 times levels established to protect aquatic life.

The John Amos and Mitchell plants in West Virginia discharge large quantities of selenium into Little Scary Creek and Conner Run, respectively, and the State has identified both as "fly ash influenced streams." Selenium levels in each stream were more than 6 times the level the EPA has determined is safe for aquatic life. Toxic selenium in fish taken from Conner Run averaged above 3 times the fish tissue limit the EPA has proposed, while selenium concentrations in fish from Little Scary Creek exceeded the proposed limit by a factor of 7. Fish from both streams exceeded the West Virginia advisory for fish consumption.

From the Karn Weadock ash disposal site in Michigan, groundwater heavily laden with arsenic flows to Saginaw Bay at a level that contributed to the designation of part of Lake Huron as an "International Area of Concern." Data indicate that high levels of arsenic are also found in drainage from the Wateree site in South Carolina, as documented in on-site groundwater wells and in arsenic-filled catfish in the adjacent Wateree River.

On-site Damage: Polluted Groundwater

At least 26 of these sites report on-site groundwater contamination that exceeds one or more primary drinking water criteria. Concentrations of toxic pollution at many of these sites are shockingly high. Groundwater monitoring data show that pollutant concentrations have exceeded federal primary drinking water standards by a factor of 10 or more at the following sites: Indian River (arsenic, 145 times); Seminole Generating Station (arsenic, 19 times); Big Bend Station (arsenic, 11 times); Seward Generating Station (antimony, 17 times); Brandywine Landfill (cadmium, 100 times); Karn Weadock Generating Facility (arsenic, 100 times); Sutton Steam Plant (arsenic, 29 times); Lee Steam Plant (arsenic, 44 times); Belews Creek (nitrate, 16 times); Reid Gardner (arsenic, 73 times); Seward Generating Station (turbidity, 15 times); Fern Valley Landfill (arsenic, 36 times); Hunlock Power Station (arsenic, 12 times); Wateree Station (arsenic, 18 times); Grainger Generating Station (arsenic, 92 times); and Trans-Ash Landfill (arsenic, 27 times).

The Electric Power Research Institute (EPRI) and some state agencies stubbornly insist that coal ash is "safe," because it passes the EPA's Toxicity Leaching Characteristic Procedure (TCLP) test.[v] But the National Research Council (NRC) warned in a 2006 report that the TCLP leach test was *not* an accurate method for measuring the leaching potential for toxic metals from coal ash, because it does not accurately reflect how ash degrades

in the natural environment.[vi] The very high concentrations of toxic metals in the groundwater underneath and around these ash sites clearly show that the NRC was right. Reliance on a faulty leach test ignores the ample evidence of poison in waters near all the ash sites described in this report.

Damage at Structural Fill Sites: Reuse or Dumpsites in Disguise?

Every year, about 11.5 million tons of coal ash are placed in structural fills such as highway embankments or building foundations.[vii] Because this "reuse" is subject to little or no regulation in many states, some structural fills may be little more than dumpsites in disguise. Two structural fills identified in this study — Rocky Acres in Illinois and Swift Creek in North Carolina — have polluted groundwater. At the Swift Creek fill, oozing arsenic contaminated an off-site aquifer. Both cases illustrate the importance of setting standards to ensure that recycling of ash is done responsibly and not used as a loophole for the back door disposal of material that is hazardous when mismanaged.

State Compliance Orders and Cleanup Actions

State enforcement actions to obtain cleanup at several of the contaminated sites make it obvious that these sites belong on the EPA's list of proven damage cases. State agencies have required cleanup actions or begun enforcement actions to obtain remediation at 14 sites described in this report. For example:

- Consumers Power installed a slurry wall to prevent further arsenic leaking from the Karn Weadock landfill;
- The Maryland Attorney General notified Mirant Mid-Atlantic of its intent to sue for discharges of pollutants from the Brandywine ash dump;
- States have required corrective action at the Big Bend and Stanton facilities in Florida, the Reid Gardner site in Nevada, the Swift Creek Structural Fill in North Carolina, and the Seward Plant in Pennsylvania.

Many of these state actions were taken, however, years after the damage was done. At several sites, pollution was allowed to continue for decades after it was discovered. Lastly, despite monitoring data that indicate pervasive contamination, our file review was unable to identify any significant state response at many of the sites.

The Communities at Risk—A Case for Environmental Justice

Low-income communities shoulder a disproportionate share of the health risks from disposal of coal combustion waste. Of the 31 sites in this report, 22 are in communities that have a family poverty rate above the national median.[viii] Similar high poverty rates are found in 118 of the 120 coal-producing counties, where coal combustion wastes increasingly are being disposed in unlined, under-regulated mines, often in direct contact with groundwater.

According to the EPA's risk assessment, residents near coal ash dump sites not only have a higher risk of getting cancer from drinking water contaminated by arsenic, they also have increased risk of damage to the liver, kidney, lungs and other organs as a result of exposure to toxic metals like cadmium, cobalt, lead, and other pollutants at concentrations far above levels that are considered safe.[ix] No community, rich or poor, should be asked to shoulder these highly elevated health risks, particularly when safer disposal methods, proven to reduce the release of harmful contaminants, can be readily mandated by EPA.

Conclusion: The Tip of the Iceberg

The 31 sites described in this report represent only a fraction of the contaminated coal ash sites currently leaking poisons into streams, rivers, aquifers and wetlands throughout the United States. If one considers that over 100 "damage cases" have been identified, this alone represents about 15% of the coal-fired power plants presently operating in the United States. Yet EPA has acknowledged that most coal ash ponds and a significant portion of coal ash landfills are unlined (or inadequately lined) and unmonitored.[x] Consequently, at hundreds of coal combustion waste disposal sites where there is great risk that dangerous pollutants are migrating from the ash to the underlying groundwater, there is no monitoring to track this movement. EPA has conceded that more contaminated sites are likely to exist.[xi] The agency, however, has never attempted to systematically assess the thousands of coal ash disposal sites located across the nation.

While the catastrophic spill at TVA's Kingston plant has become the poster child for the damage that coal ash can wreak, there are hundreds of leaking sites throughout the United States where the damage is deadly, but far less conspicuous. This widespread problem needs an immediate national solution — in the form of federally enforceable standards that protect every community near coal ash dumpsites. Water sources contaminated by coal ash may eventually be cleaned up, but only at great expense and over long periods of time. Injury to human health or wildlife, however, cannot always be reversed. The evidence is overwhelming — these 31 sites sound a clear warning that the EPA must heed before more damage is done.

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[i] Luther, Linda. "Managing Coal Combustion Waste (CCW): Issues with Disposal and Use," *Congressional Research Service*, 1 (Jan. 12, 2010).
[ii] U.S. Envtl. Prot. Agency, Coal Combustion Waste Damage Case Assessments, July 2007. *See also* 75 Fed. Reg. 816, 869 n. 78&80 (Jan. 6, 2010).
[iii] 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.
[iv] U.S. Envtl. Prot. Agency, Human and Ecological Risk Assessment of Coal Combustion Wastes (released as part of a Notice of Data Availability) (Aug. 6, 2007) (draft).
[v] Electric Power Research Institute, "Coal Ash: Characteristics, Management, and Environmental Issues" at 7 (September 2009), available at http://www.whitehouse.gov/omb/oira_2050_meetings/.
[vi] National Research Council, *Managing Coal Combustion Residues in Mines* 127 (2006), *available at* http://www.nap.edu/catalog.php?record_id=11592#toc.
[vii] American Coal Ash Association, "2008 Coal Combustion Product (CCP) Production and Use Survey Results," *available at* http://acaa.affiniscape.com/associations/8003/files/2008_ACAA_CCP_Survey_Report_FINAL_100509.pdf.
[viii] U.S. Census Bureau, Census 2000 Summary File 3 (SF 3) - Sample Data, All 5-Digit ZIP Code Tabulation Areas (860), Table P76 "Family Income in 1999" (downloaded June 23, 2009), *available at* http://factfinder.census.gov/servlet/DownloadDatasetServlet?_lang=en&_ts=263843114140.
[ix] U.S. Envtl. Prot. Agency, Human and Ecological Risk Assessment of Coal Combustion Wastes (released as part of a Notice of Data Availability) (Aug. 6, 2007) (draft).
[x] Envtl. Prot. Agency, Final Regulatory Determination on Wastes from the Combustion of Fossil Fuels, 65 Fed. Reg. 32,214, 32,216 (May 22, 2000).
[xi] *Id.*

SUMMARY OF DAMAGE CASES

Site/Owner	State	Wastes Present	Determination	Documented Impact
Indian River Power Station, NRG Energy	DE	Coal fly ash and bottom ash	Demonstrated off-site damage to sediments and surface water	Contamination of groundwater, sediments and surface water in the Indian River and Island Creek by a coal ash landfill on Burton Island. Levels of arsenic, chromium, and thallium in on-site groundwater exceeded federal primary drinking water standards ("maximum contaminant levels" or "MCLs"). Off-site concentrations of aluminum and iron in Island Creek exceeded EPA water quality criteria. Levels of aluminum, antimony, arsenic, barium, chromium, iron, manganese, selenium, thallium, and vanadium exceeded Delaware Uniform Risk-Based Standards (URS). Average concentrations of arsenic exceeded the URS in soil/ash; groundwater; shoreline sediments and surface water. *State Action: Voluntary Clean Plan and Remedial Investigation and Ecological Assessment.*
Curtis Stanton Energy Center, Orlando Utility Commission	FL	Coal fly ash, bottom ash, flue gas desulfurization (FGD) waste, and plant wastewater.	Demonstrated on-site damage of groundwater and surface water. No off-site monitoring data available.	For over 20 years, groundwater contamination around the coal combustion waste (CCW) landfill and ponds at the Curtis Stanton Power Plant has been well documented. Data shows concentrations of aluminum, chloride, iron, manganese, and sodium five to hundreds of times higher than Florida Department of Environmental Protection (FDEP) Groundwater and Surface Water Clean-up Target Levels. Surface water samples also exceed FDEP Freshwater Surface Water Quality Criteria. *State Action: Enforcement actions for failure to monitor and meet landfill requirements.*

Site/Owner	State	Wastes Present	Determination	Documented Impact
Seminole Generating Station, Seminole Electric Cooperative	FL	Coal fly ash, FGD sludge stabilized with lime, and FGD system process water. Before 1996, the FGD sludge was stabilized with process water high in TDS, chloride, and other chemicals.	Demonstrated damage to groundwater, surface water and wetlands that is moving off-site. No off-site monitoring data available.	CCW ponds and a flue gas desulfurization (FGD) landfill at the Seminole Generating Station contaminated groundwater at the property line up to one mile from the FGD landfill. Deep and shallow aquifers are contaminated far above Florida's Clean-Up Target Levels for sulfate, chloride, iron, TDS and boron as well as many times above federal secondary MCLs for these contaminants. Arsenic has been measured 19 times higher than the primary MCL and lead measured more than 10 times the primary MCL in groundwater underneath the FGD landfill. *State Action: Required remediation monitoring and groundwater recovery system.*
Big Bend Station, Tampa Electric Company	FL	Coal fly ash, bottom ash, synthetic gypsum, FGD waste and wastewater, process discharges and stormwater runoff.	Demonstrated off-site damage to groundwater.	Off-site groundwater exceeds federal MCLs and Florida Clean-up Target Levels for thallium, sulfate, chloride and manganese. Thallium was measured in off-site groundwater at more than twice the primary MCL, and at groundwater monitoring locations closer to CCW disposal areas, at eight times the MCL. Arsenic in on-site groundwater was measured at 11 times the primary MCL, and many other pollutants were also measured at levels far above Florida Groundwater Clean-up Target Levels at on-site locations. *State Action: Required remedial action plan and groundwater monitoring plan.*

Site/Owner	State	Wastes Present	Determination	Documented Impact
Rocky Acres Coal Combustion By-Product Landfill	IL	Coal combustion waste generated by fluidized bed coal-fired boilers.	Demonstrated damage to groundwater moving off-site	A CCW dump adjacent to the Grays Siding neighborhood may have contaminated two private drinking water wells with lead, iron and manganese at levels above Illinois groundwater standards. Groundwater sampling identified arsenic, barium, chromium, lead, nickel, iron, and manganese at levels that exceed groundwater quality standards. In addition, fugitive dust from CCW may affect the community, and runoff and CCW-leachate in groundwater may affect surface water quality in nearby Kickapoo State Park. *State Action: Required groundwater monitoring and investigation.*
Gibson Generating Station, Duke Energy	IN	Coal fly ash and bottom ash.	Demonstrated off-site damage to surface and groundwater and aquatic life.	Ground and surface water monitoring show high levels of boron, arsenic, and selenium from CCW waste at Duke Energy's Gibson Station. Boron contamination has reached drinking water wells in the nearby community. Selenium in surface water discharges from the plant's cooling lake, which receives water from the plant's ash ponds, has also contaminated fish and aquatic invertebrates in the Cane Ridge Wildlife Area.
Clifty Creek Station, Indiana Kentucky Electric	IN	Coal fly ash and boiler slag.	Demonstrated on-site damage moving off-site. No off-site monitoring data available.	Groundwater monitoring at Clifty Creek Station's CCW landfill has measured high levels of boron, manganese, iron and sulfate in downgradient groundwater. Manganese concentrations have climbed to 38 times the secondary MCL and boron concentrations increased to 18 times the US EPA's Life-time Health Advisory.

Site/Owner	State	Wastes Present	Determination	Documented Impact
Brandywine Coal Ash Landfill, Mirant Mid-Atlantic, LLC	MD	Coal fly ash and bottom ash	Demonstrated on-site damage to groundwater and off-site damage to surface water	Groundwater monitoring has documented cadmium, iron, aluminum, manganese, sulfates, total dissolved solids, and chlorides at levels that exceed drinking water standards — some as high as 50, 100, and even 600 times the MCL—in groundwater beneath and downgradient of the Brandywine CCW landfill. Cadmium levels, for example, have been documented at 100 times the .005 mg/L MCL in one groundwater monitoring well. Cadmium and lead levels also regularly exceed water quality criteria regularly in Mataponi Creek downstream of the landfill. *State Action: Notice Letter filed for Clean Water Act violations.*
Karn/Weadock Generating Facility, Consumer Energy	MI	Coal ash	Documented off-site damage to surface water	The Karn and Weadock landfills are two adjacent coal ash disposal sites constructed on a narrow strip of land between the Saginaw River and Saginaw Bay of Lake Huron. Groundwater monitoring at the site detected high levels of boron (up to 19.4 mg/L) and arsenic (up to 0.997 mg/L, more than 99 times the primary MCL) in the groundwater surrounding the site. Studies found that the landfills are a major contributor of arsenic to the Saginaw Bay Area. State Action: Consent Order under negotiation to require construction of slurry walls to stop landfill leakage.

Site/Owner	State	Wastes Present	Determination	Documented Impact
Colstrip Power Plant, PPL Montana	MT	Coal fly ash, bottom ash, and FGD wastes.	Demonstrated off-site damage to private water wells	Groundwater contaminant plumes with very high levels of boron, total dissolved solids and sulfates extend more than 1000 feet from the currently "closed" Stage I CCW Evaporation Pond to northwest of the Town of Colstrip. The contaminant plume affected multiple private water wells, but information about the contamination was not publically known until residents who were made ill by drinking the contaminated water filed a lawsuit in 2003. The most contaminated well, at the Moose Lodge, had boron levels more than six times EPA's Health Advisory for child ingestion of boron in drinking water and sulfate at twelve times the health-based EPA's Drinking Water Advisory for drinking water. In 2008 the owners of the power plant settled for $25 million in damages with 57 Colstrip residents. State action: Montana Department of Environment proposed a consent order with PPL in February 2010 to address CCW damage.
Sutton Steam Plant, Progress Energy	NC	Coal combustion waste	Demonstrated on-site damage to groundwater migrating off-site. No off-site monitoring data available.	Levels of arsenic, boron, manganese, and iron exceed North Carolina groundwater standards in groundwater underneath the coal ash impoundment at Progress Energy's Sutton Plant. Arsenic concentrations have been measured as high as 29 times the federal primary MCL. Monitoring indicates that the contamination is migrating outside of the state designated "compliance" boundary on-site. *State action: Notice of violation and request for corrective action.*

Site/Owner	State	Wastes Present	Determination	Documented Impact
Lee Steam Plant, Progress Energy	NC	Coal combustion waste	Demonstrated on-site damage to groundwater moving off-site.	On-site groundwater monitoring found levels of arsenic, lead, boron, manganese, and iron that exceed North Carolina groundwater standards. Arsenic concentrations have been measured as high as 44 times the federal primary MCL and lead concentrations nearly three times the federal primary MCL in underlying groundwater.
Cape Fear Steam Plant, Progress Energy	NC	Coal combustion waste	Demonstrated on-site damage to groundwater	On-site groundwater monitoring found levels of lead, chromium, boron, iron, manganese, and sulfates that exceed state groundwater standards. Lead was 3.5 times the North Carolina groundwater standard and federal primary MCL, and chromium was two times the North Carolina groundwater standard and equal to the federal MCL in underlying groundwater.
Swift Creek Structural Fill, ReUse Technology, Inc. / Full Circle Solutions, Inc.	NC	Coal fly ash from six (6) Cogentrix power plants: Lumberton (NC), Elizabethtown (NC), Kenansville (NC), Rocky Mount (NC), Hopewell (VA), and Portsmouth (VA).	Demonstrated off-site damage to groundwater.	CCW was placed directly into a wetland and into groundwater, contaminating off-site groundwater, and causing coal ash dust to migrate off-site to adjacent property. Arsenic, barium, lead, mercury, and sulfate levels in groundwater all exceeded North Carolina groundwater standards and EPA drinking water MCLs. Lead concentrations were as high as 0.93 mg/L, more than 6 times the MCL; and arsenic concentrations were as high as 0.068 mg/L, nearly 7 times the MCL. Lead was measured at more than twice the MCL in off-site groundwater downgradient from the ash, and arsenic and sulfate levels also exceeded MCLs in off-site groundwater.

Site/Owner	State	Wastes Present	Determination	Documented Impact
Belews Creek Steam Station, Duke Energy	NC	Coal combustion waste, including fly ash and FGD wastes	Demonstrated on-site damage to groundwater and surface water moving off-site. No off-site monitoring data available.	Large volumes of CCW produced by Belews Creek Power Plant have contaminated underlying groundwater above North Carolina standards, and are polluting surface water above North Carolina standards. Contamination at the 40-acre Pine Hall Road Fly Ash Landfill has exceeded one or more state groundwater standard in 17 of 18 on-site wells. All nine wells at the more newly permitted Craig Road Fly Ash Landfill, and all ten wells at the new FGD Residue Landfill are also contaminated although the FGD Residue Landfill site appears to have been contaminated with undisclosed fill materials prior to its use for scrubber sludge.
Asheville Steam Electric Plant, Progress Energy	NC	Coal combustion waste	Demonstrated damage to groundwater moving off-site. No off-site monitoring data available.	Levels of chromium, boron, iron, and manganese exceed North Carolina groundwater standards in groundwater underneath and downgradient of the Asheville Plant's CCW impoundment. Data indicates that the groundwater contamination is migrating outside of the state designated review boundary for the CCW impoundment and approaching the compliance boundary near the property line.

Site/Owner	State	Wastes Present	Determination	Documented Impact
Four Corners Power Plant, Arizona Public Service,	NM	Coal fly ash, bottom ash, and scrubber sludge	Demonstrated off-site damage to surface waters	Data shows significant degradation of water quality downstream from CCW impoundments at Four Corners Power Plant. Boron concentrations downstream of the CCW impoundments were nearly twelve times higher than upstream concentrations. Total dissolved solids (TDS), sulfates and selenium were also more than three times higher in the downstream segment of the river basin than upstream. Data also shows higher downstream levels of copper, lead, mercury and zinc. The Navajo Nation water quality standards state that Chaco Wash is used for wildlife and livestock watering and aquatic habitat. For these uses, the elevated concentrations of boron, selenium and zinc are exceed New Mexico levels for freshwater aquatic organisms, and concentrations of copper and lead exceed levels recommended for livestock.
Reid Gardner Generating Facility, NV Energy	NV	Coal fly ash, and FGD wastes	Demonstrated off-site damage to groundwater	Groundwater data shows that chloride, sulfate, TDS, nitrate, arsenic, boron, chromium, manganese, magnesium, molybdenum, selenium, sodium, vanadium, and titanium exceed Nevada action levels and drinking water standards. The Nevada Department of Environmental Protection determined that CCW contamination from impoundments at the Reid Gardner Generating Station spread, and found arsenic as high as 31 times the federal MCL in an off-site well. *State Action: 1997 order to stop migration of contaminants; currently negotiating corrective action.*

Site/Owner	State	Wastes Present	Determination	Documented Impact
Mitchell Power Station, Allegheny Energy	PA	Coal fly ash, bottom ash and residuals	Demonstrated damage to groundwater moving off-site toward the Monongahela River	Groundwater downgradient from two CCW lagoons contain concentrations of arsenic measured at twice the primary MCL and boron from two to nearly seven times EPA Health Advisory of 1.0 mg/L. Nickel, molybdenum, manganese, total alkalinity, chemical oxygen demand, ammonia, chloride, sulfate, total dissolved solids, calcium, iron, potassium, magnesium and sodium are elevated in downgradient wells.
Phillips Power Plant, Orion Power Midwest (a subsidiary of RRI Energy)	PA	Coal ash, FGD wastes, and process waters with coal ash and FGD wastes	Demonstrated off-site damage to public drinking water supply (ash ponds) Demonstrated damage to groundwater moving off-site (ash landfill)	Two coal ash ponds at the Phillips Power Plant contaminated several public water wells operated by the Cresswell Heights Joint Authority with high levels of TDS in the late 1980s. Groundwater contamination was later identified at the coal ash and FGD waste landfill west of the Phillips Power Plant. For example, samples from wells located where groundwater moves off-site regularly exceed secondary MCLs for TDS, chloride, fluoride, manganese and aluminum. *State action: Consent order required closing of ash ponds.*

Site/Owner	State	Wastes Present	Determination	Documented Impact
Seward Generating Station, RRI Energy	PA	Coal combustion waste, including fluidized CFB ash from fluidized bed boilers (since 2004).	Demonstrated off-site damage to surface water, and demonstrated on-site damage to groundwater.	The Seward Generating Station's unlined coal ash and coal refuse pit, as well as its closed ash sites, have leached and continue to leach pollutants into the underlying aquifer at levels that far exceed state and federal MCLs, as well as upgradient concentrations. For example, groundwater levels of antimony exceed the primary MCL of 0.006 mg/L, including a concentration of 0.1 mg/L (nearly 17 times the standard); and cadmium exceeded the primary MCL of 0.005 mg/L, including a concentration of 0.041 (over eight times the standard). In addition, surface water data from 2005 to 2009 contained 27 exceedances of Pennsylvania's Water Quality Criteria, for such pollutants as aluminum, nickel, and zinc. *State Action: Consent orders requiring groundwater remediation and surface water.*
Fern Valley Landfill, Orion Power Holdings, Inc. (a subsidiary of RRI Energy)	PA	Coal fly ash	Demonstrated damage to groundwater and surface water moving off-site	High concentrations of arsenic, 2.8 times the primary MCLs, were first noted in groundwater monitoring in 1995, and peaked in 2001 when arsenic levels rose to 36 times the primary MCL. Concentrations of boron, chloride, sulfate and TDS in monitoring wells regularly exceeded health-based levels or secondary MCL. Leachate from the CCW landfill has also degraded downstream surface water quality with high levels of arsenic, boron, chloride, sulfate and TDS compared to upstream levels.

Site/Owner	State	Wastes Present	Determination	Documented Impact
Hunlock Power Station, UGI Development Company	PA	Coal combustion waste	Demonstrated on-site damage to groundwater moving to off-site surface water.	A coal ash surface impoundment at this small power plant on the Susquehanna River has contaminated the underlying groundwater with concentrations of arsenic, iron, and manganese that are several to hundreds of times drinking water standards. Dissolved arsenic has been found at 3 to 12 times the primary MCL in multiple downgradient wells. Iron has been measured at up to 131 times the secondary MCL and manganese up to 314 times the secondary MCL in downgradient water.
Portland Generating Station, RRI Energy	PA	Coal combustion waste, including fly ash, bottom ash, and "Trona Test Ash" (ash produced during a PADEP-approved Trial Burn utilizing injection of a substance intended to reduce air emissions)	Demonstrated on-site damage to groundwater	Outfall 001 has discharged boron, cadmium, hexavalent chromium, and selenium into Brushy Meadow Creek at concentrations far higher than Pennsylvania's Water Quality Criteria Continuous Concentration for Fish and Aquatic Life (CCC). For example, boron was measured at 86,600 µg/L, more than 54 times the state's CCC of 1,600 µg/L; and selenium was measured at 41.3 µg/L, almost nine times the PA CCC of 4.6 µg/L (adjusted for a hardness of 400). Outfall 002 also discharges boron, cadmium, and selenium into Brushy Meadow Creek at concentrations that exceed PA's CCC water quality criteria. In addition, on-site groundwater exceeds MCLs for several heavy metals and other typical constituents found in ash, including sulfate.
Wateree Station, SCE & G	SC	Coal fly ash and bottom ash	Demonstrated off-site damage of surface waters and fish	Groundwater monitoring around the Wateree Station's coal ash impoundment measured arsenic at 18 times the federal primary MCL. Recent data shows that the arsenic contamination migrated to an adjacent property and is accumulating in biota in the Wateree River.

Site/Owner	State	Wastes Present	Determination	Documented Impact
Urquhart Station, South Carolina Electric & Gas Company (SGE&G),	SC	Coal combustion waste	Demonstrated on-site damage to groundwater	Groundwater contamination has been reported at a coal ash landfill and two ash settling basins adjacent to the Urquhart Station. The landfill is located approximately 300 feet from the Savannah River, and the ash basins are located approximately 100 feet from the river. Arsenic and nickel concentrations have been greater than their South Carolina drinking water standards and the federal MCL for arsenic in at least one well at the coal ash landfill, and arsenic concentrations greater than the state drinking water standard and federal MCL in one well at the ash basins.
Grainger Station, South Carolina Public Service Authority	SC	Coal fly ash	Demonstrated on-site damage to groundwater	Leachate from fly ash ponds used by the Grainger Generating Station contaminated groundwater near the Waccamaw River with arsenic at up to 91 times the drinking water standard.
John Sevier Fossil Plant, Tennessee Valley Authority	TN	Coal fly ash and bottom ash	Demonstrated damage to groundwater moving off-site to surface water	Data from groundwater monitoring wells located between John Sevier Fossil Plant's CCW impoundment and the Holston River show that cadmium levels exceed federal MCLs, and that aluminum, manganese and sulfate levels exceed Secondary MCLs for drinking water. In addition, arsenic and manganese exceed EPA National Recommended Water Quality Criteria (WQC) for human health, and cadmium levels exceed both chronic and acute levels for freshwater aquatic life. Boron levels of 18,000 µg/L are far above EPA Superfund Removal Action Levels of 3,000 µg/L and 900 µg/L and exceed both of EPA's Drinking Water Health Advisory levels of 3,000 and 6,000 µg/L. In addition, strontium measured at 5,300 µg/L exceeds EPA's health advisory level of 4,000 µg/L.

Site/Owner	State	Wastes Present	Determination	Documented Impact
Trans-Ash CCW Landfill	TN	Coal ash from the Tennessee Valley Authority, Johnsonville Fossil Plant	Demonstrated off-site damage to groundwater and private residential water wells by mercury. Demonstrated damage moving off-site into a wetland	After complaints by a resident living near the Trans-Ash landfill, the Tennessee Department of Environment and Conservation tested private wells and found mercury concentrations ranging from 0.011 to 0.013 mg/L – 5.5 to 6.5 times higher than the primary MCL. In July 2009, U.S. EPA confirmed mercury levels and initiated Emergency Removal Action to connect the residence to the Camden city water supply. Sampling data shows that the sediment pond has high concentrations of mercury (up to .28 mg/kg) and on-site groundwater has high concentrations of boron (up to 9.39 mg/L) and sulfate (up to 739 mg/L).
John Amos Power Plant, American Electric Power, dba Appalachian Power	WV	Coal fly ash and bottom ash	Demonstrated off-site damage to surface waters and aquatic life. No groundwater monitoring data available.	Selenium discharges from the Little Scary Creek fly ash impoundment exceed selenium NPDES permit limits and fish taken from the receiving stream in 2006 had selenium concentrations in their tissue that exceeded EPA's proposed selenium fish tissue criterion for the protection of aquatic life by 7 fold, exceeded the threshold value established by a selenium expert at the USDA Forest Service by more than 14 fold, and exceeded the West Virginia advisory for fish consumption.

Site/Owner	State	Wastes Present	Determination	Documented Impact
Mitchell Generating Station, American Electric Power (AEP) dba Ohio Power Company	WV	Mixed wastes, including coal fly ash and bottom ash from two coal plants (AEP Mitchell and AEP Kammer) and unspecified "coal mining wastes" from the Consol McElroy Mine.	Demonstrated off-site damage to surface waters and aquatic life.	Since 2005, surface water discharges from the unlined, 71-acre Conner Run fly ash impoundment located adjacent to the Ohio River have exceeded EPA's recommended water quality criterion for selenium by more than 23 times. Seepage of ash pond leachate was identified in the abutment of the impoundment. Fish tissue testing in the receiving stream has exceeded EPA's proposed selenium fish tissue criterion by 3 to 4 times, and are high enough to trigger a state fish consumption advisory. Groundwater monitoring data shows exceedances of standards for antimony, arsenic, sulfate, sodium, and zinc.

Table 1. Coal Combustion Waste: Damage to Water Quality (Highest Monitoring Results)*

Owner/Site	State	Pollutant	Reference	Limit (µg/L unless noted)	Maximum Result	Media/ Location	Enforcement Action
NRG/Indian River Power Plant	DE	Arsenic	Primary MCL	10	1,450	Groundwater/ On-site	State approved remediation plan in 2008; further remediation needs are being evaluated
		Chromium	Primary MCL	100	211	Groundwater/ On-site	"
		Thallium	Primary MCL	2	8.4	Groundwater/On-site	"
		Aluminum	WQC - EPA CCC for Aquatic Life	87	4,120	Surface water/ Off-site in Island Creek	"
		Iron	WQC - EPA CCC for Aquatic Life	1,000	5,480	Surface water/ Off-site in Island Creek	"
OUC/ Curtis Stanton Energy Center Power Plant	FL	Alpha radiation	Primary MCL	15 pCi/L	65.4 pCi/L	Groundwater/ On-site	State required facility upgrades, investigations, and corrective actions; 2009 Inspection says requirements have not been met
Seminole Electric Cooperative/ Seminole Generating Station	FL	Arsenic	Primary MCL	10	190	Groundwater/ On-site	Remediation monitoring and contaminated groundwater capture system implemented in 2004; unclear if voluntary or required by State
		Lead	Primary MCL	15	150	Groundwater/On-site	"
Tampa Electric/Big Bend Station	FL	Thallium	Primary MCL	2	4.7	Groundwater/Off-site	State issued Consent Order in 2001 required remedial actions; such actions not complete as of 2009
		Chloride	Secondary MCL	250 mg/L	4,610 mg/L	Groundwater/ Off-site	"
		Manganese	Secondary MCL	50	849.7	Groundwater/ Off-site	"
		Sulfate	Secondary MCL	250 mg/L	2,150 mg/L	Groundwater/ Off-site	"
		Arsenic	Primary MCL	10	110	Groundwater/On-site	"
		Thallium	Primary MCL	2	16	Groundwater/On-site	"

Table 1. Coal Combustion Waste: Damage to Water Quality (Highest Monitoring Results)*

Owner/Site	State	Pollutant	Reference	Limit (µg/L unless noted)	Maximum Result	Media/ Location	Enforcement Action
Rocky Acres CCB Disposal Site	IL	Arsenic	Primary MCL	10	Exceeded	Groundwater/ On-site	State sent notice that the site was an illegal open dump in 2006; in 2007, Bunge Corp. agreed to monitor groundwater and submitted groundwater work plan
		Barium	Primary MCL	2,000	Exceeded	Groundwater/ On-site	"
		Chromium	Primary MCL	100	Exceeded	Groundwater/ On-site	"
		Lead	Primary MCL	15	Exceeded	Groundwater/ On-site	"
Duke Energy/ Gibson Power Plant	IN	Arsenic	Primary MCL	10	71	Groundwater/On-site	Duke agreed to supply drinking water to homes with contaminated wells; State has not taken enforcement action
		Boron	EPA Child Health Advisory	3 mg/L	5.7 mg/L	Private Well/ Off-site	"
		Manganese	Secondary MCL	50	1,730	Private Well/ Off-site	"
Mirant/Brandywine Coal Ash Landfill	MD	Cadmium	Primary MCL	5	500	Groundwater/On-site	State sent Notice of Intent to Sue in 2010
		Cadmium	WQC - EPA CCC for Aquatic Life	0.25	Exceeded	Surface water/ Off-site in Mataponi Creek	"
		Lead	WQC - EPA CCC for Aquatic Life	2.5	Exceeded	Surface water/ Off-site in Mataponi Creek	"
Consumers Power/ Karn/Weadock Generating Facility	MI	Arsenic	Primary MCL	10	997	Groundwater/On-site	State is negotiating to require slurry walls around the landfills to contain contaminants
		Arsenic	Primary MCL	10	443	Groundwater/ Off-site in Lake Huron	"

Table 1. Coal Combustion Waste: Damage to Water Quality (Highest Monitoring Results)*

Owner/Site	State	Pollutant	Reference	Limit (µg/L unless noted)	Maximum Result	Media/ Location	Enforcement Action
Montana PPL/Colstrip	MT	Boron	EPA Child Health Advisory	3 mg/L	20 mg/L	Drinking Well/Off-site	State proposed an Administrative Order on Consent in February 2010 to require remediation
		Sulfate	Secondary MCL	250 mg/L	6,000 mg/L	Drinking Well/Off-site	"
		Total Dissolved Solids	Secondary MCL	500 mg/L	9,500 mg/L	Drinking Well/Off-site	"
Progress/Sutton Steam Plant	NC	Arsenic	Primary MCL	10	290	Groundwater/On-site	State issued a Notice of Violation, requested corrective action
Progress/Lee Steam Plant	NC	Arsenic	Primary MCL	10	440	Groundwater/On-site	State is aware of contamination but has not required corrective action
		Lead	Primary MCL	15	47	Groundwater/On-site	"
Progress/Cape Fear Steam Plant	NC	Lead	Primary MCL	15	53.3	Groundwater/On-site	State is aware of contamination but has not required corrective action
		Chromium	State ground-water (gw) standard	50	100	Groundwater/ On-site	"
Full Circle/Swift Creek Landfill	NC	Lead	Primary MCL	15	32	Groundwater/Off-site	State issued Notice of Violation in 2002 and Compliance Order in 2006 (assessing $4,000 penalty); corrective action system installed in 2008 to intercept groundwater
		Sulfate	Secondary MCL & State gw standard	250 mg/L	350 mg/L	Groundwater/Off-site	"
		Arsenic	Primary MCL	10	Exceeded	Groundwater/Off-site	"
		Lead	Primary MCL	15	93	Groundwater/On-site	"
		Arsenic	Primary MCL	10	68	Groundwater/On-site	"

Table 1. Coal Combustion Waste: Damage to Water Quality (Highest Monitoring Results)*

Owner/Site	State	Pollutant	Reference	Limit (µg/L unless noted)	Maximum Result	Media/ Location	Enforcement Action
Duke/Belews Creek	NC	Arsenic	Primary MCL	10	73	Groundwater/On-site	State required corrective action and approved Closure Plan in 2007 for Pine Hall Road Landfill; no action has been taken at remaining two landfills or one impoundment
		Selenium	Primary MCL	5	20	Groundwater/On-site	"
		Cadmium	State gw standard	2	3.7	Groundwater/On-site	"
		Nitrate	Primary MCL	10 mg/L	158 mg/L	Groundwater/On-site	"
Progress/Asheville Steam Electric Plant	NC	Chromium	State gw standard	50	82.2	Groundwater/On-site	State is aware of contamination but has not required corrective action
Arizona Public Service/Four Corners Power Plant	NM	Selenium	WQC - EPA CCC for Aquatic Life; State wildlife WQC	5; 4	13	Surface water/ Off-site in Chaco Wash	None
		Copper	State livestock WQC	500	800	Surface water/ Off-site in Chaco Wash	"
		Lead	WQC - EPA CCC for Aquatic Life; State livestock WQC	2.5; 100	120	Surface water/ Off-site in Chaco Wash	"
		Zinc	WQC - EPA CCC for Aquatic Life	120	210	Surface water/ Off-site in Chaco Wash	"
NV Energy/Reid Gardener Generating Station	NV	Nitrate	Primary MCL	10 mg/L	13 mg/L	Groundwater/On-site	State Administrative Order required corrective action in 2007; groundwater still contaminated
		Arsenic	Primary MCL	10	730	Groundwater/On-site	"

Table 1. Coal Combustion Waste: Damage to Water Quality (Highest Monitoring Results)*

Owner/Site	State	Pollutant	Reference	Limit (µg/L unless noted)	Maximum Result	Media/ Location	Enforcement Action
		Chromium	Primary MCL	100	110	Groundwater/ On-site	"
		Selenium	Primary MCL	50	150	Groundwater/On-site	"
		Arsenic	Primary MCL	10	310	Groundwater/Off-site	"
Allegheny/Mitchell Power Station	PA	Arsenic	Primary MCL	10	20	Groundwater/On-site	State issued Notice of Violation in 2001 regarding fugitive dust emissions, but monitoring ceased in 2004; no action taken regarding water pollution
Orion/Phllips Power Plant	PA	Total Dissolved Solids	Secondary MCL	500 mg/L	Exceeded	Municipal Water Supply/ Off-Site	State Consent Order in 1990 assessed $50,000 penalty, ordered cessation of contamination, and required groundwater monitoring and site closure
RRI/Seward Generating Station	PA	Antimony	Primary MCL	6	100	Groundwater/On-site	State Consent Order in 1982 closed No. 1 Ash Site, assessed $308,000 penalty; another Consent Order ordered cessation of surface discharges, but discharges persist
		Arsenic	Primary MCL	10	20	Groundwater/On-site	"
		Cadmium	Primary MCL	5	41	Groundwater/On-site	"
		Chromium	Primary MCL	100	330	Groundwater/On-site	"
		Lead	Primary MCL	15	50	Groundwater/On-site	"
		Selenium	Primary MCL	50	Exceeded	Groundwater/On-site	"
		Turbidity	Primary MCL	5 NTU	75.3 NTU	Groundwater/On-site	"
		Aluminum	WQC - State CMC for Aquatic Life	750	5,300	Surface water/ Off-site in Conemaugh River	"

Table 1. Coal Combustion Waste: Damage to Water Quality (Highest Monitoring Results)*

Owner/Site	State	Pollutant	Reference	Limit (µg/L unless noted)	Maximum Result	Media/ Location	Enforcement Action
		Nickel	WQC - State CCC for Aquatic Life	4.05	30	Surface water/ Off-site in Conemaugh River	"
		Zinc	WQC - State CCC for Aquatic Life	48.54	93	Surface water/ Off-site in Conemaugh River	"
Orion/Fern Valley Landfill	PA	Arsenic	Primary MCL	10	363	Groundwater/On-site	State Notice of Violations issued in 2002 for CCW placed beyond permitted landfill boundary and reporting violations
UGI/Hunlock Power Station	PA	Arsenic	Primary MCL	10	119	Groundwater/On-site	State ordered gw assessment in 2008; facility closing May 2010 but state found closure plan inadequate
SCE&G/Wateree Station	SC	Arsenic	Primary MCL	10	180	Groundwater/On-site	State cited plant for groundwater violation in 2001
		Arsenic	WQC - State	NA	Exceeded	Surface water/ Off-site	"
SCE&G/Urquhart Station	SC	Arsenic	Primary MCL	10	Exceeded	Groundwater/ On-site	Informal state actions have been required, including listing site on Groundwater Contamination Inventory (2008) for arsenic from ash basins and requiring gw assessments
Santee Cooper/Grainger Generating Station	SC	Arsenic	Primary MCL	10	917	Groundwater/On-site	Informal state action required contamination assessment; no formal action
TVA/John Sevier Fossil Plant	TN	Cadmium	Primary MCL	5	6.8	Groundwater/On-site at Property Boundary	None
Trans-Ash/CCW Landfill	TN	Mercury	Primary MCL	2	13	Drinking Well/Off-site	State issued Order in 2005, assessed $160,000 penalty; in 2009, EPA initiated Emergency Removal Action to give water to residence with mercury contamination in well

Table 1. Coal Combustion Waste: Damage to Water Quality (Highest Monitoring Results)*

Owner/Site	State	Pollutant	Reference	Limit (µg/L unless noted)	Maximum Result	Media/ Location	Enforcement Action
		Arsenic	Primary MCL	10	270	Groundwater/On-site	"
		Chromium	Primary MCL	100	Exceeded	Groundwater/On-site	"
		Lead	Primary MCL	15	Exceeded	Groundwater/On-site	"
		Mercury	Primary MCL	2	Exceeded	Groundwater/On-site	"
AEP/John Amos Plant's Little Scary Creek Fly Ash Impoundment	WV	Selenium	WQC - EPA Proposed Fish Tissue Criterion	7.9 mg/kg	58.02 mg/kg	Fish tissue/ Off-site in Little Scary Creek	None; and state granted discharge variances from the state numeric criteria for selenium and copper
		Selenium	WQC - EPA CCC for Aquatic Life	5	31.5	Surface Water/ Off-site in Little Scary Creek	"
AEP/Mitchell Generating Station	WV	Selenium	WQC - EPA Proposed Fish Tissue Criterion	7.9 mg/kg	31.5 mg/kg	Fish tissue/ Off-site in Conner Run	None
		Selenium	WQC - EPA CCC for Aquatic Life	5	47.8	Surface Water/Off-site in Conner Run	"
		Arsenic	Primary MCL	10	Exceeded	Groundwater/On-site	"
		Antimony	Primary MCL	6	Exceeded	Groundwater/On-site	"

* Note: "MCL" = maximum contaminant level; "WQC" = water quality criteria; "CCC" = criterion continuous concentration; "CMC" = criterion maximum concentration; "gw" = groundwater.

Out of Control: Mounting Damages from Coal Ash Waste Sites

DAMAGE CASES

ENTITY/COMPANY - LOCATION

NRG Energy – Indian River Generating Station
Power Plant Road
Millsboro, DE 19966
Sussex County
GPS Coordinates: 38°35'7.23"N, 75°13'57.61"W

Summary

Contamination of groundwater, sediments and surface water in the Indian River and Island Creek by erosion of an inactive coal ash landfill on Burton Island. Levels of arsenic, chromium, and thallium in on-site groundwater exceeded federal primary drinking water standards ("maximum contaminant levels" or "primary MCLs"). Off-site concentrations of aluminum and iron in Island Creek exceeded EPA's Criteria Continuous Concentration Water Quality Criteria for Aquatic Life (CCC) by 47.3 times and 5.48 times, respectively. In addition, levels of arsenic, barium, selenium and seven other metals (aluminum, antimony, chromium, iron, manganese, thallium and vanadium) exceeded Delaware Department of Natural Resources and Environmental Control's (DNREC) Uniform Risk-Based Standards (URS). Average concentrations of arsenic exceeded the URS in all media (by a factor of 12.3 times in the soil/ash; by a factor of 9 to 900 times in groundwater; by a factor of 3.3 times in shoreline sediments; and somewhat above the URS in surface water samples). Active erosion of the coal ash landfill has been controlled under DNREC's Voluntary Remediation Program and a Remedial Investigation and Ecological Risk Assessment is being conducted.

Determination

Demonstrated off-site damage to sediments and surface water

Test of Proof

Initial sampling of soil/ash, groundwater, shoreline and offshore sediment; and surface water found levels of metals exceeding DNREC's Uniform Risk-Based Standards (URS) for arsenic, barium, selenium and seven other metals (aluminum, antimony, chromium, iron, manganese, thallium and vanadium). Data analysis of the samples (summarized below) by Shaw Environmental (2008) identified a total of nine constituents of potential concern (COPC) for human and ecological impacts from the sediment contamination based on potential for bioaccumulation and whether concentrations were above background levels. The identified COPCs were arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc. Notable concentrations were as follows (groundwater is in mg/L, all other units in mg/kg; data from Shaw Environmental, 2008):

- Soil/Ash samples (averages): arsenic (123 vs. URS of 10), barium (387 vs. URS of 283), selenium (4.3 vs. URS of 0.20), vanadium (42.7 vs. URS of 2.0), and zinc (33.6 vs. URS 8.5).
- Groundwater (in ash): average concentrations exceeded URS for aluminum, antimony, arsenic, barium, chromium, iron, manganese, thallium, vanadium. Highest exceedances were for aluminum (128 times), arsenic (9 to 900 times), and iron (113 times).

- Shoreline Sediments: average concentrations of arsenic (26.4, 3.3 times URS) and barium (56.5, 2.8 times URS).
- Offshore Sediments: average concentrations of arsenic (16.6, 2.1 times URS) and barium (59.3, 3 times URS).
- Surface Water: average aluminum, arsenic, barium and iron concentrations were above background and URS.

On-site groundwater actually exceeded EPA's primary MCLs for three pollutants, arsenic, chromium, and thallium.

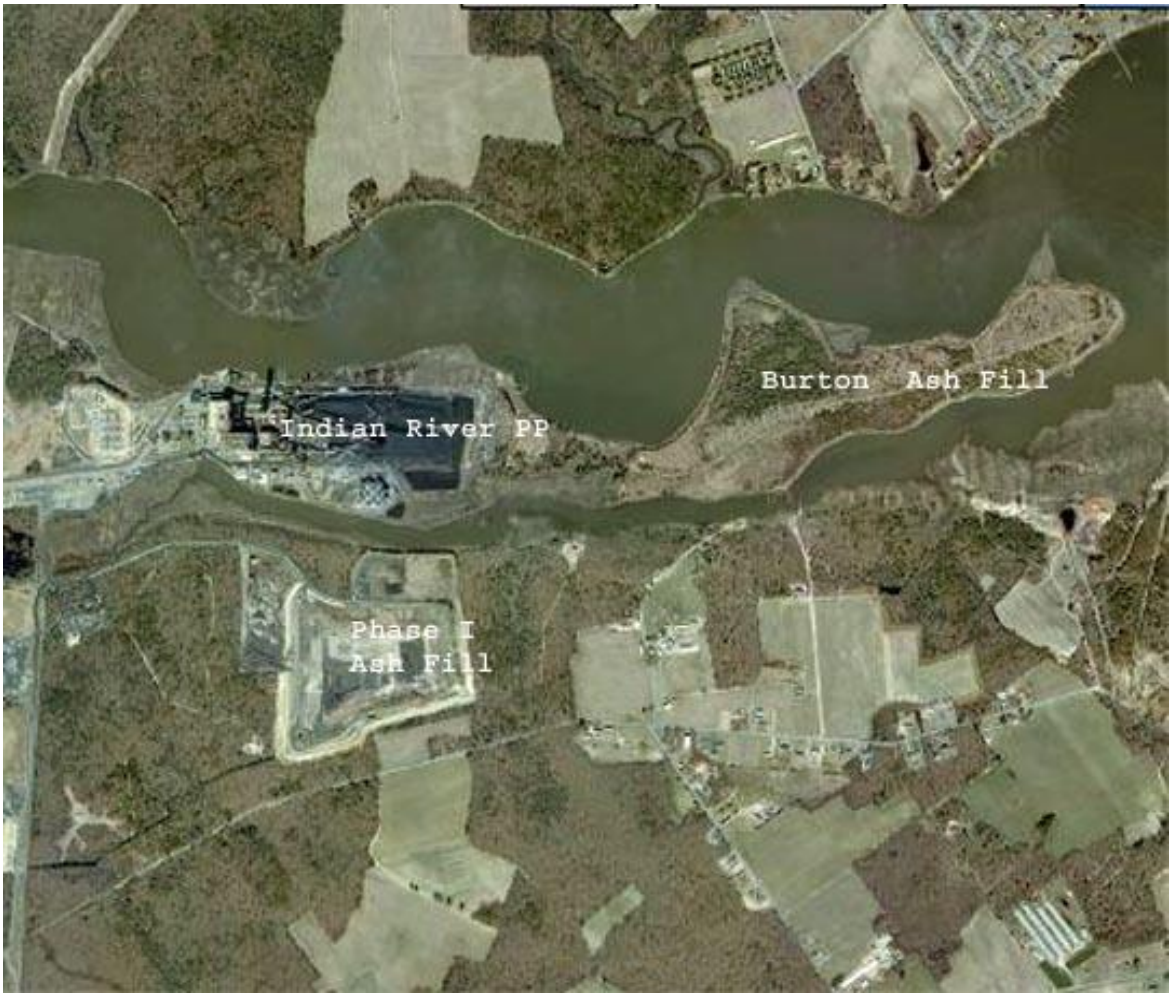
- The maximum arsenic concentration was 1,450 ug/L (which is 145 times the primary MCL of 10 ug/L).
- The maximum chromium concentration was 211 ug/L (which is more than twice the primary MCL of 100 ug/L).
- The maximum thallium concentration was 8.4 ug/L (which is 4.2 times the primary MCL of 2 ug/L).

Off-site surface water samples in Island Creek exceeded EPA's Freshwater CCC for Aquatic Life for aluminum and iron, with a maximum aluminum reading of 4,120 ug/L (which is 47.3 times the CCC of 87 ug/L), and a maximum iron reading of 5.480 mg/L (which is 5.48 times the CCC of 1 mg/L).

COPCs in shoreline and offshore sediment (takes into account potential for bioaccumulation and whether concentrations were above background): arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc.

Constituents Involved

Aluminum, antimony, arsenic, barium, cadmium, chromium, copper, lead, mercury, nickel, selenium, thallium, vanadium, zinc, iron, and manganese.



Incident and Date Damage Occurred / Identified

From 1957 to 1980 coal ash from the Indian River Power Plant was disposed of on the eastern two-thirds of Burton Island. In 2005, a DNREC scientist observed active erosion of the ash berms into Island Creek and Indian River.

Regulatory Actions

DNREC approved a final remedial action plan for Burton Island Ash Disposal Area Operable Unit 1 (OU1—shoreline, intertidal zone and vicinity) & Operable Unit 3 (OU3—subtidal sediments and waters seaward of berms) on July 30, 2008 (Delaware DNREC, 2008). The possible need for further remedial action is still being evaluated for the landfill (Operable Unit 2).

Wastes Present

Coal fly ash and bottom ash

Type(s) of Waste Management Unit

Coal ash landfill placed on ground surface without liners and above-grade berms built from ash and dredge spoils.

Active or Inactive Waste Management Unit

Inactive

Hydrogeologic Conditions

Groundwater on Burton Island and surface waters of Indian River and Island Creek are hydrologically interconnected. Shaw Environmental (2008) suggests that groundwater flow into surface waters is reduced by reversals of flow during high tide.

Probable Cause(s)

Leaching and erosion of coal ash impoundment into Indian River, Island Creek, and tidal sediments.

Additional Narrative (summary information taken mainly from DeCowsky, 2009)

The Indian River Power Plant has four coal-fired units and began operation in 1957. Originally owned by Delmarva Power & Light (DP&L), it was sold to NRG (Indian River Power LLC) in 2001. From 1957 to 1980, DP&L sluiced coal ash from the plant to Burton Island, which consisted of tidal marshes and flats. Berms were built from coal ash and dredged spoils and excess water ran into Indian River north of the island and Island Creek south of the island. About 15 feet of coal ash covered 144 acres before a new Phase I landfill on the mainland began operation with a permit from DNREC Solid and Hazardous Waste Management Branch (SHWB). In 2005, a DNREC scientist observed erosion of the ash berms on the island, and the site was referred to the DNREC Site Inspection and Restoration Branch (SIRB) for investigation. Initial soil and shoreline sediment sampling found levels of metals exceeding DNREC standards. A Voluntary Cleanup Program agreement between NRG Energy and DNREC led to further investigations and division of the site into three Operable Units (OUs): OU1 (shoreline, intertidal zone and vicinity), OU2 (landfill/land areas and the berms), and OU3 (subtidal sediments and waters seaward of berms). A final plan for remediation of OU1 and OU3, which focuses mainly on stabilization and erosion control, was approved on July 30, 2008. An initial human health risk assessment estimated carcinogenic risk for adults to marginally exceed DNREC's regulatory guidance, and a screening level ecological risk assessment, still being evaluated by DNREC, suggests that ecological risk to riparian and aquatic communities from OU1 and OU2 would no longer be a concern if landfill erosion is controlled. (Shaw Environmental, 2008). Operable Unit 2 is currently the subject of a remedial investigation, including a full Ecological Risk Assessment and Natural Resource Damage Assessment.

Special ecological concerns related to coal ash identified at the project site:

- Deer may use coal ash as a salt lick (Sample and Suter, 2002).
- Coal ash exposure causes developmental impairments and other damage in certain frogs, toads, turtles, snakes, fish and crayfish (Hopkins, et al. undated).
- Possible risk to migratory shorebirds feeding on Horseshoe Crab eggs in contaminated sediments.

Since 1980, Indian River Power Plant disposed of coal ash in a Phase I Landfill on the mainland operated with a permit from the DNREC SHWMB. The NRG Response to the U.S. EPA 2009 coal combustion waste survey provides information on the sedimentation pond and ash silo sump system at the Indian River power plant, but NRG did not provide information about the Phase I Landfill (NRG, 2009). On March 19, 2008, NRG filed a permit application for a Phase II landfill that includes extensive hydrogeologic characterization as well as a liner and leachate collection system. (NRG 2008).

SOURCES

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Indian River Power Plant, *available at* http://www.awm.delaware.gov/Info/Pages/NRGIndianRiver.aspx.

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NRG. 2008. Indian River Operations Inc. Application for a Phase II Industrial Landfill Permit (Mar. 19, 2008) *available at* http://www.awm.delaware.gov/SHWMB/Pages/NRGPhaseIIApplication.aspx.

Sample, Bradley E. and Glenn W. Suter. 2002. Screening Evaluation of the Ecological Risks to Terrestrial Wildlife Associated with a Coal Ash Disposal Site. *Human and Ecological Risk Assessment* 8:4:637-656.

Shaw Environmental, Inc. 2008. Facility Evaluation Report Indian River Generating Station Burton Island Old Ash Landfill, Millsboro, Delaware Site Number DE-1399. Prepared for Indian River Power LLC (Revised March 2008).

ENTITY/COMPANY - LOCATION

Orlando Utility Commission (OUC) – Curtis Stanton Energy Center
5100 S. Alafaya Trail
Orlando, FL 32831
Orange County
GPS Coordinates: 28°28'58.18"N, 81°10'3.30"W

Summary

Data show groundwater contamination around a coal combustion waste (CCW) landfill and ponds at the Curtis Stanton Power Plant over a period of 22 years. Data collected since 2003 show concentrations of aluminum, chloride, iron, manganese, and sodium 5 to 100s of times higher than Florida Department of Environmental Protection (FDEP) Groundwater and Surface Water Clean-up Target Levels. Sulfate, vanadium, gross alpha radiation, and radium-226 levels have exceeded one or both of these standards often by several times. Surface water samples collected from one location exceed FDEP Freshwater Surface Water Quality Criteria and Secondary Maximum Contaminant Levels (secondary MCLs). According to FDEP, Orlando Utility Commission (OUC) agreed to investigate the extent of the groundwater contamination from the CCW landfill; however, no off-site groundwater or surface monitoring was required. The plant is located near residential areas east of Orlando.

Determination

Demonstrated on-site damage of groundwater and surface water

Test of Proof

Since 2003, quarterly groundwater monitoring data from upper surficial aquifer wells show the following exceedances of FDEP Groundwater Clean-up Target Levels: aluminum (67 mg/L max vs. 0.05 mg/L standard), chloride (2,800 mg/L max vs. 250 mg/L standard), iron (29 mg/L max vs. 0.3 mg/L standard), manganese (0.3 mg/L max vs. 0.05 mg/L standard), sodium (1,200 mg/L max vs. 160 mg/L standard), sulfate (1,600 mg/L max vs. 250 mg/L standard), total dissolved solids (TDS) (13,000 mg/L max vs. 500 mg/L standard), and gross alpha radiation (65.4 pCi/L max vs. 15 pCi/L standard) (FDEP, 2009a). The gross alpha level also exceeds EPA's primary MCL of 15 pCi/L. Wells near the coal ash ponds have exceeded FDEP Clean-Up Target Levels for iron, aluminum, vanadium, TDS, sodium, chloride, gross alpha, and radium-226. Coal storage area wells have exceeded Clean-Up Target Levels for aluminum, iron, and pH (<3). Coal ash landfill area wells have exceeded FDEP clean-up target levels for aluminum, iron, manganese, TDS, chloride, sulfate, gross alpha, radium-226, and pH.

Surface water discharges exceeded FDEP Freshwater Clean-up Target levels (Chapter 62-777, April 17, 2005) for aluminum (40,000 µg/L vs. 13 µg/L standard), sodium (770 mg/L vs. 160 mg/L standard), chloride (3,200 mg/L vs. 250 mg/L standard), sulfate (750 mg/L vs. 250 mg/L standard), gross alpha (27.9 pCi/L vs. 15 pCi/L standard). In addition, secondaryMCLs were exceeded for iron (3.5 mg/L vs. 0.3 mg/L standard), manganese (0.086 mg/L vs. 0.05 mg/L standard), TDS (6,500 mg/L vs. 500 mg/L standard), and pH (4.06 vs. 6 -9 standard) (FDEP, 2009a).

Furthermore, inspections of Curtis Stanton Energy Center revealed compliance problems such as the un-permitted discharge of pollutants to a wetland and water discharges of pH 4.0.

A separate, additional data review by FDEP concluded that groundwater monitoring results for the last 22 years (since 1987) at four wells along the eastern side of the landfill (MW-11, 12, 13, and 15) were influenced by leachate from the coal ash landfill – as indicated by increases in beryllium, chloride, calcium,

magnesium, sodium, sulfate, total dissolved solids (TDS), manganese, and vanadium (FDEP, 2009b). The FDEP concluded that the groundwater in those wells was characteristic of CCW residues (FDEP, 2009b).

Constituents Involved

Aluminum, beryllium, calcium, chloride, iron, magnesium, manganese, sodium, sulfates, TDS, vanadium, gross alpha, radium-226, and pH in groundwater. Aluminum, iron, manganese, TDS, sodium, chloride, sulfate, gross alpha, and pH in surface water.

Incident and Date Damage Occurred / Identified

Since 2003, multiple substantive exceedances of Groundwater and Surface Water Clean-up Target Levels and secondary MCLs. (Chapter 62-777, Groundwater Clean-Up Target Levels, April 17, 2005) (FDEP, 2009a). Ongoing contamination of groundwater under the CCW landfill since 1987 (FDEP, 2009b).

Regulatory Actions

The Curtis Stanton Energy Center has repeatedly been non-compliant with groundwater and surface water monitoring criteria (FDEP, 2009a) and monitoring and operational requirements, although the status of FDEP enforcement activities is unclear. A January 29, 2009 inspection report concluded that the landfill was not operating according to plans and that the CCW landfill did not have a permit as required under the Florida

Site Certification authorization (FDEP, 2009a). FDEP has required numerous upgrades to the facility, investigative reports, and corrective actions, yet OUC has not satisfactorily addressed FDEP's requests (FDEP, 2009a, 2009b). FDEP required evaluation monitoring of the CCW landfill because the surficial aquifer was contaminated (FDEP, 2009b). OUC was required to determine if the waste placed into the landfill is a Class I or Class III waste, and those determinations were due by November 14, 2009 (FDEP, 2009b). If the waste is determined to be a Class I waste, it cannot be placed in the CCW landfill. Additionally, inspections have revealed compliance problems such as inadequate freeboard in ash ponds, the unpermitted discharge of pollutants to a wetland, failure to collect stormwater samples, water discharge of pH 4.0, and inadequate testing of water discharges. According to FDEP, OUC agreed to investigate the groundwater contamination associated with the CCW landfill; however, no off-site monitoring is required (Lubozynski).

Wastes Present

Fly ash, bottom ash, flue gas desulfurization (FGD) wastes, brine concentrate, CCW runoff, recycled water and waste water from the Curtis Stanton Energy Center.

Type(s) of Waste Management Unit

The Curtis Stanton Energy Center operates a CCW landfill (in which coal ash is initially hardened with lime and bottom ash is dewatered), a CCW runoff pond, a coal storage area runoff pond, a recycled water pond, and a plant wastewater pond – all of which are supposed to be lined (FDEP, 2009,a).

Active or Inactive Waste Management Unit

Active

Hydrogeologic Conditions

Shallow water table aquifer conditions exist. The file review did not indicate the distance between the wastes and the seasonal high groundwater table. Additional groundwater monitoring wells are planned with screened intervals in the "shallow" portion of the water table aquifer from five (5) to fifteen (15) feet below ground surface (FDEP, 2009a). Existing groundwater monitoring wells are reported to be in the undefined "lower surficial aquifer".

Probable Cause(s)

Leachate from CCW landfill and ponds.

SOURCES

Florida Department of Environmental Protection (FDEP). 2008. Inspection Checklist, by Laxsamee Levin Principal Inspector (Mar. 13, 2008)

Florida Department of Environmental Protection (FDEP). 2009a. Non-Compliance Letter from Vivian Garfein, Director Central District to Denise Stalls, Orlando Utility Commission (Feb. 11, 2008).

Florida Department of Environmental Protection (FDEP). 2009b. Solid Waste Inspection Report Transmittal letter from F. Thomas Lubozynski to Denise Stalls, Orlando Utility Commission (Sept. 14, 2009).

Lubozynski, Tom. 2010. Phone conversation with Tom Lybozynski, FDEP, Waste Program Administrator, telephone conversation (Jan. 29, 2010).

Orlando Utility Commission (OUC). 2009. Solid Waste Inspection Report Transmittal letter from Garfield Blair, Director, Environmental Affairs, OUC to Tom Lubozynski, FDEP (Dec. 1, 2009).

ENTITY/COMPANY - LOCATION

Seminole Electric Cooperative – Seminole Generating Station
890 Highway 17 North
Palatka, FL 32177
Putnam County
GPS Coordinates: 29°44'6.98"N, 81°37'53.02"W

Summary

Three process wastewater ponds, two stormwater runoff ponds, and a flue gas desulfurization (FGD) landfill that accommodate the Seminole Generating Station have contaminated groundwater at the property line up to one mile from the FGD landfill, the suspected source area. Chloride concentrations above the Florida Groundwater Clean-up Target Level at the property line more than doubled above the standard from 2006 to 2007. Deep and shallow aquifers are contaminated far above Clean-Up Target Levels for sulfate, chloride, iron, TDS and boron as well as many times above federal secondary MCLs and health advisories for these contaminants. Arsenic has been measured 19 times higher than the primary MCL and lead measured more than 10 times the primary MCL in groundwater underneath the FGD landfill, although these constituents are not being analyzed in remedial monitoring elsewhere at this extensive site. Despite the distance the contamination has traveled, the file review did not indicate any existence of off-site groundwater or surface monitoring locations or sampling requirements. The plant is located within 0.5-mile of the St. Johns River.

Determination

Demonstrated damage to groundwater, surface water and wetlands that is moving off-site

Test of Proof

Contamination of groundwater exceeding Florida Department of Environmental Protection (FDEP) Groundwater Clean-up Target levels (Chapter 62-777, Groundwater Clean-Up Target Levels, April 17, 2005) for chloride, sulfate, TDS, boron, and iron was documented up to at least one mile from the source area (Ardaman, 2008). Chloride concentrations above the 250 mg/L Target Level at the property line more than doubled from 2006 to 2007. Leakage from three lined process ponds, two unlined storm water runoff ponds, and an unlined FGD sludge landfill were identified as causes of groundwater contamination. Deep and shallow aquifers are contaminated far above FDEP standards and secondary drinking water standards, and contaminated groundwater has affected on-site wetlands. Surface water data indicate gross exceedances of primary MCLs, secondary MCLs and water quality standards at the FGD landfill (FDEP, 2003).

Eleven groundwater monitoring wells were drilled in the shallow surficial aquifer, and six wells in the deeper portion of the surficial water table aquifer (Ardaman, 2008). Seminole Electric was required to install a groundwater collection system to partially capture contaminated groundwater. That system has been fully operational since October 2004. Yet increasing trends in chloride, sulfate, TDS, boron, and iron (the only parameters monitored in the collection system) levels continue in the disposal area and downgradient points.

Groundwater underlying the FGD landfill has been contaminated with arsenic measured at up to 190 µg/L, 19 times the primary MCL of 10 µg/L, and lead, measured at more than 150 µg/L over 10 times the primary MCL of 15 µg/L (FDEP, 2003). Boron was measured at over 40 times its guidance concentration, aluminum at over 20 times the secondary MCL, and sulfate at over 3 times the secondary MCL.

Historical surface water data showed boron at levels over 1,000 times its guidance concentration (FDEP, 2003). Surface water data also revealed exceedances for aluminum at 4,100 times the Class III fresh surface water standard. In addition, secondary MCL exceedances were documented in surface water for chloride

(over 30 times the standard), sodium (over 3 times the standard), sulfate (over 3 times the standard) and TDS (over 8.5 times the standard).

The highest shallow groundwater constituent concentrations measured in the former FGD sludge disposal area in August / September 2007 relative to the FDEP groundwater clean-up target standards are as follows: 21,000 mg/L chloride (84 times the 250 mg/L standard); 1,100 mg/L sulfate (4.4 times the 250 mg/L standard); 59,000 mg/L TDS (118 times the 500 mg/L standard); 344 mg/L boron (245 times the 1.4 mg/L standard); and 29 mg/L iron (96 times the 0.3 mg/L standard) (Ardaman, 2008).

The groundwater concentrations measured in the deeper portion of the water table aquifer (approximately 43 feet below ground surface) under the FGD disposal area in August / September 2007 are as follows: 5,000 mg/L chloride (20 times the standard); 250 mg/L sulfate (equal to the standard); 9,200 mg/L TDS (18.4 times the standard); 73 mg/L boron (52 times the standard); and 9.3 mg/L iron (31 times the standard).

The groundwater constituent concentrations in August / September 2007 at the edge of the property line located approximately one (1) mile from the FGD disposal area relative to the FDEP standard are as follows: 590 mg/L chloride (2.4 times the standard); 780 mg/L sulfate (3.1 times the standard); 3,100 mg/L TDS (6.2 times the standard); 4 mg/L boron (2.9 times the standard); and 12 mg/L iron (40 times the standard).

The groundwater constituent concentrations in August / September 2007 from monitoring wells in the wetland area located just north of the FGD landfill relative to the FDEP standard are as follows: 3,100 mg/L chloride (12.4 times the standard); 1,500 mg/L sulfate (6 times the standard); 9,300 mg/L TDS (18.6 times the standard); 29 mg/L boron (20.7 times the standard); and 36 mg/L iron (120 times the standard).

Arsenic and aluminum were reported in groundwater at undisclosed locations greater than the standard (FDEP, 2003), although those constituents are not being monitored during remedial system performance monitoring. Surface water data also indicate excessive concentrations of arsenic (at unknown locations).

Constituents Involved

Chlorides, sulfates, iron, TDS, boron, aluminum, arsenic, lead and sodium

Incident and Date Damage Occurred / Identified

Although the exact date is unclear, the contamination dates at least to 1999, when a hydrogeological study and contaminant assessment provided the approximate extent of the contamination and identified the cause of groundwater impacts from within the FGD sludge disposal area (Ardaman, 2008).

Regulatory Actions

Although there is extensive remediation monitoring ongoing at this site and Seminole Electric Cooperative was required to construct a contaminated groundwater capture system in 2004, the file review did not identify a FDEP order that required investigation or cleanup. Feasibility studies and remedial action plan references were noted in the file.

Wastes Present

Dewatered FGD sludge stabilized (initially hardened) with lime and fly ash (prior to 1996, stabilized with process water high in TDS, chloride, and other chemicals) and excess water for the FGD system in process water ponds.

Type(s) of Waste Management Unit

An unlined FGD sludge landfill, and lined and unlined process water and storm water runoff impoundments.

Active or Inactive Waste Management Unit

Active

Hydrogeologic Conditions

A shallow surficial aquifer of a fine sand to silty sand exists to a depth ranging from 23.5 to 48.5 feet below ground surface (Ardamore, 2008). A deeper surficial aquifer occurs underneath this shallow aquifer at an average depth of 43 feet. The feet of separation between the CCW and the groundwater table is unknown.

Probable Cause(s)

Leachate migrating from the unlined FGD landfill, and process water discharges to a lined and unlined pond.

SOURCES

Ardaman and Associates, Inc. 2008. Third Progress Report, Evaluation of Operation Data and Water Quality Data, Groundwater Recovery System (Apr. 3, 2008).

Earthjustice. 2008. Comments on U.S. Environmental Protection Agency's Coal Combustion Waste Damage Case Assessment (July, 2007), Prepared in response to U.S EPA, Notice of Data Availability 72 Fed. Reg. 49714, RCRA Docket No. EPA-HQ-RCRA-2006-0796 (Aug. 29, 2007).

Florida Department of Environmental Protection (FDEP). 2003. Preliminary Evaluation of Analytical Data on Coal Combustion Products, (draft), FDEP Solid Waste Section (Mar. 18, 2003).

ENTITY/COMPANY - LOCATION

Tampa Electric Company – Big Bend Station
13031 Wyandotte Road
Apollo Beach, FL 33572
Hillsborough County
GPS Coordinates: 27°47'43.26"N, 82°24'17.04"W

Summary

Several coal combustion waste (CCW) disposal areas are all apparent causes of shallow groundwater and surface water contamination at the Big Bend Station adjacent to Tampa Bay, including flue gas desulfurization (FGD) wastes, a gypsum storage pond, a bottom ash pond, fly ash ponds, and recycled wastewater ponds. Contaminated groundwater has migrated off-site but Tampa Electric Company (TECO) later purchased the land affected by groundwater migration. Federal MCLs and Florida Clean-up Target Levels for chloride, manganese, sulfate, and thallium have been exceeded on this previously off-site property. Thallium has been previously measured in off-site groundwater at more than twice the federal primary MCL and at groundwater monitoring locations closer to CCW disposal areas, at 8 times the federal primary MCL. Arsenic in on-site groundwater has been measured at 11 times the federal primary MCL. Many other pollutants and trace elements have also been measured at levels far above secondary Drinking Water Standards and Florida Groundwater Clean-up Target Levels. TECO has installed liners at some CCW disposal ponds, as required by a 2001 Consent Order, but others have still not been lined. At present, there are no apparent off-site monitoring locations. Contaminated shallow groundwater discharges to surface water via inter-tidal canals.

Determination

Demonstrated off-site damage to groundwater.

Test of Proof

TECO discovered groundwater exceedances at one CCW disposal area during an internal records review, although no numerical standards for comparison were included in TECO's 2001 Consent Order with FDEP (FDEP, 2001). TECO submitted a Preliminary Contamination Assessment Report to the FDEP on August 2, 1999. A FDEP review of TECO at about the same time showed that TECO was exceeding effluent limits for flow and total suspended solids (TSS) at a recycled wastewater pond, and that the groundwater Zone of Discharge for two spray fields frequently showed elevated levels for arsenic, chloride, sodium, gross alpha, and total dissolved solids (TDS).

Surface water samples collected in February 2000 from ditches on-site, from a CCW seepage location, from a process water pond, and from a recycled wastewater pond indicated violations of state surface water standards for iron and boron above guidance criteria (FDEP, 2001).

The FDEP also concluded that contaminated groundwater had migrated downgradient and off-site (on property now owned by TECO) from one CCW disposal area known as DA-2 at the following concentrations: thallium at 0.0047 mg/L, more than twice as high as the current 0.002 mg/L Groundwater Clean-up Target Level which is also the federal primary MCL; sulfate at 2,150 mg/L, nearly 10 times the current 250 mg/L Clean-up Target Level and federal secondary MCL; sodium at 2,020 mg/L, while no Clean-up Target Level is defined, this is more than 100 times the federal health-based Drinking Water Advisory for individuals on a sodium restricted diet; manganese at 0.8497 mg/L, 17 times higher than the current 0.05 mg/L Clean-up Target Level and federal secondary MCL; and chloride at 4,610 mg/L, nearly 20 times the 250 mg/L Clean-up Target Level and secondary MCL (FDEP, 2001).

The FDEP reported in 2003 substantial exceedances of primaryMCLs in on-site groundwater, including arsenic at 11 times the primary MCL; thallium at 8 times the primary MCL; and fluoride at 4 times the primary MCL (FDEP, 2003). Exceedances of secondary MCLs were documented at much greater levels. Boron in groundwater was measured at over 700 times the Florida guidance concentration; manganese at 240 times its secondary MCL; sulfate at 128 times its secondary MCL; aluminum at 25 times its secondary MCL; molybdenum was above the state guidance concentration; chloride was 40 times the secondary MCL; and TDS was 46 times the secondary MCL. Groundwater under the Gypsum Storage Area was 40 times higher than boron standards; iron exceeded the secondary MCL by 66 times; as well as manganese (11 times the secondary MCL); sulfate (4 times the secondary MCL); and TDS (5 times the secondary MCL).

Constituents Involved

Aluminum, arsenic, boron, chloride, fluoride, iron, manganese, molybdenum, sulfate, sodium, thallium, gross alpha, and TDS.

Incident and Date Damage Occurred / Identified

The damage started at an undetermined time, although damage is documented back to 1999.

Regulatory Actions

The FDEP issued a Consent Order (OGC File No. 1275) in April 2001 because multiple CCW disposal areas had contaminated on-site groundwater and surface water. Some of that contamination had migrated off-site (FDEP, 2001). TECO later bought that property. The Order required that liner systems of numerous waste

disposal units be repaired or replaced or that TECO prove that the disposal units were not leaking. According to correspondence from TECO to the FDEP, such demonstration, repair, or replacement had not yet been completed for the FGD disposal area, the recycle pond, or the slag pond as of 2009 (TECO, 2009,b). The FDEP required TECO to submit an Environmental Contamination Assessment Plan (ECAP) before June 10, 2001. FDEP approved TECO's Remedial Action Plan and Groundwater Monitoring Plan on January 24, 2007 (FDEP, 2007). To address arsenic concentrations exceeding a groundwater standard of 0.01 mg/L in four wells (MWB-23, MWB-26, MWB-27, and MWB-28) in the spray field area, TECO proposed a Monitored Natural Attenuation Plan (MNAP). No long-term arsenic concentrations were included in the plan or found in the file review to understand if the MNAP was a valid, environmentally protective action plan.

Wastes Present

Fly ash, bottom ash, synthetic gypsum, FGD waste and wastewater, process discharges and stormwater runoff.

Type(s) of Waste Management Unit

Bottom and Fly Ash Ponds, a Bottom Ash Dry Storage Unit, a Wastewater Recycling / Waste Management Pond, a FGD Gypsum By-Product Storage Pond, and Waste Disposal Management Unit (DA-2).

Active or Inactive Waste Management Unit

Some units remain active. Use of the spray fields was terminated in 1999.

Hydrogeologic Conditions

Inter-tidal canals that cross the Big Bend site are considered to be groundwater discharge boundaries where the shallow groundwater is discharged to the surface water of Tampa Bay (Kutash, 2010). The upper-most groundwater occurs in unconsolidated sediments consisting mostly of shell and silty sands. There is a combination of natural landforms and heterogeneous dredge fill units consisting of shell hash, sand, clayey sand, sandy clay, and clay at the site (Tampa Electric, 2008). The power plant was built in 1968 on two dredge fill peninsulas. The file review did not indicate the distance between CCW waste and the seasonal high groundwater table.

Probable Cause(s)

Highly-polluted FGD wastewater, as well as the bottom ash pond, fly ash ponds, gypsum storage pond, and recycle wastewater ponds are likely additional causes of contamination (Kutash, 2010).

SOURCES

Florida Department of Environmental Protection (FDEP). 2001. Consent Order OGC File No. 1275, Tampa Electric Company (Apr. 10, 2001).

Florida Department of Environmental Protection (FDEP). 2003. Preliminary Evaluation of Analytical Data on Coal Combustion Products, (draft), FDEP Solid Waste Section (Mar. 18, 2003).

Florida Department of Environmental Protection (FDEP). 2007. Letter from Deborah A. Getzoff, District Director, to Hugh W. Smith, Tampa Electric Company (Jan. 24, 2007).

Kutash, William. 2010. Phone conversation with William Kutash, Waste Management Division, FDEP (Jan. 28, 2010).

Tampa Electric Company (TECO). 2008. Transmittal letter from Terry Eastley to Yanisa Angulo, FDEP, transmitting the Monitored Natural Attenuation Plan, prepared for TECO by EnHydro, LLC (Apr. 17, 2008).

Tampa Electric Company (TECO). 2009. Letter from B. Randall Melton of TECO to William Kutash, FDEP (Dec. 17, 2009).

ENTITY/COMPANY - LOCATION

Rocky Acres Coal Combustion By-Product Disposal Site
Gray's Siding Road
Oakwood, IL
Vermillion County
GPS Coordinates: 40° 7'1.81"N, 87°44'43.91"W

Bunge Milling, Inc. (source of CCW)
321 East North Street
Danville, IL 61832

Summary

Disposal of more than 380,000 tons of coal combustion waste from the Bunge Corporation's coal plant adjacent to the rural Grays Siding neighborhood (also called Rocky Acres) in Oakville, Illinois may have contaminated two private drinking water wells with levels of lead, iron and manganese above Illinois Department of Environmental Protection groundwater standards. Recent groundwater sampling at the site identified arsenic, barium, chromium, lead, nickel, iron, and manganese at levels that exceeded groundwater quality standards, with arsenic, barium, chromium, and lead also exceeding federal primary MCLs.. The surface water quality of a lake designated for fishing in Kickapoo State Park that receives surface runoff and probably groundwater inflow from the site may also be degraded.

Determination

Demonstrated damage to groundwater moving off-site

Test of Proof

Levels of lead, iron and manganese in two home wells were above the state groundwater standards. Illinois Environmental Protection Agency (IEPA) advised the residents to stop drinking water from their wells. The water sampling location (at the tap) creates some uncertainty as to whether the lead originated in the groundwater or from water pipes in the houses. However, 2009 groundwater monitoring results from underneath the site found iron, lead, manganese, arsenic, barium, nickel and chromium at levels that exceed Illinois groundwater quality standards (Madonna, 2010). The on-site groundwater concentrations for arsenic, barium, chromium, and lead also exceeded federal primary MCLs.. The stream that flows from the ash-filled ravine directly into a lake in Kickapoo State Park has not been sampled to assess possible surface water quality impacts.

Constituents Involved

Arsenic, barium, boron, chromium, lead, iron, nickel and manganese

Incident and Date Damage Occurred / Identified

From approximately 1995 to 2006, CCW was placed as fill in a ravine adjacent to the Grays Siding neighborhood. In November 2006 sampling of two nearby residential wells used for drinking water found state groundwater standards were exceeded (BME, 2007).

Regulatory Actions

In 2006, the Illinois Environmental Protection Agency (IEPA) sent a notice to the owners/operators of the ash disposal site informing them that the site was an illegal open dump. In response, the owner/operators claimed that the site was not a landfill, but a beneficial use site and that a building would be constructed on top of the coal ash. To date, no building or impervious surface has ever been constructed on top of the site (Earthjustice, 2008). Bunge Corporation claims that the site owner/operators, who have filed for bankruptcy,

are liable for any damages at the site. However, in response to a request from IEPA, Bunge Corporation agreed to install groundwater monitoring wells and sample them. Bunge Corporation also prepared and submitted to IEPA a Groundwater Investigation Work Plan in August 2007 (BME, 2007).

Wastes Present

CCW generated by fluidized bed coal-fired boilers.

Type(s) of Waste Management Unit

This site is an open dump for CCW, and although it is often referred to as a landfill or structural fill, it has never received a landfill or solid waste permit, and there does not appear to be a structure that was filled with CCW. In addition, claims by the owner/operators that the site is "beneficial use" of CCW are not credible. The dump is located approximately six miles west southwest of Danville, Illinois and north of Highway 150 and Grays Siding Road in Vermilion County. The site is approximately 25 acres.

Active or Inactive Waste Management Unit

Inactive. Dumping activities stopped in 2006.

Hydrogeologic Conditions

The Bunge Corporation's Groundwater Investigation Work Plan assumes a thick depth of unconsolidated materials over shale bedrock at the site (MBE, 2007). IEPA suggested basing the work plan on geologic and hydrogeologic information before installing groundwater monitoring wells (IEPA, 2007).

Probable Cause(s)

Leaching of coal ash into groundwater and possible contamination of surface water by runoff.

Additional Narrative

For ten years, Bunge Milling, Inc sent approximately 380,000 tons of CCW generated by its fluidized bed coal-fired boilers in Dansville, Illinois to be disposed of in a ravine adjacent to the Grays Siding neighborhood. The Grays Siding neighborhood is a rural subdivision of 30 homes that all draw drinking water from area groundwater.

The CCW disposal site is owned by Mr. Jack Salts and Mr. Robert Porter, and Jack Salts Trucking hauled the CCW from the Bunge Corporation to the CCW disposal site. The owners did not take measures to protect surface and groundwater quality, or to control fugitive dust at the site. State testing of the CCW dumped at the site found lead levels at 3.5-4 times the Illinois standard of 0.007 mg/L. Subsequent testing of the site surface found high boron levels. In addition, levels above Illinois groundwater standards of lead, iron and manganese were found in two homes in the adjacent Grays Siding neighborhood. IEPA advised the residents in these two homes to stop drinking water from their wells, but no alternative source of drinking water has been provided to residents. In addition, fugitive dust from exposed coal ash has been encroaching on residential property, and the residential community is adversely affected by dust from the CCW disposal site.

The CCW disposal site is also located next to Kickapoo State Park. Drainage from the site is flowing into Number Six Lake in the southwestern part of the park. Number Six Lake is a designated fishing lake within the park, and has a boat ramp (http://dnr.state.il.us/lands/Landmgt/PARKS/R3/kickapoo.htm). The lake is hydrologically connected to the Middle Fork of the Vermillion River, a designated National Wild and Scenic River.

In 2006, the Illinois Environmental Protection Agency (IEPA) sent a notice to the owners/operators of the CCW disposal site informing them that the site was an illegal open dump. In response, the owner/operators claimed that the site was not a landfill, but a beneficial use site and that a building would be constructed on top of the coal ash. To date, no building or impervious surface has ever been constructed on top of the site (Earthjustice, 2008). Further site investigation has been hampered by the site owner's bankruptcy declaration.

In August 2007, Bunge Corporation agreed to perform a groundwater investigation of the site (BFE, 2007). IEPA submitted detailed comments for improving the proposed work plan (IEPA, 2007). According to Mr. Kevin Madonna, an attorney who has been working with the residents of Grays Siding Neighborhood, subsequent groundwater monitoring has identified arsenic as another contaminant of concern. Groundwater monitoring results in 2009; include levels of arsenic, barium, chromium, iron, lead, manganese, and nickel that exceed Illinois groundwater quality standards (Madonna, 2010). The Bunge Corporation has refused to accept liability for any damages caused by disposal of their CCW.

SOURCES

Burns & McDonnel Engineering Co. Inc (BME). Groundwater Investigation Work Plan: Rocky Acres Coal Combustion By-Product Structural Fill Site, Bucktown/Oakwood, Vermillion County, Illinois. Prepared for Bunge Milling Inc. (August 2007).

Earthjustice. 2008. Comments on U.S. Environmental Protection Agency's Coal Combustion Waste Damage Case Assessment (July, 2007), Prepared in response to U.S EPA, Notice of Data Availability 72 Fed. Reg. 49714, RCRA Docket No. EPA-HQ-RCRA-2006-0796 (Aug. 29, 2007).

Illinois Dep't of Environmental Quality, 2007. Letter from Jeff Turner, Champaign Regional Office, Bureau of Land to Mr. Loren Polak, Director of Environmental Management, Bunge Milling, Inc. St. Louis, MO (Nov. 5, 2007).

Madonna, Kevin J. 2010. Phone and email communications on with Kevin J. Madonna, Kennedy & Madonna, LLP, Hurley NY (Jan. 28, 2010).

ENTITY/COMPANY - LOCATION

Duke Energy – Gibson Generating Station
SR 64 W & CR 975
Princeton, IN 47670
Gibson County
GPS Coordinates: 38°22'14.00"N, 87°46'4.62"W

Summary

Ground and surface water monitoring at Gibson Generating Station show high levels of boron, arsenic, and selenium. Arsenic in on-site groundwater was more than 7 times higher than the primary MCL. Boron contamination has reached drinking water wells in the nearby community of East Mt. Carmel at concentrations nearly twice as high as the EPA Child Health Advisory for ingestion of boron in drinking water. Manganese has been measured at concentrations 34 times its secondary MCL, iron more than 23 times its secondary MCL, and sulfate and TDS nearly twice their respective secondary MCLs in those wells. Sodium levels have been as high as 347 mg/L in a church well, some 17 times the EPA's Drinking Water Advisory, the safe level for individuals on a sodium restricted diet. Selenium in Gibson Lake fish has risen to levels that resulted in a fishing ban in this 3,490-acre former fishing lake by Duke Energy. Surface water discharges from Gibson Lake, which receives water from the plant's ash ponds, contaminated fish and aquatic invertebrates in the Cane Ridge Wildlife Area and may have adversely affected the population of endangered least terns that nest there.

Determination

Demonstrated off-site damage to surface and groundwater, drinking water and aquatic life.

Test of Proof

On-site wells downgradient of the ash ponds show clear signs of CCW contamination with high levels of arsenic (ranging from 0.017 to 0.071 mg/L, 7 times the primary MCL), boron (ranging from 1.2 to 19 mg/L, more than 6 times the EPA, Child Health Advisory), iron (ranging from 3.1 to 45 mg/L, 150 times the secondary MCL), and manganese (1.2 to 5.2 mg/L, 104 times the secondary MCL) (IDEM). Drinking water contamination from boron and manganese has been documented in at least nine off-site private residential wells sampled in the fall of 2007 by Duke Energy and the fall of 2008 by the Natural Resources Defense Council with levels reaching 5.7 mg/L for boron, almost twice the Child Health Advisory, 6.95 mg/L for iron, 23 times the secondary MCL and 1.73 mg/L for manganese, 34 times the secondary MCL. Test results in the second round of sampling (2008) found very high levels of sodium. The average concentration was 139 mg/L, nearly 7 times the EPA's Drinking Water Advisory for healthy levels of sodium in water. The peak concentration of sodium in a semipublic well used by a church was 347 mg/L, 17 times the Drinking Water Advisory.

Selenium discharged from Gibson Generating Station to the Cane Ridge Wildlife Area led to concentrations of selenium in the water, soil, and biota that posed a high hazard risk to wildlife (Lemly, 1995). Water sampling in 2007 of discharges from Gibson Lake into the Cane Ridge Wildlife Area indicated selenium levels of 0.011-0.014 mg/L (USFWS, 2008). Aquatic invertebrates sampled in Cane Ridge had whole body selenium levels of 8-50 ug/g (USFWS, 2008). Fish whole body selenium levels in the wildlife area were 9-30 ug/g (USFWS, 2008). Recommended dietary level of selenium for wildlife is 3.0 ug/g (Lemly, 1993). Least tern eggs gathered at the site in 1996 and 2004 had selenium levels of 3.53-5.48 ug/g with levels rising over time and hatchling mortality was high (USFWS, 2008).

Constituents Involved

Arsenic, selenium, boron, manganese, and iron.

Incident and Date Damage Occurred / Identified

Groundwater monitoring began in the early 1990s. Contamination of private drinking water wells was discovered in 2007. Discharge to Cane Ridge Wildlife Area occurred from 2003-2008.

Regulatory Actions

Duke Energy agreed to supply drinking water to the homes with contaminated drinking water wells. The Indiana Department of Environmental Management (IDEM) plans no enforcement action.

Wastes Present

Fly ash and bottom ash.

Type(s) of Waste Management Unit

The site contains five ash impoundments and a Type II restricted waste landfill.

Active or Inactive Waste Management Unit

Active and inactive units.

Probable Cause(s)

Leaking of contaminants from ash impoundments into groundwater on the property and surface water discharges to the Cane Ridge Wildlife Area.

Additional Narrative

Duke Energy's Gibson Generating Station contains the generating station; five surface impoundments; a 3,490-acre lake that supplies all of the plant's cooling water; and a Type II restricted waste (CCW) landfill. Sizeable wetland habitats are adjacent to the site. The cooling lake and wetlands are part of a designated Important Bird Area and are important habitat and migration grounds for numerous bird species including the Least Tern. The cooling lake was formerly used by the public for fishing, but the Indiana Department of Environmental Management (IDEM) closed the lake to the public due to the detection of high selenium levels.

CCW generated by the Gibson Generating Station is sluiced into on-site impoundments. Excess water is discharged into the cooling pond, so the impoundments do not have National Pollution Discharge Elimination System (NPDES) permits. CCW is periodically scooped out of the impoundments and sent to an on-site CCW landfill. IDEM considers the surface impoundments to be temporary CCW storage areas and not subject to solid waste regulations. (IDEM, 2007) Gibson Generating Station's CCW impoundments are not lined, and groundwater monitoring is restricted to only one peizometer located near the impoundments. The results from this peizometer are not reported to the State.

Surface water samples are drawn from the East Ash Impoundment System and the cooling lake as part of the monitoring conducted for the CCW landfill. The surface water monitoring results shows high levels of arsenic (22 µg/L-490 µg/L), boron (8.7 mg/L-17 mg/L), and selenium (16 µg/L -75 µg/L). Monitoring at the cooling lake also shows signs of contamination from CCW due to elevated levels of arsenic (23 µg/L -57 µg/L), boron (6.1 mg/L- 8.4 mg/L), and selenium (6.8 µg/L -18 µg/L) (IDEM).

According to a preliminary assessment by senior scientist and selenium expert at the U.S. Forest Service, A. Dennis Lemly, Ph.D., the contaminated impoundments and cooling lake at Gibson Generating Station present "a definite hazard to aquatic life." Dr. Lemly stated:

> Waterborne selenium concentrations of 6-18 ppb would be expected to bioaccumulate to toxic levels in the diet of fish and aquatic birds (sufficient to cause reproductive impairment), particularly if selenium is predominantly selenite (which is likely in power plant effluents), and in a closed system.

Waste generated at the site is also dumped in a Type II Restricted Waste Landfill. The landfill has an older portion built in the 1970's, which is unlined. The only boundary between the wastes and the local aquifer is 5-8 feet of local clay soil. The newer portion was constructed around 2002 and has a composite liner. The landfill has 17 monitoring wells, 2 designated as upgradient wells and 15 designated as downgradient wells. The "upgradient" wells have detected high levels of boron, an indicator of CCW contamination. This should call into question whether the results from these wells can truly be considered upgradient. Downgradient wells show clear signs of CCW contamination with high levels of boron (ranging from 1.2-19 mg/L) and arsenic (ranging from 17-71 µg/L) (IDEM). IDEM staff have conceded that the current wells designated as "upgradient" are too close to the CCW to be reliably considered "upgradient."

Boron contamination was found in drinking water wells in the nearby town of East Mt Carmel while the company was testing the wells as part of a study on contamination from CCW impoundments. The results of the residential well testing are not publicly available. Duke Energy has accepted responsibility for the contamination and is supplying the town residents with bottled water. The bottled water is not being supplied through any official agreement, so it is unknown how long Duke will supply the water, however a water line has been laid to the town from a nearby water supply utility. IDEM is satisfied with the voluntary action taken by Duke Energy and has not taken any official action with regard to the contamination of drinking water wells.

From 2003-2008, water from the cooling lake was discharged to the Cane Ridge Wildlife Management Area, a section of the Patoka River National Wildlife Refuge. Cane Ridge is an important habitat area for a number of bird species including the endangered least tern. The site is also adjacent to Coffee Bayou Natural Area, the largest remaining floodplain forest along the lower Wabash River. Selenium was measured at 11-14 µg/L in samples of this discharge collected in the Fall of 2007 (USFWS, 2008).

SOURCES

John Guerrettaz, Senior Geologist of IDEM, Discussion with Brian Wright (Dec. 12, 2007).

Indiana Department of Environmental Management. Various Dates. Gibson Monitoring Results.

Lemly, A. D. 1993. Guidelines for Evaluating Selenium Data from Aquatic Monitoring and Assessment Studies. *Environmental Monitoring and Assessment* (28):83-100.

Lemly, A. D. 1995. A Protocol for Aquatic Hazard Assessment of Selenium. *Ecotoxicology and Environmental Safety* (32):280-288.

United States Fish and Wildlife Service (USFWS). 2008. Briefing Statement: Duke Energy's Gibson Lake Selenium Contamination - Ramifications for Cane Ridge and Interior Least Terns (May 28, 2008).

ENTITY/COMPANY - LOCATION

Indiana Kentucky Electric Corporation (IKEC) – Clifty Creek Station
1335 Clifty Hollow Rd
Madison, IN 47250
Jefferson County
GPS Coordinates: 38°44'18.34"N, 85°25'12.65"W

Summary

Groundwater monitoring at Clifty Creek Station's CCW Landfill has measured high levels of boron, manganese, iron and sulfate in downgradient groundwater. Manganese concentrations have climbed to 38 times the secondary MCL, and boron concentrations increased to 6 times the US EPA's Child Health Advisory. The extent of the plume has not been determined.

Determination

Demonstrated on-site damage moving off-site.

Test of Proof

Groundwater monitoring found elevated levels of boron, up to 18 mg/L, manganese, up to 1.9 mg/L, iron, up to 5.2 mg/L, and sulfates, up to 480 mg/L (IDEM).

Constituents Involved

Boron, manganese, iron, and sulfates.

Regulatory Actions

None.

Wastes Present

Fly ash and boiler slag.

Type(s) of Waste Management Unit

The landfill is a Type III Restricted Waste Landfill as defined by Indiana regulations. The landfill is constructed on top of an old unlined ash impoundment, yet the Indiana Department of Environmental Management (IDEM) approved a new permit allowing IKEC to build a new Type I Restricted Waste Landfill on top of the existing landfill.

Active or Inactive Waste Management Unit

Active.

Probable Cause(s)

Leaching of contaminants into groundwater.

Additional Narrative

The landfill is located between the bluffs of the Ohio River and a narrow ridge of limestone. The landfill was built in 1992 on top of an ash impoundment. The existing landfill does not have a liner. The landfill has three downgradient wells and one well located within the old fly ash impoundment. The site has no upgradient wells. All the wells are located on the southern end of the landfill. Citizens groups appealed the renewal

permit for the landfill in 2002, and requested monitoring along the northern end of the landfill and a liner for future expansions (Save The Valley). IKEC and IDEM have rejected these proposed changes. The permit appeal is still being disputed in court.

The downgradient wells have detected statistically significant increases in boron. The latest groundwater monitoring results show boron contamination up to 13.7 mg/L in downgradient wells. IKEC and IDEM contend that the contamination is flowing into the river where it is diluted. However, groundwater studies of the area indicate that groundwater is flowing out of the northern end of the landfill where it could potentially flow to the City of Madison's municipal wells.

SOURCE(S)

Indiana Department of Environmental Management (IDEM). Various Dates. Indiana Kentucky Electric Corporation Clifty Creek Landfill Permit, FP #39-04 and permit monitoring data.

Save the Valley. 2002. Save the Valley et al vs. Indiana Kentucky Electric Corporation and Indiana Department of Environmental Management. Objection to Approval Of Solid Waste Facility Major Modification. Cause NO. 08-S-J-4106.

ENTITY/COMPANY - LOCATION

Mirant MD Ash Management, LLC / Mirant Mid-Atlantic, LLC – Brandywine Coal Ash Landfill
11700 North Keys Road
Brandywine, MD 20613
Prince George's County
GPS Coordinates: 38°41'50.36"N, 76°48'19.31"W

Summary

The Brandywine Coal Ash Landfill has contaminated groundwater and surface water with multiple pollutants through leaks in disposal pits and direct discharges of leachate to surface water from outfalls. The Maryland Department of the Environment (MDE) has documented , cadmium levels that exceed the primary MCL, and levels of, aluminum, chlorides, iron, manganese, sulfates, and total dissolved solids at levels that exceed secondary MCLs —some as high as 50, 100, and even 600 times the primary MCL—in groundwater beneath and downgradient of the landfill. Cadmium levels, for example, have been documented at 100 times the 5 µg/L primary MCL in one groundwater monitoring well. Cadmium and lead levels also exceed water quality criteria regularly in Mataponi Creek downstream of the discharges from this Landfill.

Determination

Demonstrated on-site damage to groundwater and off-site damage to surface water

Test of Proof

Ground and surface water monitoring reveal exceedances of primary and secondary MCLsand water quality criteria for the protection of aquatic life for multiple pollutants. In addition, discharge monitoring reports detected exceedances of the water quality criteria for aquatic life for selenium. For example, groundwater, surface water, and discharge monitoring data collected from 2002 through 2008 document the following:

- Well B10 reported cadmium levels 100 times the 5 µg/L primary MCL.
- Wells B3, B12, B13, and B14 repeatedly report high levels of iron, and Well B14 reported levels exceeding the 0.3 mg/L secondary MCL by as much as 600 times.
- All wells reported manganese levels as high as 50 to 60 times the secondary MCL of 0.05 mg/L.
- All wells reported significant levels of aluminum, and Well B14 reported levels as high as 100 to 150 times the 0.2 mg/L secondary MCL.
- Wells B14, B12, and B10 reported levels of total dissolved solids as high as 5 times the 500 mg/L secondary MCL.
- Most wells reported high levels of sulfates, and Wells B12, B10, and B14 were as high as 6 to 8 times hthe 250 mg/L secondary MCL.
- Well B14 reported levels 2 times the drinking water standard for chlorides.
- Cadmium regularly exceeds the chronic water quality criteria in Mataponi Creek and occasionally exceeds the acute criteria.
- Lead levels regularly exceed the chronic water quality criteria.
- Between 2006 and 2008, selenium levels in discharge from outfalls consistently exceeded the water quality criteria.

Constituents Involved

Cadmium, selenium, lead, manganese, iron, aluminum, sulfates, total dissolved solids, and chlorides

Incident and Date Damage Occurred / Identified

An MDE report dated August 12, 2008 identified exceedances of drinking water standards in groundwater and exceedances of water quality criteria for aquatic life in surface water based on monitoring data from 2002 through 2008.

Regulatory Actions

Citizen groups sent a notice of intent to sue to Mirant MD Ash Management, LLC and Mirant Mid-Atlantic, LLC for violations of the Clean Water Act on November 19, 2009, and MDE sent a separate notice of intent to sue for similar violations on January 15, 2010. The citizen groups and MDE claim that Mirant is discharging pollutants into groundwater without a permit. They also allege that Mirant is discharging antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, mercury, nitrate, nitrogen, phenols, radium, and silver from outfalls without a National Pollutant Discharge Elimination System (NPDES) permit. In addition, the citizen groups and MDE claim that Mirant is discharging cadmium from outfalls at levels that exceed state water quality standards.

Wastes Present

Fly ash and bottom ash generated at the Chalk Point power plant.

Type(s) of Waste Management Unit

Landfill

Active or Inactive Waste Management Unit
Active.

Hydrogeologic Conditions
Shallow groundwater beneath the site discharges into Mataponi Creek and its tributaries.

Probable Cause(s)
Migration of pollutants to ground and surface water from leaks in multiple disposal pits and ponds, and direct discharge of pollutants to surface water from four outfalls.

Additional Narrative
In addition to exceedances of primary and secondary MCLs in the shallow groundwater underneath the landfill, this groundwater discharges to Mataponi Creek. As a result cadmium and lead regularly exceed water quality criteria for the protection of aquatic life in Mataponi Creek downstream from this landfill. Although Mirant does not appear to monitor for selenium at surface water stations in Mataponi Creek, Mirant consistently reports selenium exceedances of the water quality criteria in its discharges to Mataponi Creek.

Most of the disposal pits at the Brandywine landfill are unlined. Some disposal pits have leachate collection systems. Only one of the disposal pits is lined with a Geosynthetic Liner, which consists of a "compacted clay sub-base, 60-mil PVC geomembrane liner, a 250-mil HDPE geonet, and 18 inches of bottom ash drainage layer." Wastewater treatment at the site consists of four settling ponds that collect and treat leachate and groundwater. Leachate is discharged from four outfalls into Mataponi Creek and its tributaries. In addition, shallow groundwater beneath the site discharges into Mataponi Creek.

SOURCES

Hatfield, Charles. 2008. Brandywine Ash Site, MDE (Aug. 12, 2008).

Mirant MD Ash Management, LLC (Mirant). 2008. Brandywine Fly Ash Facility: Report Addressing NPDES Condition 'M' Chesapeake Bay 2000 Agreement (Feb. 29, 2008).

Barrett, Jane. 2009. Letter from Jane Barrett, Environmental Law Clinic at the University of Maryland School of Law, et al., to Edward R. Muller, Mirant Corporation, et al. (Nov. 19, 2009).

Wilson, Shari T. 2010. Letter from Shari T. Wilson, MDE, to Edward R. Muller, Mirant Corporation, et al. (Jan. 15, 2010).

ENTITY/COMPANY - LOCATION

Consumer Energy – Karn/Weadock Generating Facility
2742 North Weadock Highway
Essexville, MI 48732
Bay County
GPS Coordinates: 43° 38'43" N, 83°49'54" W

Summary

The Karn and Weadock Landfills are two adjacent coal ash disposal sites constructed on a narrow strip of land between the Saginaw River and Saginaw Bay of Lake Huron. Both sites are unlined and were originally coal ash impoundments. Monitoring onsite has measured very high levels of arsenic and boron in the groundwater surrounding these landfills. Arsenic concentrations at up to 0.443 mg/L, more than 44 times the federal primaryMCL, in groundwater outside of the landfill and the power plant property (MDEQ, 2009a). Studies have found that the landfills are a major contributor of arsenic to the Saginaw Bay Area of Concern (AOC) (MDEQ, 2005).

Determination

Demonstrated on-site damage to groundwater moving off-site.
Demonstrated off-site damage to surface water.

Test of Proof

Groundwater monitoring at the site has detected high levels of boron (up to19.4 mg/L) and arsenic (up to 0.997 mg/L) in the groundwater surrounding the site (MDEQ, 2009a). Studies have found that the landfills are a major contributor of arsenic to the Saginaw Bay Area of Concern (AOC) (MDEQ, 2005). Arsenic concentrations have been documented at up to 0.443 mg/L outside of the landfill and power plant property, more than 44 times the federal primary MCL (MDEQ, 2009a). This concentration came from a groundwater monitoring well in Lake Huron that is measuring the quality of groundwater discharging to the Lake.

Constituents Involved

Arsenic, boron, lithium, mercury, and phosphorus.

Incident and Date Damage Occurred / Identified

The State of Michigan and Consumer Energy first determined that there was a potential for leakage from the landfills in 1982. In 2001, an assessment determined that the contaminants could reach Lake Huron. Groundwater monitoring later confirmed that contaminants were reaching Saginaw Bay in levels that exceed federal standards (MDEQ, 2009b).

Regulatory Actions

In response to ongoing contamination, the Michigan Department of Environmental Quality (MDEQ) issued a Letter of Warning to Consumer Energy as the first step in an enforcement action. As a result, the state and Consumer Energy have been negotiating a consent decree that will require Consumer Energy to build slurry walls around both landfills in order to reduce the flow of contaminants outside of the landfill. One wall has already been finished, and the other is currently being constructed.

Wastes Present

Coal combustion waste.

Type(s) of Waste Management Unit

The two sites are surface impoundments that are currently being regulated as landfills.

Active or Inactive Waste Management Unit

Active.

Probable Cause(s)

Migration of contaminants from coal ash leachate to groundwater and subsequent discharge to surface water.

Additional Narrative

The Karn and Weadock Landfills, as they are officially called, are in fact large surface impoundments located adjacent to where the Saginaw River flows into Saginaw Bay. The two disposal sites receive coal ash from Consumer Energy's Karn/Weadock Generating Facility, and were constructed in 1959 and 1961. The two disposal sites cover a total of 174 acres, and have a capacity of 4,175,000 cubic yards. Ash was traditionally sluiced from the generating station to the two impoundments, but the Weadock Landfill is transitioning over to a dry ash disposal system in response to ongoing contamination problems.

According to state documents, groundwater contamination from the two impoundments has resulted in elevated levels of arsenic, boron, and lithium. Mercury and phosphorous are also identified as constituents of concern although no exceedances of standards were provided in the information reviewed. A groundwater mound has developed beneath the impoundments, and as a result the contamination is flowing into both the Saginaw River and Saginaw Bay. Arsenic levels up to 0.997 mg/L have been measured in the groundwater between the berm of the impoundment and Lake Huron (MDEQ, 2009a). The contamination plumes are estimated to extend 100 to 500 feet from the dike of the Karn Landfill and 100 to 300 feet from the dike of the Weadock Landfill.

The area where the Saginaw River flows into Saginaw Bay has been designated an Area of Concern (AOC) by the International Joint Commission, which is a joint American and Canadian board that addresses issues regarding the Great Lakes and Boundary Waters area. An AOC is declared due to impairments of beneficial uses by contamination, which, in the case of the Saginaw Bay AOC, includes damage to fish and wildlife populations and restrictions on drinking water consumption. The AOC is a result of multiple sources of pollution, but studies have found that the Karn and Weadock Landfills are major contributors of arsenic contamination to the AOC (MDEQ, 2005).

SOURCES

Michigan Department of Environmental Quality(MDEQ). 2005. Phase II Final Report, Karn/Weadock Landfills.

Michigan Department of Environmental Quality (MDEQ). 2009a. DEQ CE Karn Weadock Ground Water Monitoring, *available at* http://www.michigan.gov/documents/deq/GSI_MZ_Monitoring_298496_7.pdf

Michigan Department of Environmental Quality (MDEQ). 2009b. Overview: DEQ Information Sharing Meeting (Oct. 13, 2009), *available at* http://www.michigan.gov/documents/deq/OverviewCompHist_298495_7.pdf .

ENTITY/COMPANY - LOCATION

PPL Montana – Colstrip Power Plant
580 Willow Ave.
Colstrip, MT 59323
Rosebud County
GPS Coordinates: 45° 54' 18"N 106° 39' 10"W (Stage I and II Evaporation Ponds)

Summary

Temporary and permanent CCW disposal ponds serving the Colstrip Steam Electric Station surround the town of Colstrip, MT. Temporary ponds at the Plant Site have leached boron and other constituents into groundwater beneath an adjacent residential area. Permanent disposal ponds located to the northwest of Colstrip include the "closed" Stage I Evaporation Pond and the active 176-acre Stage II Evaporation Pond, which opened in the late 1980s. The combined contaminant plume from the Units I & 2 Stage I & II Evaporation Ponds extends more than 1000 feet in the direction of Colstrip and has affected downgradient private property and drinking water wells. Testing results from the most contaminated well, at the local Moose Lodge, revealed boron levels at more than 6 times the EPA's Health Advisory for child ingestion of boron in drinking water, and sulfate at 12 times the health-based EPA's Drinking Water Advisory for sulfate in drinking water.

Company officials were aware of the boron contamination at the Moose Lodge in the 1980s, but information about the extent of contamination was not made public until the power companies replaced it in 1998. By then, many members of the Lodge had experienced stomach ailments after drinking the wellwater. City water was eventually extended to the subdivision. Fifty-seven residents of Colstrip, including members of the Moose Lodge, filed a lawsuit in 2003, claiming damages for groundwater contamination, damage to homes and businesses caused by subsurface subsidence (from leakage from the Surge Pond, the 140-acre reservoir built above town to hold Yellowstone River water for use at the plant), emotional distress regarding leakage of contamination from the Stage I Evaporation Pond into the Surge Pond (which is the drinking water supply within the city limits), remediation damages and punitive damages. In 2008 the owners of the power plant settled with the 57 plaintiffs for $25 million.

The 367-acre Units 3 & 4 Effluent Holding Pond (EHP) is located approximately 3 miles to the southeast of Colstrip. The 3/4 EHP, which opened in 1983, has caused contamination far greater than expected in every direction. In 2004, a leak of polluted water was discovered on private property about one mile to the south of the EHP. The owners of the Colstrip SES purchased the impacted property from the railroad, and terminated the long-standing grazing leases held by neighboring ranching families. Surface and groundwater contamination from the EHP was also extended far to the west of the EHP. The ranchers who own these lands filed an ongoing lawsuit in 2007. Their claims include damages for groundwater contamination, emotional distress, groundwater depletion due to capture well and trench systems employed by the power companies to attempt to collect the leakage from the 3/4 EHP, remediation, and punitive damages.

Determination

Demonstrated off-site damage to private water wells

Test of Proof

Waters in the various CCW disposal areas, specifically in four areas of the Stage I and Stage II evaporation ponds have extremely high average concentrations of TDS (14,600 mg/L to 22,700 mg/L), sulfates (10,100 mg/L to 21,700 mg/L), and boron (68.5 mg/L to 122 mg/L). Selenium concentrations were 2 to 3 times the primary MCL (0.103 mg/L to 0.174 mg/L) and levels of molybdenum (where measured—0.121mg/L) exceeded the World Health Organization MCL for drinking water (0.07 mg/L). (Data from PPL Montana Environmental Engineering Department, Colstrip, MT).

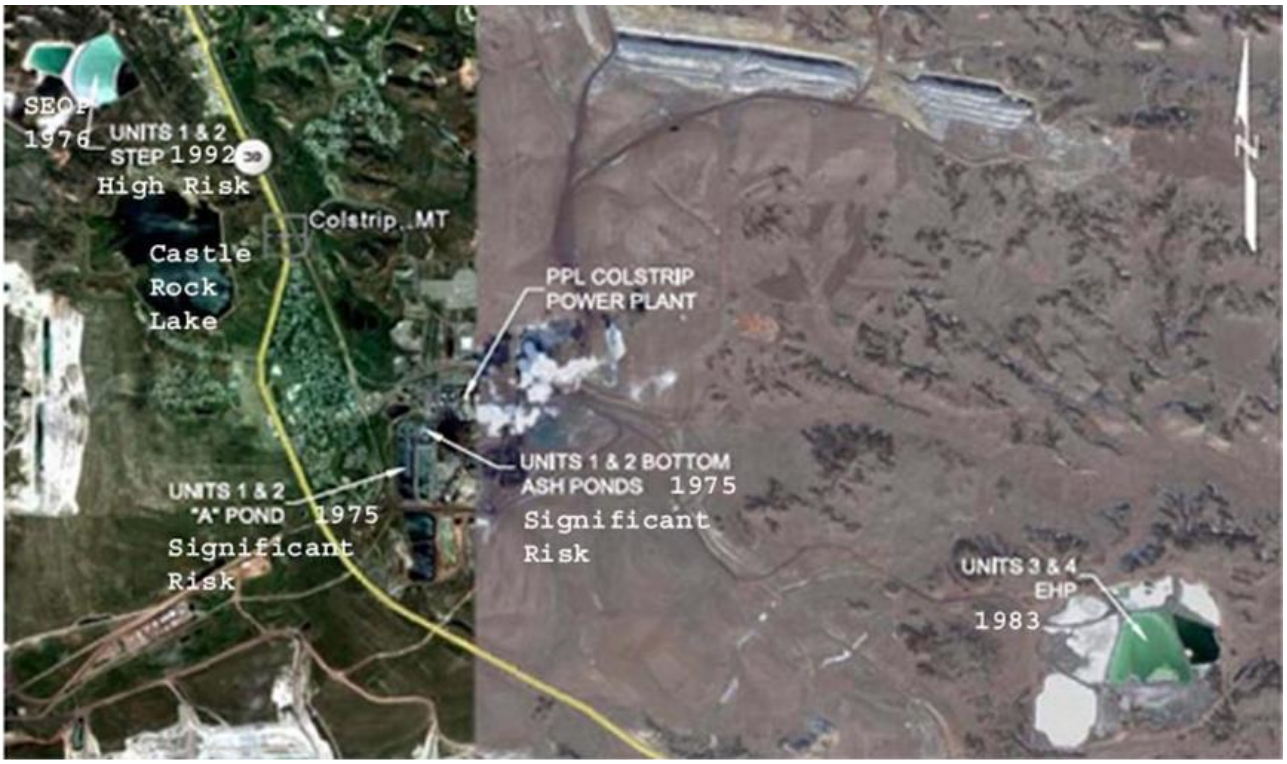
Boron contamination of groundwater from the Stage 1 Pond (SOEP) was known to company officials by the early 1980s (Pack, 1984). Data in a hydrogeologic assessment of the Stage I and Stage II Evaporation Pond (EP) area and the Plant Site areas (Maxim, 2004) show the following:

- Groundwater in many monitoring wells near the Stage I and Stage II ponds contains elevated levels of boron, chloride, sulfate, specific conductance (SC) and total dissolved solids (TDS).
- From 1976 to 1995 contaminated groundwater had migrated 200 to 300 feet north from the Stage I pond and by 2003 the contaminant plume had extended a distance of 400 or 500 feet north (an additional 200 to 300 feet in eight years).
- From 1976 to 2003, contaminated groundwater from the Stage I pond had also migrated more than 1,000 feet southeast.
- By 1993, water from the Stage I and Stage II ponds had seriously contaminated shallow groundwater to the southeast of the Stage II Dam where residents of Colstrip lived and used wells for drinking water.
- Moose Lodge (PW-704) was the most severely contaminated well, where boron concentrations gradually rose from 1.0 mg/L around 1987 to 3.0 mg/L in 1993, and then to levels around 20 mg/L since 1999. The latest boron levels are more than 6 times the EPA's Child Health Advisory of 3.0 mg/L and 20 to 40 times health-based standards for boron in drinking water used by other regulatory agencies such as the European Union (1.0 mg/L), World Health Organization (0.5 mg/L) and Minnesota Department of Health (1.0 mg/L). By the late 1990s, concentrations of sulfate at Moose Lodge were around 6000 mg/L. This is 12 times the EPA's health-based Drinking Water Advisory and 24 times the secondary MCL. TDS levels were around 9500 mg/L, 19 times the secondary MCL. The Moose Lodge well was replaced and is no longer used for water supply. In 2003, three other private wells showed contamination by TDS or chloride.
- In the Plant Site area (southeast of the town of Colstrip) where the Units 1 & 2 "A" Pond and Units 1 & 2 Bottom Ash Ponds are located, groundwater beneath and downgradient contains elevated levels of boron, chloride, SC, sulfate and TDS. Groundwater samples taken in 2003 found levels of boron ranging from 5.0 to 65.2 mg/L (22 times the EPA's Child Health Advisories) in 17 monitoring wells.

The extent of groundwater contamination was not publicly known until the power companies replaced the Moose Lodge well in 1998. More information about the contamination was revealed when residents of Colstrip sued the consortium that owns PPL Montana over groundwater issues in 2003. Through the discovery process, subsurface compaction issues during construction at Stage II ponds were revealed and the fact that repeated liner failures at the pond occurred in 1989, 1991, and most notably in 1996. When the failures occurred, the companies failed to inform residents downgradient from the ponds. Several residents of the B&R subdivision experienced very strange odors and taste in their drinking water. Furthermore, the power companies denied boron contamination in the Trailer Court next to the Plant Site by avoiding placement of monitoring wells in the vicinity. When three wells were eventually drilled to test for contamination, it was found in each well. Alan Nye, a Tennessee toxicologist who reviewed the contamination data for the plaintiffs in the lawsuit, noted in court records that "private wells contaminated by the… plume should not be used for irrigation water or for drinking by people or animals." (Lombardi, 2009)

Constituents Involved

Boron, sulfate, TDS, selenium and molybdenum.



Incident and Date Damage Occurred / Identified

Boron contamination of groundwater from the Stage I Evaporation Pond northwest of the Town of Colstrip was known to company officials by the early 1980s. In the early 1990s members of the Moose Lodge were made ill by drinking water from the well and stopped using it.

Regulatory Actions

In February 2010, the Montana Department of Environmental Quality (DEQ) proposed an Administrative Order on Consent (AOC) regarding the Colstrip Steam Electric Station to require remediation of seepage of waste water into groundwater and soil at and downgradient of: (1) the main plant site; (2) the Units 1 & 2 Stage I and II evaporation ponds northwest of the main plant site; (3) the Units 3 & 4 effluent holding ponds southeast of the main plant site; and (4) downgradient of past pipeline spills and other mutually agreed upon miscellaneous areas. The proposed AOC provides a mandatory procedure for the investigation and remediation of releases from the Colstrip Station, including a public participation component.

There are concerns that this AOC could actually sanction continued off-property leakage from the ponds of Colstrip. Instead of fixing the reservoirs, and complying with their "closed-loop" permit, citizens fear the AOC could allow Colstrip's operators to discharge from all 3 sites and from leaks in attendant pipelines. The AOC reportedly has no provisions for compliance boundaries and includes no timeframe for compliance with remediation objectives.

Wastes Present

Fly ash, bottom ash, flue gas desulfurization wastes.

Type(s) of Waste Management Unit

CCW Impoundments

Active or Inactive Waste Management Unit

Inactive: Stage One Evaporation Pond (SEOP) northwest of town built in 1976 with a clay buffer, covered with an earthen liner in 1997.

Active: 176-acre Stage Two Evaporation Ponds (STEP) northwest of town built in 1992. In 2006 the B cell section was double-lined with 45-mill RFP and a leachate collection system installed. In 2006 the unit was estimated to be at 45% of capacity. This is rated as a "high hazard" impoundment by U.S. EPA (2009).

Inactive: Units 1 & 2 Fly ash "A" Pond southeast of town built in 1975 removed from service in 2005 by covering with a geocomposite clay blanket and bottom ash. The area is now used as a clean water storage pond from stormwater runoff. This is rated as a significant hazard impoundment by U.S. EPA (2009).

Active: Units 1 & 2 B Fly ash Pond southeast of town built in 1975. In 2004 this unit was converted to a double-lined 45-mil RFP pond with leachate collection.

Active: Units 1&2 Bottom Ash Pond southeast of town was built in 1988. Bottom ash and boiler slag are temporarily stored in this pond before placed in the Units 3&4 EHP. This impoundment is rated as a significant hazard impoundment by U.S. EPA (2009).

Active: 367-acre Units 3 & 4 Effluent Holding Pond (EHP) was built in 1983 to hold fly ash, bottom ash, boiler slag and flue gas emission control residuals. In 2005 it was estimated to be at 55% of capacity. In 1999 a seepage event resulted in internal erosion of the Saddle Dam embankment and core that made the dam unsafe if water levels rose significantly above an elevation of 3,237 ft (GEI Consultants, 2009).

Hydrogeologic Conditions

Principle water bearing units in the area surrounding the Stage I and Stage II Evaporation Ponds (EP) where much of the contamination originated are the Shallow Sub McKay Sandstones, Deep Sub McKay Sandstones, alluvium in the ephemeral drainage beneath and downstream of the ponds and alluvium associated with the East Fork Armells Creek. Groundwater north of the Stage I pond flows to the north.

Principle water-bearing zones at the Plant Site area are the shallow groundwater system in alluvium, spoils, unconsolidated overburden and Rosebud coal, and a deeper system in McKay Coal and the Sub McKay Sandstones. Groundwater in the southeastern part of the area flows to the southeast. Shallow and deeper groundwater in the northern area flows to the northwest towards the East Fork Armells Creek. Groundwater in the Town of Colstrip generally flows to the east and northeast toward the East Fork Armells Creek. (Maxim Technologies, 2004)

Probable Cause(s)

Seepage from unlined CCW impoundments

Additional Narrative

Since Units 1 & 2 of the Colstrip power plant were constructed by Montana Power Company in the 1970s, and with the addition of Unit 3 in 1983 and Unit 4 in 1986, numerous waste ponds for disposal of CCW have been constructed in the vicinity of the Town of Colstrip (see above summary information about seven of them). Since 1999 PPL Montana, which operates the plant, has installed liners and leachate collection systems in some of the CCW disposal areas.

As noted above in the description of CCW management units, the EPA's Coal Ash Impoundment Survey identifies three of the impoundments in the vicinity of the Town of Colstrip as having a significant or high hazard potential (US EPA, 2009). The detailed site assessment recommended designing and installing piezometers to monitor water pressure in the embankment and foundations for these dams and noted that repair of minor surface erosion on the upstream and downstream slopes of the STEP Dam was needed (GEI, 2009). Although the EPA gave the EHP impoundment a low hazard potential rating because it is more distant from the Town of Colstrip, the site specific assessment noted structural weakening of this impoundment as a result of a seepage event in 1999 which requires maintaining water levels below its design capacity (GEI, 2009).

In 2003 a lawsuit was filed by residents of Colstrip alleging harm from the operations of Colstrip's impoundments and waste ponds. In May 2008 the five utility companies that jointly own and operate the Colstrip power plant finalized a $25 million settlement with the 57 plaintiffs who blame the utilities for contaminating their groundwater and causing structural damage to some properties (Halstead-Acharya, 2008). In a statement, the PPL Montana calls the $25 million settlement reached in May "a good outcome for all parties involved." It stresses that PPL Montana "inherited the groundwater issues after it purchased an interest in Colstrip in 1999 and took immediate steps to correct them" — installing monitoring wells and modern pond liners. The lawsuit prompted the company to spend $900,000 to extend municipal water to the neighborhoods below the ponds (Lombardi, 2009).

The 367-acre Units 3 & 4 Effluent Holding Pond (EHP) is located approximately 3 miles to the southeast of Colstrip. The 3/4 EHP, which opened in 1983, has caused contamination far greater than expected in every direction. In 2004, a leak of polluted water was discovered on private property about one mile to the south of the EHP. The owners of the Colstrip SES purchased the impacted property from the railroad, and terminated the long-standing grazing leases held by neighboring ranching families. Surface and groundwater contamination from the EHP was also extended far to the west (up to at least 0.7 mile to one impacted well) of the EHP.

The ranchers who own these lands filed a lawsuit in 2007. Their claims include damages for groundwater contamination, emotional distress, groundwater depletion due to capture well and trench systems employed by the power companies to attempt to collect the leakage from the 3/4 EHP. Residents of Colstrip also allege that the Stage I Evaporation Pond, one of the oldest unlined waste ponds at the plant, contributes contaminants to Castle Rock Lake, the city's fresh water supply (Earthjustice, 2008).

SOURCES

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ENTITY/COMPANY - LOCATION

Progress Energy – Sutton Steam Plant
801 Sutton Steam Plant Road
Wilmington, NC 28401
New Hanover County
GPS Coordinates: 34°16'59.78"N, 77°59'8.14"W

Summary

Voluntary groundwater monitoring at the Sutton Plant coal ash impoundment detected levels of arsenic, boron, iron and manganese that exceed state groundwater standards. Arsenic concentrations were measured as high as 29 times the federal primary MCL. Groundwater monitoring indicates that the contamination is migrating outside of the state designated compliance boundary for the coal ash impoundment. The North Carolina Department of Environment and Natural Resources (DENR) issued a Notice of Violation and requested corrective action.

Determination

Demonstrated on-site damage to groundwater migrating off-site

Test of Proof

Groundwater monitoring found exceedances of North Carolina Groundwater Standards (15 A N.C. Administrative Code 2L Groundwater Standards) in groundwater downgradient of the impoundment. Arsenic ranged from 0.13-0.29 mg/L, nearly 6 times the state groundwater standard of 0.05 mg/L and 29 times the federal primary MCL. Boron ranged from 0.73 – 3.06 mg/L, more than 9 times the groundwater standard of 0.315 mg/L. Manganese ranged from 0.06-1.09, more than 21 times the groundwater standard for manganese of 0.05 mg/L. Iron ranged from 0.331-4.75, nearly 16 times the groundwater standard of 0.3 mg/L (DENR). The full extent of the plume is unknown. Contamination has spread at least 500 ft. from the ash impoundment, outside of the state designated compliance boundary for the ash impoundment.

Constituents Involved

Arsenic, boron, manganese, and iron.

Incident and Date Damage Occurred / Identified

Groundwater monitoring began in December 2006 and immediately detected exceedances of groundwater standards.

Regulatory Actions

The North Carolina Department of Environment and Natural Resources (DENR) is aware of existing groundwater contamination at levels that exceed state groundwater standards at 13 coal ash impoundments across the state. The Sutton Plant manages the only coal ash impoundment in North Carolina that has monitoring wells beyond the compliance boundary that are not upgradient or considered background. Since groundwater contamination has occurred beyond the compliance boundary at the Sutton plant, DENR issued a Notice of Violation and requested corrective action.

Wastes Present

Coal combustion waste, unknown components.

Type(s) of Waste Management Unit

Coal ash surface impoundment.

Active or Inactive Waste Management Unit

Active.

Probable Cause(s)

Leaching of contaminants from CCW impoundments into groundwater.

Additional Narrative

The Progress Energy Sutton Plant is a 600 MW coal plant constructed in 1949. The plant's impoundment actually consists of two ash ponds covering a total of 135 acres. Voluntary groundwater monitoring results detected levels of arsenic, boron, iron, and manganese levels above state groundwater standards. New Hanover County operates public water supply wells on property immediately to the south of the property that contains these ash ponds.

SOURCES

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Progress Energy. 2009b. Map, Sutton Ash Pond Figure 1 4-23-09.pdf

ENTITY/COMPANY - LOCATION

Progress Energy – Lee Steam Plant
1677 Old Smithfield Road
Goldsboro, NC 27530
Wayne County
GPS Coordinates: 35°22'48.54"N, 78° 5'16.18"W

Summary

Groundwater monitoring at the Lee Steam Plant site has found levels of arsenic, boron, iron, lead, and manganese that exceed North Carolina Code 2L Groundwater Standards. Arsenic concentrations have been measured as high as 44 times the federal primary MCL and lead concentrations have been measured at nearly 3 times the primary MCL in underlying groundwater. The extent of the plume is unknown.

Determination

Demonstrated on-site damage to groundwater moving off-site

Test of Proof

Groundwater monitoring has found contaminant concentrations that exceed state groundwater standards. Arsenic ranged from 0.08-0.44 mg/L, over 8 times the North Carolina groundwater standard of 0.05 mg/L at the upper limit, and 44 times the primary MCL of 0.010 mg/L. Lead ranged from .031-.047 mg/L, up to 3 times the state groundwater standard of 0.015 mg/L (identical to the primary MCL). Boron levels ranged from 0.49-1.7, over 5 times the state groundwater standard of 0.315 mg/L. Manganese ranged from 0.81 – 1.91 mg/L, over 38 times the state groundwater standard. Iron ranged from 3.14 – 22.1 mg/L, over 73 times the state groundwater standard (DENR).

The Lee Plant property boundary is less than 250 feet from the ash impoundment, and downgradient wells show contamination migrating toward neighboring properties. No off-site monitoring exists to determine whether the contamination has crossed the property line.

Constituents Involved

Arsenic, lead, boron, manganese, and iron.

Incident and Date Damage Occurred / Identified

Monitoring began in July 2007 and testing immediately found groundwater contamination.

Regulatory Actions

The North Carolina Department of Environment and Natural Resources (DENR) is aware of existing groundwater contamination at levels that exceed state groundwater standards at the Lee Plant. DENR has not required a corrective action plan to restore contaminated groundwater at the site. DENR has no plans to take action to eliminate the source of contamination until it reaches the compliance boundary, which in the case of the Lee Plant is 500 feet beyond the coal ash pond boundary. According to Progress Energy maps, the compliance boundary extends beyond the Progress Energy property line onto an adjacent property and across the public navigable waters of the Neuse River.

Wastes Present

Coal combustion waste, unknown components

Type(s) of Waste Management Unit

Unlined ash impoundment.

Active or Inactive Waste Management Unit

Active.

Probable Cause(s)

Leaching of CCW contaminants into groundwater.

Additional Narrative

The Progress Energy Lee Plant was constructed in 1951 and has 397 MW of coal-fired capacity. The Lee Plant has one active unlined ash impoundment covering 143 acres with a capacity of 1980 acre-feet. Voluntary groundwater monitoring at the site has detected levels of arsenic, boron, iron, lead and manganese that exceed state groundwater standards. According to groundwater monitoring records for the site, contamination is migrating to the south of the impoundment toward the Neuse River, and to the north of the plant where homes are located less than half a mile from the impoundment (NC DENR).

SOURCES

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North Carolina Department of Environmental and Natural Resources (NCDENR). 2009. Conversations with Ed Mussler and Sergei Chernikov of the DENR.

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ENTITY/COMPANY - LOCATION

Progress Energy – Cape Fear Steam Plant
500 CP&L Road
Moncure, NC 27559
Chatham County
GPS Coordinates: 35 degrees 35'25" N, 79 degrees 02'28" W

Summary

Groundwater monitoring at the impoundments at Cape Fear Steam Plant has found levels of lead, chromium, boron, iron, manganese, and sulfates that exceed North Carolina Code 2L Groundwater Standards. For example, lead was 3.5 times the state groundwater standard and federal primary MCL, and chromium was two times the state groundwater standard and equal to the federal primary MCL in underlying groundwater. The only monitoring that has occurred has been from points adjacent to the impoundments, so the extent of the plume has not been determined.

Determination

Demonstrated on-site damage to groundwater

Test of Proof

Groundwater monitoring found lead at concentrations as high as 0.0533 mg/L, 3.5 times the North Carolina groundwater standard and federal primary MCL of 0.015 mg/L. Chromium was found at 0.1 mg/L, 2 times the North Carolina groundwater standard of 0.05 mg/L. Boron concentrations were as high as 5.24 mg/L, over 16 times the North Carolina groundwater standard of 0.315 mg/L. Manganese was measured up to 9.55 mg/L, 191 times the North Carolina groundwater standard of 0.05 mg/L. Iron was measured up to 114 mg/L, 380 times the North Carolina groundwater standard of 0.3 mg/L. Sulfate was measured up to 448 mg/L, 1.8 times the North Carolina groundwater standard of 250 mg/L. (DENR). All wells are within 125 ft. of the impoundment so the extent of the contamination is unknown.

Constituents Involved

Lead, chromium, boron, iron, manganese, and sulfate.

Incident and Date Damage Occurred / Identified

Monitoring began in March of 2007, and evidence of contamination was found in the first round of sampling.

Regulatory Actions

The North Carolina Department of Environment and Natural Resources (DENR) is aware of existing groundwater contamination at levels that exceed state groundwater standards at 13 coal ash impoundments across the state including the Cape Fear Plant. DENR has not required a corrective action plan to restore contaminated groundwater at the Cape Fear plant to the level of the NC groundwater standards. It has no plans to take immediate action to require elimination of the source of contamination. They do not plan to take any regulatory action until groundwater contamination reaches the compliance boundary which in the case of the Cape Fear plant is less than 500 feet beyond the coal ash pond boundary. According to Progress Energy maps, the compliance boundary extends beyond the plant property line across a railroad right of way.

Wastes Present

Coal combustion waste, components unknown.

Type(s) of Waste Management Unit

Four ash impoundments.

Active or Inactive Waste Management Unit

One active and three inactive ash impoundments on-site.

Probable Cause(s)

Leaching of contaminants from CCW ponds into groundwater.

Additional Narrative

The Progress Energy Cape Fear Steam Plant was constructed in 1923 and has 316 MW of coal fired capacity. The coal plant operates four unlined ash impoundments, one active and three inactive. The impoundments cover a total area of 153 acres. The one active impoundment has a capacity of 1764 acre-feet, and was rated by U.S. EPA as having significant hazard potential. Voluntary groundwater monitoring has been conducted at only one of the impoundments at the site.

SOURCES

North Carolina Administrative Code. 2006. Title 15A North Carolina Administrative Code Subchapter 2L Section .0100, .0200, .0300 Classifications and Water Quality Standards Applicable to the Groundwaters of North Carolina (Amended Dec. 7, 2006).

North Carolina Department of Environmental and Natural Resources (NCDENR). 2009. Conversations with Ed Mussler and Sergei Chernikov of the DENR.

North Carolina Department of Environmental and Natural Resources (NCDENR). Various Dates. NC0000396 Progress Energy, Voluntary Monitoring Data.

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Progress Energy. 2009b. Cape Fear_GW_Monitoring_Map_2009_FINAL.jpg.

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ENTITY/COMPANY - LOCATION

ReUse Technology, Inc. / Full Circle Solutions, Inc. – Swift Creek Structural Fill site
Highway 301 Swift Creek-Battleboro Road
Rocky Mount, NC
Nash County
GPS Coordinates: 36°04'50", -77°44'48"

Summary

This coal combustion waste (CCW) disposal site was a 25-acre beneficial use structural fill operating from 1991 through at least 2001. CCW was placed directly above a shallow water table and into a wetland and into groundwater, contaminating off-site groundwater and causing off-site coal ash dust impacts to adjacent property. Arsenic, barium, lead, mercury, and sulfate levels in groundwater all exceeded North Carolina Code 2L Groundwater Standards and federal primary MCLs and secondary MCLs. Lead concentrations were as high as 0.093 mg/L, exceeding the state groundwater standard and primary MCL by more than 6 times. Arsenic concentrations were as high as 0.068 mg/L, also exceeding the state groundwater standard and measuring nearly 7 times the primary MCL in site groundwater. Lead was measured at more than twice the primary MCL in off-site groundwater downgradient from the ash, and arsenic and sulfate levels also exceeded primary MCLs in off-site groundwater.

Coal ash from six North Carolina and Virginia power plants was placed at this CCW disposal site. The site was classified as a beneficial use site (called a "beneficial re-use" site by the site developer) and did not require a permit from the North Carolina Department of Environment and Natural Resources (NC DENR).

Determination

Demonstrated off-site damage to groundwater.

Test of Proof

Groundwater sampling data in a July 2004 report confirmed that 15A N.C. Administrative Code 2L Groundwater Standards (Code 2L standards) had been exceeded in one well for lead (0.028 mg/L vs. 0.015 mg/L standard), arsenic (0.068 mg/L vs. 0.050 mg/L standard), and sulfate (490 mg/L vs. 250 mg/L standard, which is identical to the secondary MCL) (NCDENR, 2006). Additional monitoring wells were installed, and sampling of seven wells on December 1, 2005 again found state groundwater standards being exceeded for "several wells on-site" for lead (0.093 mg/L, maximum concentration) and sulfate (608 mg/L, maximum concentration) (NCDENR, 2006).

Coal ash samples collected by NC DENR in 2004 from the Cogentrix plants where the ash originated had "elevated levels of lead, arsenic, and sulfates" (concentrations not given) (NC DENR, 2006). These constituents are also found in the coal ash on-site, indicating that the groundwater constituents were related to the ash.

The results of a January 2008 groundwater sampling event indicated that contaminants had migrated off-site to one well (MW-8) in excess of groundwater standards for lead (0.032 mg/L vs. 0.015 mg/L standard), which is also the primary MCL, and sulfate (350 mg/L vs. 250 mg/L standard) (Sherrill). There is no indication that additional off-site downgradient monitoring exists. Lead was also reported on-site for the January 2008 sampling event at nearly 6 times the Code 2L standard in MW-7 or primary MCL (0.088 mg/L). Sulfate was exceeded in these on-site wells: MW-3 (550 mg/L), MW-6 (560 mg/L), and MW-7 (500 mg/L). According to the potentiometric surface reported for the January 2008 event, all of these wells are hydraulically downgradient of the coal ash fill. Arsenic and barium were also found in the January 2008 sampling event. (Sherrill).

The state groundwater standard for arsenic is 0.05 mg/L, which is 5 times higher, or less stringent than the federal primary MCL (0.01 mg/L). Two on-site wells (MW-1S and MW-7) and one off-site well (MW-8) have had samples exceeding the primary MCL dating to June 2004. Mercury has also been measured sporadically in several on-site wells exceeding a method detection limit of 0.0002 mg/L. Results dating back to June 2006 have been as high as 0.00089 mg/L in MW-1S, 0.00091 mg/L in MW-6 and 0.00072 mg/L in MW7, nearly half the primary MCL for mercury of 0.002 mg/L.

Constituents Involved

Arsenic, barium, lead, mercury, and sulfate.

Incident and Date Damage Occurred / Identified

Groundwater sampling first completed in 2004 found concentrations of arsenic, lead, and sulfate in site groundwater that exceeded state groundwater standards and EPA primary and secondary MCLs. However this was 13 years after coal ash was first placed at the site. Furthermore the NC DENR determined nine years earlier, in a January 4, 1995 inspection, that CCW was placed within one (1) foot of the seasonal high groundwater table, in violation of Condition 17 of the approved plan (NC DENR, 2006). This inspection also determined that ash had been placed too close to the property line and surface water, in violation of Condition 19 of the approved plan. In August 2001, the NC DENR determined that coal ash had been placed into a wetland on-site. Thus groundwater contamination is likely to have occurred well before 2004.

Regulatory Actions

In response to a complaint from an adjacent homeowner, the NC DENR inspected the site in February 1997 and found that coal ash dust had accumulated on the neighbor's property and waste had been placed too close to a stream and the property line (NC DENR, 2006). According to NC DENR, coal ash continued to be disposed of until 2001; however, this date conflicts with a report prepared by the owner's consultant, which indicates that the site received ash through January 2003 (Sherrill).

The NC DENR determined that the beneficial use/structural fill operation resulted in a violation of NC Title 15A, N.C. Admin code, Subchapter 13B, Section .1705(a), because the site was "not maintained in a manner to minimize the potential for harmful release of constituents of coal combustion by-products," resulting in a violation of the groundwater standards of 15A NCA 2L (NC DENR, 2010).

A Notice of Violation was issued on April 4, 2002 for failure to bring the coal ash fill area in compliance with the original plan for waste placement (NC DENR, 2001). A Compliance Order was issued on September 15, 2006, and a $4,000 penalty was assessed (NC DENR, 2006). The Order required that the nature and concentration of constituents in the groundwater and surface water be determined. The horizontal and vertical extent and rate of migration of contamination were also to be determined. A subsurface drainpipe corrective action system was installed in January 2008 to intercept groundwater and lower groundwater elevation in contact with CCW.

Wastes Present

Fly ash from six (6) Cogentrix power plants: Lumberton (NC), Elizabethtown (NC), Kenansville (NC), Rocky Mount (NC), Hopewell (VA), and Portsmouth (VA) (NCDENR, 2006).

Type(s) of Waste Management Unit

25-acre structural fill.

Active or Inactive Waste Management Unit

Inactive.

Hydrogeologic Conditions

Shallow groundwater exists. In 2002, the owner determined that as much as seven (7) feet of standing water was present in the bottom of the coal ash fill. A site investigation report in 2003 demonstrated that groundwater existed throughout the entire fill area. The reported hydraulic gradient on-site is relatively steep (approx. 2 ft per 100 ft) and as such, groundwater seepage velocities could be expected to be moderate.

Probable Cause(s)

Fly ash placed above shallow groundwater with subsequent mounding of groundwater in the fill and into a wetland.

SOURCES

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North Carolina Department of Environmental and Natural Resources (NCDENR). 2010. Solid waste database (Jan. 25, 2010) *available at* www.wastenotnc.org/sw/swpenalties.asp.

Poindexter, Mark. 2010. Phone conversation with Mark Poindexter, Branch Head, Division of Waste Management, Central Office, (Jan. 25, 2010), mark.poindexter@ncdenr.gov, (919) 508-8513.

Sherrill Environmental, Inc., 2009. Assessment Monitoring Report, January 14, 2009, Swift Creek Project, Highway 301 (February 2009).

ENTITY/COMPANY - LOCATION

Duke Energy, Belews Creek Steam Station
3195 Pine Hall Road
Belews Creek, NC 27009
Stokes County
GPS Coordinates: 36°16'51", 80°03'35"

Summary

Large volumes of coal combustion waste (CCW) produced by Belews Creek Power Plant and placed in three landfills and a surface impoundment have contaminated underlying groundwater above North Carolina Code 2L Groundwater Standards. Duke Energy reports also indicate the CCW landfills are polluting surface water above these groundwater standards.

Contamination at the 40-acre Pine Hall Road Fly Ash Landfill has exceeded one or more state groundwater standards in 17 of 18 on-site wells. Arsenic concentrations have exceeded the groundwater standard by as much as 1.5 times and the federal primary MCL by more than 7 times. There have also been exceedances of the groundwater standards for selenium and cadmium and "hits" of numerous other toxic metals in monitoring wells. A groundwater corrective action plan was pending in 2007 for the Pine Hall Road Landfill. Despite this extensive contamination, the NC DENR recently approved a major reduction in monitoring points as a condition of post-closure monitoring at this site.

All nine wells at the more newly permitted Craig Road Fly Ash Landfill adjacent to Belews Lake and all ten wells at the Flue Gas Desulfurization (FGD) Residue Landfill are also contaminated. In addition, sampling has documented exceedances of state groundwater standards for boron, iron, manganese, sulfate, and TDS in surface waters draining the Pine Hall Road Landfill and exceedances of iron in surface waters draining the Craig Road Landfill.

Voluntary groundwater monitoring surrounding the coal ash impoundment has detected levels of arsenic, iron, manganese, and pH that exceed state groundwater standards. A point source discharge of effluent from the ash impoundment contaminated Belews Lake in the 1970's with selenium, wiping out 19 of 20 fish species in this popular fishing lake in a well known proven case of ecological damage recognized by EPA (EPA, 2007). Although distant from each other, these CCW disposal sites are located in close proximity to Belews Lake, and groundwater from two of them, which are newly permitted-- the Craig Road and FGD Landfills, appear to be draining directly into Belews Lake. However, each of these sites is causing its own contamination today that is distinct from the damage to Belews Lake, which was caused by impoundment discharges that were stopped in the 1970s.

Determination

Demonstrated on-site damage to groundwater and surface water moving off-site.

Test of Proof

Monitoring dating from 2005 for the closed 40-acre Pine Hall Road Landfill documented exceedances of the North Carolina Code 2L regulatory standards for arsenic, boron, cadmium, iron, pH, manganese, nitrate, selenium, sulfate, and total dissolved solids (TDS) in groundwater under this facility (NC DENR, 2005 and Duke Energy, 2007a,b). "Hits" were also reported for barium, chloride, copper, fluoride, lead, mercury, silver, TOH, total organic carbon (TOC), and zinc (NCDENR, 2005). Groundwater monitoring in April 2007 found 17 of 18 wells having a pH less than the standard (6.5), and "several wells" exceeding groundwater standards for boron (0.7 mg/L), iron (0.3 mg/L), manganese (0.05 mg/L), selenium (0.02 mg/L), sulfate (250

mg/L), and total dissolved solids (TDS) (500 mg/L). Exceedances also occurred for cadmium (0.0037 mg/L vs. 0.002 mg/L standard) and nitrate (158 mg/L vs. 10 mg/L standard) in one well (Duke Energy, 2007,a,b).

The locations of exceedances of groundwater standards are indicating a decisive movement off-site. For example, an April 2007 sample from Well OB-4, 400 feet downgradient from landfill had an arsenic concentration of 0.073 mg/L (above the state groundwater standard of 0.050 mg/L and more than 7 times the primary MCL of 0.01 mg/L). Arsenic was measured at 0.059 mg/L and boron at 25.88 mg/L in an October, 2007 sample from this well. The boron concentration is 37 times the state groundwater standard of (0.7 mg/L). This October sample also had an iron concentration of 4.5 mg/L, 15 times the state groundwater standard of 0.3 mg/L, a manganese concentration of 5.78 mg/L, 115 times the state groundwater standard of 0.05 mg/L, a sulfate concentration of1,452 mg/L, 5.8 times the state groundwater standard of 250 mg/L and a TDS concentration of 2,334 mg/L, 4.6 times the state groundwater standard of 500 mg/L.

A October 2007 sample from downgradient MW2-3, approximately 624 feet from landfill had a boron concentration of 8.6 mg/L, iron concentration of 0.303 mg/L, manganese concentration of 0.285 mg/L, sulfate concentration of 540 mg/L, and a TDS concentration of 954 mg/L.. All of these values exceed state groundwater standards with the boron concentration exceeding it by more than 12 times and nearly three times higher than the EPA's Child Health Advisories for boron. .

And a surface water sample collected in October 2007 from SW-2 in a ditch draining the landfill into the ash impoundment had a boron concentration of 19.16 mg/L, an iron concentration of 0.526 mg/L, and a manganese concentration of 2.09 mg/L, a sulfate concentration of 661 mg/L and a TDS concentration of 1,040 mg/L. All of these values exceed the state groundwater standard used by Duke as the relevant standard for surface waters instead of the state's surface water quality standards. In the case of boron and manganese, the concentrations are exceeding the groundwater standards by 27 times and 42 times, respectively (Duke Energy 2007, a,b)..

Monitoring data in 2008 for the Craig Road Landfill documented exceedances of state groundwater standards for pH (<6.5, in all 9 wells on-site), iron (in 8 of 9 wells, 6.48 mg/L max), and manganese (in 7 of 9 wells, 1.58 mg/L max). Clearly the contamination is moving beyond these monitoring wells that are located from 125 to 250 feet from the waste. A January 2008 sample from downgradient CRW-6, a well that is within 50 feet of the compliance boundary (250 feet from the waste) had an iron concentration of 3.3 mg/L and a manganese concentration of 0.463 mg/L., exceeding their groundwater standards by 11 times and 9 times, respectively. With an estimated seepage velocity of 0.9 feet per day and a steep groundwater gradient (almost 7%), this contamination is no doubt reaching Belews Lake, which is downgradient of the landfill and forms the facility boundary in some areas.

Duke also reported exceedances of the state groundwater standard for iron at four of five surface water sampling stations. A maximum measurement of 172 mg/L at surface water station CRS-5 in a January 2008 sample was 573 times higher than the standard (Duke Energy, 2008,b). This station is within 50 to 75 feet of Belews Lake. Manganese concentrations also exceeded the groundwater standard at at least three surface water monitoring stations by as much as 28 times in the January 2008 sampling. Surface station CRS-3, is beyond the compliance boundary and at the facility boundary and is adjacent to a creek that flows into Belews Lake. Manganese in the January sample at this monitoring station was 0.169 mg/L, 3.4 times the groundwater standard, and iron was 1.77 mg/L, 5.9 times the groundwater standard (Duke Energy, 2008,b). Based on topographic maps of the site, these stations appear to be in seeps, drainage swells and ditches draining the site in some cases no more than 50 feet from Belews Lake.

Monitoring data in 2008 for the FGD Residue Landfill that just began operation sometime in late 2007/early 2008 document exceedances of groundwater standards for pH (<6.5, in all 10 wells), iron (in all 10 wells), and manganese (in 8 of 10 wells, 0.81 mg/L max) (Duke Energy, 2008,c). The maximum iron concentration,

99.7 mg/L, was 332 times the state's groundwater standard (0.30 mg/L). Water from this landfill is also moving toward Belews Lake with an estimated seepage velocity of 0.5 feet per day (based on slug test and potentiometric surface data and an assumed value for effective porosity). One downgradient well, approximately 300 feet downgradient of the waste boundary and 242 feet from Belews Lake, (BC-25), yielded a sample that exceeded groundwater standards for lead (0.023 mg/L vs. 0.015 mg/L standard) and chromium (0.1 mg/L vs. 0.01 mg/L standard) as well as pH, iron and manganese. (Duke Energy, 2008,c). However, BC-25 has yielded similar high values for lead and chromium prior to official operation of the landfill. Duke explains that this well is "in an area previously used for material laydown for recent construction projects on site," suggesting that groundwater in this area was already contaminated by an undisclosed material.

Voluntary groundwater monitoring for the ash impoundment measured levels of arsenic, iron, manganese, and pH levels above state groundwater standards (NC DENR). Arsenic ranged from 0.0547 to 0.0636 mg/L - over 1.2 times the 0.05 mg/L state groundwater standard and more than 6 times the federal primary MCL in underlying groundwater. Manganese exceedances ranged from 0.053 to 2.85 mg/L, up to 57 times the 0.05 mg/L groundwater standard (which is also the secondary MCL). Iron ranged from 0.311 to 46.5m/L, 155 times the groundwater standard and secondary MCL. The full extent of the plume is unknown. There are several homes to the west of the impoundment, yet there are no monitoring wells between the impoundment and those homes.

Constituents Involved

Arsenic, barium, boron, cadmium, copper, chromium, chloride, fluoride, iron, lead manganese, mercury, nitrate, selenium, silver, zinc, sulfate, TDS, TOH, TOC, and pH.

Incident and Date Damage Occurred / Identified

Exceedances in groundwater of NC Code 2L groundwater standards date to at least an October 2005 sampling event at the Pine Hall Road Landfill (NC DENR, 2005). Surface water sampling at this facility found similar constituent exceedances later (Duke Energy, 2007a,b).

Groundwater contamination above relevant standards was documented by sampling in 2008 at the newly permitted Craig Road Landfill and FGD Residue Landfill (Duke Energy, 2008a, b). Extremely high levels of iron were measured in surface waters draining the Craig Road Landfill in 2008 sampling. These waters drain to Belews Lake.

Voluntary groundwater monitoring at the ash impoundment began in November of 2007, immediately detecting exceedances of groundwater standards.

Regulatory Actions

The 40-acre Pine Hall Road Landfill was closed "due to the previously detected exceedances of NCAC 2L standards" (Duke Energy, 2007b). NC DENR required that a Ground Water Corrective Action Plan and a Methane Gas Remediation Plan be submitted prior to final closure (NC DENR, 2007). A Closure Plan was approved on December 7, 2007. No groundwater remediation plans were identified by the file review. NC DENR allowed the abandonment of 14 groundwater wells and two (2) surface water sampling points as a condition of post-closure monitoring.

No regulatory actions were identified for the Craig Road Landfill, the FGD Residue Landfill, or the ash impoundment.

Wastes Present

Fly ash and flue gas desulfurization (FGD) wastes in the landfill. Undetermined CCW in the ash impoundment.

Type(s) of Waste Management Unit

Pine Hall Road Fly Ash Landfill (NC Permit #85-03); Craig Road Fly Ash Landfill (NC Permit #85-04); FGD Residue Landfill (NC Permit #85-05); and an ash impoundment.

Active or Inactive Waste Management Unit

The Pine Hall Road Landfill is closed. The Craig Road Landfill and the FGD Residue Landfill are active. Placement of FGD clarifier sludge started in the Craig Road Landfill on February 12, 2008 (Duke Energy, 2008a). Information obtained does not indicate whether any of these sites are lined.

The NCDENR numbering system suggests that two other (numbered -01and -02) landfills exist on-site although the file review did not divulge further details of their presence.

The ash impoundment is active. It is one of the largest coal ash ponds in North Carolina at 512 acres with a total capacity of 2.2 million cubic yards.

Hydrogeologic Conditions

The depth and type of the aquifer under the landfills and impoundment was not determined by the file review. The closeness of these facilities to Belews Lake suggests that shallow water table aquifer conditions

occur. The direction of groundwater flow from the Pine Hall Road Landfill is reportedly towards the station's "ash basin," i.e., the impoundment. (Duke Energy, 2007a,b).

Probable Cause(s)

Leachate from coal combustion wastes has infiltrated the groundwater and contaminated surface water in the vicinity of the three (3) landfills. Leaching of contaminants into groundwater has also occurred at the ash impoundment.

Additional Narrative

The Belews Creek Steam Station was constructed in 1974 and has 2,240 megawatts of coal-fired capacity. The two-unit facility is Duke Energy's largest coal-burning power plant in the Carolinas.

Despite the pervasive contamination from CCW at the Belews Station property, there is apparently no off-site groundwater or surface water monitoring being undertaken beyond the plant's property boundary for any of the three (3) landfills or the surface impoundment.

SOURCES

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North Carolina Department of Environmental and Natural Resources (NCDENR). 2009. Conversations with Ed Mussler and Sergei Chernikov of the DENR.

ENTITY/COMPANY - LOCATION

Progress Energy - Asheville Steam Electric Plant
200 CP and L Drive
Arden NC, 28704
Buncombe County
GPS Coordinates: 35.468556, -82.545278

Summary

Recent monitoring surrounding the coal ash impoundment at the Asheville Power Plant found levels of chromium, boron, iron, and manganese that exceed North Carolina Code 2L Groundwater Standards in groundwater underneath and downgradient of impoundment. The monitoring indicates that the contamination is migrating outside of the state designated review boundary for the impoundment and approaching the compliance boundary near the property line, but the extent of the contamination is unknown.

Determination

Demonstrated damage to groundwater moving off-site.

Test of Proof

Groundwater monitoring found exceedances of state groundwater standards in 2007 at downgradient monitoring points. Boron exceedances ranged from 0.322 - 1.32 mg/L, over 4 times the state groundwater standard of 0.315 mg/L. Chromium exceedances ranged from 0.0817 - 0.0822 mg/L, over 1.6 times the state groundwater standard of 0.05 mg/L. Iron exceedances ranged from 0.319 - 46.2 mg/L, over 154 times the state groundwater standard of 0.3 mg/L. Manganese exceedances ranged from 0.0608 - 2.04, up to 40 times the groundwater standard for manganese of 0.05 mg/L (DENR). The full extent of the plume is unknown.

Constituents Involved

Boron, chromium, iron, and manganese.

Incident and Date Damage Occurred / Identified

Voluntary groundwater monitoring began in November of 2007, and immediately detected exceedances of state groundwater standards.

Regulatory Actions

The North Carolina Department of Environment and Natural Resources (DENR) is aware of existing groundwater contamination at levels that exceed state groundwater standards at 13 coal ash impoundments across the state including this impoundment at the Asheville Plant. DENR has not required a corrective action plan to restore contaminated groundwater at the Asheville plant to the level of the standards. It has no plans to take immediate action to require elimination of the source of contamination. They do not plan to take any action until contamination reaches the compliance boundary.

Wastes Present

Unknown components of coal combustion waste (CCW) from the Asheville Plant.

Type(s) of Waste Management Unit

Ash impoundment.

Active or Inactive Waste Management Unit

Active.

Probable Cause(s)

Leaching of contaminants from CCW ponds into groundwater.

Additional Narrative

The Asheville Steam Electric Plant has two coal ash ponds. One is actively being used for wet storage of coal combustion waste, while the other is being used to dry store material dredged from the other. The wet storage pond has a total capacity of 1,400 acre-feet and as of March, 2009 it is estimated to be storing 1,260 acre-feet of material. The dry storage pond has a total capacity of 1,380 acre-feet and their actual storage was unreported.

South of the impoundment, the property boundary is less than 250 feet from the ash pond, and a downgradient well (GW-5) shows contamination migrating toward neighboring properties. No off-site monitoring exists to determine whether the contamination has crossed the property line.

SOURCES

Dewberry & Davis, Inc. 2009. Coal Combustion Waste Impoundment Dam Assessment Report Site 7 1982 Pond &1964 Pond Progress Energy Carolinas Asheville, North Carolina. Prepared By: Dewberry & Davis, Inc. for Lockheed Martin Services, Inc. (Sept. 11, 2009).

North Carolina Department of Environmental and Natural Resources (NCDENR). 2009. Conversations with Ed Mussler and Sergei Chernikov of the DENR.

North Carolina Department of Environmental and Natural Resources (NCDENR). Various Dates. NC0000396 Progress Energy, Voluntary Monitoring Data.

Progress Energy. 2009. Asheville Steam Electric Plant Coal Ash Voluntary Monitoring Data.

ENTITY/COMPANY - LOCATION

Arizona Public Service – Four Corners Power Plant
Ash Impoundments
PO Box 355
Fruitland, NM 87416
San Juan County
GPS Coordinates: 36° 41' 16"N 108° 30' 24"W

Summary

For more than thirty years fly ash, bottom ash and scrubber sludge from the Four Corners Power Plant was placed in unlined impoundments and backfilled into the Navajo Mine, which has supplied coal to the plant since 1968. The Power Plant and coal combustion waste (CCW) disposal areas are within the Navajo Nation. Full evaluation of the impacts of the CCW on groundwater is hampered by the lack of public availability of data, but two separate statistical analyses of surface water quality data in the Chaco River Basin have documented significant degradation of water quality downstream from the CCW impoundments, for which contamination by seepage and groundwater inflow is the only reasonable explanation. In one study concentrations of boron were nearly twelve times higher than upstream concentrations, and total dissolved solids (TDS), sulfates and selenium were more than three times higher in the downstream segment of the river basin. The second study also found higher downstream levels of copper, lead, mercury and zinc.

The Navajo Nation water quality standards list the Chaco Wash as used for wildlife and livestock watering and aquatic habitat. For these uses, the elevated concentrations of boron, selenium and zinc are approximately twice recommended levels for freshwater aquatic organisms, and the concentrations of copper and lead slightly exceed levels recommended in New Mexico for livestock.

Determination

Demonstrated off-site damage to surface waters

Test of Proof

This case focuses primarily on surface water contamination of Chaco Wash by coal combustion waste (CCW) from the Four Corners Power Plant. As discussed in the additional narrative, contamination of groundwater downgradient from the Navajo Mine ash disposal areas is well documented, but groundwater data for the CCW surface impoundments has not been made available for independent review and analysis.

Zimmerman (2005) performed a statistical analysis of thousands of measurements taken over several decades in the Chaco River basin to compare surface water quality upstream of the mine/ash disposal areas and downstream. He found elevated concentrations of many constituents downstream of the mine/CCW disposal area:

- Downstream concentrations for TDS (2,644 mg/L), sulfate (1,118 mg/L) and selenium (0.013 mg/L) were more than three times higher than upstream concentrations.
- Downstream concentrations for boron (2.57 mg/L) were nearly 12 times greater than upstream concentrations (0.22 mg/L).

Ross (2007) also analyzed available surface water data in the Chaco basin and found statistically significant increases in five metals downstream from the CCW disposal area. Average downstream concentrations were as follows: boron (3.0 mg/L), copper (0.8 mg/L), lead (0.12 mg/L), zinc (0.21 mg/L), and mercury (0.0007

mg/L—note that Figure 9 in Ross, 2007 incorrectly identifies mercury concentration as mg/L, the number shown here is calculated from the original data).

The Navajo Nation's water quality standards list the Chaco Wash as used for wildlife and livestock watering, aquatic habitat and secondary human contact (USWAG, 2008). A review of water quality criteria for these uses from a variety of sources indicates the following with respect to degradation of surface water below the CCW ash ponds:

- Average concentrations are above recommended water quality for livestock in New Mexico (Runyon et al., 2009) for copper (0.8 mg/L concentration vs. 0.5 mg/L standard) and lead (0.12 mg/L concentration vs. 0.1 mg/L standard)
- Averages concentration of selenium (0.013 mg/L) are more than twice recommended concentrations for wildlife (0.004, Nagpal, 2001) and EPA's Water Quality Criteria (WQC) for chronic exposure to aquatic freshwater organisms (0.005 mg/L)
- Average concentrations of zinc (0.21 mg/L) are nearly twice EPA's WQC for acute and chronic exposure to aquatic freshwater organisms (0.12 mg/L).
- EPA does not currently list boron in its national recommended water quality criteria, but average concentrations in downstream Chaco Wash water (2.57 to 3 mg/L) are more than twice levels recommended by one source for aquatic freshwater organisms (1.2 mg/L, Ross and Nagpal, 2003).

Chaco Wash is not currently designated as a source of drinking water, but it is worth pointing out that the increased downstream average boron levels are equivalent to EPA's Child's One and Ten-day Health Advisories and 2-3 times the health based standards of other regulatory agencies. Average downstream sulfate concentrations increase to more than four times the use-based secondary DWS and more than twice EPA's health-based Drinking Water Advisory. Average downstream concentrations of TDS increase to more than five times higher than the use-based secondary DWS and average pH also increases.

The potential for the ash ponds to pollute the Chaco Wash with a variety of metals concentrated in the ash is clear. Ross (2007) found that concentrations of antimony, arsenic, boron, cadmium, cobalt, copper, iron, manganese, molybdenum, nickel and zinc are significantly higher in samples of ash in the ponds than found in any other source material in the area (in the analysis samples were segregated into 18 categories for comparison).

In addition, Ross (2007) found that concentrations of arsenic (30 mg/L average, 3000 times primary DWS) and boron (about 9 mg/L average, three times the Child Health Advisories) in the single well completed in the ash disposal area, which reflects a combination of ash pore water and groundwater, are much higher than average arsenic and boron levels in wells completed in coal, spoils, or in areas not affected by CCW.

Constituents Involved

Antimony, arsenic, boron, cadmium, cobalt, copper, iron, manganese, mercury, molybdenum, nickel, selenium, zinc, sulfate, TDS and pH.

Incident and Date Damage Occurred / Identified

Surface water degradation was first documented by analysis of Chaco River Basin surface water quality data above and below the Four Corners CCW Ash Ponds by Zimmerman (2005) and confirmed by further statistical analysis by Ross (2007).

Regulatory Actions

None

Wastes Present

Fly ash, bottom ash, and scrubber sludge in CCW ponds west and north of the power plant

Type(s) of Waste Management Unit (information from Arizona Public Service, 2009)

Active: Dry Fly Ash Disposal Unit (landfill), which does not receive liquid-borne material.
Active: Lined Ash Impoundment constructed on top of old ash impoundments #3 and #4 (built in 2003).
Inactive: Six old unlined ash impoundments. In addition to old impoundments #3 and #4 being covered by the active Lined Ash Impoundment, a lined water impoundment is constructed on top of old impoundment #3.

Active or Inactive Waste Management Unit

Active and inactive units.

Hydrogeologic Conditions

Groundwater from Navajo coal mine and ash disposal areas is in Cretaceous sediments and flows west into Quaternary alluvium of the Chaco River valley.

Probable Cause(s)

Surface seepage and groundwater inflow from the ash disposal areas to Chaco Wash.

Additional Narrative

Full assessment of the Four Corners CCW impoundments has been hampered by the unwillingness of the operators to make monitoring data available for independent review and analysis or even to the Navajo Nation EPA, the agency with jurisdiction over the relevant environmental regulations at this site (Eathjustice, 2008). The Utility Solid Waste Advisory Groups notes that there are no regulatory requirements to make the information available (USWAG, 2008).

Zimmerman (2005) analyzed the Bitsui Wash monitoring network, a cluster of shallow wells screened in ash placed in the Navajo Mine, spoils and coal seams. The Bitsui Wash flows into the San Juan River east of the Chaco Wash. Analysis of the Bitsui Wash monitoring network found:

- Elevated levels and increasing trends of ash-constituent parameters in the down gradient groundwater flow direction.
- Serious deficiencies in the monitoring network that impair its usefulness for detecting off-site migration of ash constituents, a major one being that the "background" well intercepts water that passes through the mine, and possible major ash deposits throughout the northern half of the mine for the last thirty years.

A coal ash impoundment report for the Four Corners CCW disposal areas (GEI Consultants, 2009) focused on structural integrity of the impoundments rather than environmental concerns. However the report identified seepage at the downstream tow of the south embankment (Pond #4) and recommended an expanded program to include additional monitoring of potential seepage in other locations, as well as locations where a potential seepage pathway exists if the area with an HDPE liner fails. (GEI Consultants, 2009, p. 34).

SOURCES

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Eathjustice. 2008. *Comments on U.S. Environmental Protection Agency's Coal Combustion Waste Damage Case Assessment* (July, 2007). Prepared in response to U.S EPA, Notice of Data Availability 72 Fed. Reg. 49714, RCRA Docket No. EPA-HQ-RCRA-2006-0796 (Aug. 29, 2007).

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Ross, L. 2007. *Effects of Four Corner Power Plant Coal Combustion Waste Disposal on Surface and Groundwater Quality*. Glenrose Engineering, Austin TX. Submitted to Lisa Evans, Earthjustice (August 2007).

US EPA. 2007. Coal Combustion Waste Damage Case Assessments. Office of Solid Waste (July 9. 2007).

Runyan, C. J. Bader, and C. Mathis. 2009. *Water Quality for Livestock and Poultry*. New Mexico State University Guide M-112.

Utility Solid Waste Activities Group (USWAG). 2008. Supplementary Information to Earthjustice Allegations of Additional CCW Damage Cases, Docket ID No. EPA-HQ-RCRA-2006-0796.

Zimmerman, D.A. 2005. *A Preliminary Evaluation of the Potential for Surface Water Quality Impacts from Fly Ash Disposal at the Navajo Mine, New Mexico*. Prepared for Submission to the National Academy of Sciences Committee on Mine Placement of Coal Combustion Wastes. SETA, Inc. Cedar Crest NM (May 25, 2005).

ENTITY/COMPANY - LOCATION

NV Energy – Reid Gardener Generating Station
1 Wally Kay Way
Moapa, NV 89025
Clark County
GPS Coordinates: 36°, 39'13", N 114° 38'27" W

Summary

Groundwater contamination from coal ash impoundments at the Reid Gardner Generating Station have exceeded Nevada action levels and drinking water standards often by many times for arsenic, boron, chloride, chromium, magnesium, manganese, molybdenum, nitrate, selenium, sodium, sulfate, TDS, titanium, and vanadium. The Nevada Department of Environmental Protection (NDEP) has determined that contamination has spread finding arsenic as high as 31 times the federal primary MCL in an off-site well.

Determination

Demonstrated off-site damage to groundwater

Test of Proof

Groundwater monitoring results from multiple on-site wells are as follows:

TABLE 5
Nevada Power Company Reid Gardner Station
Monitoring Well Sampling Parameters That Exceed Action Levels

First Quarter 2007 DMR Permit No. NEV91022

Parameter	Action Level	Wells Exceeding Action Level	Concentration Range		
Chloride	520	32	73	To	8,700
Sulfate	1070	50	140	To	54,000
TDS	2570	52	740	To	140,000
Nitrate	10	1	<1	To	13
Arsenic	0.16	14	<0.005	To	0.73
Boron	1.4	55	0.7	To	520
Chromium	0.1	1	<0.015	To	0.110
Magnesium	165	32	0.9	To	3,600
Manganese	0.27	16	<0.2	To	6.0
Molybdenum	0.03	44	<0.025	To	22.0
Selenium	0.05	12	<0.0025	To	0.150
Sodium	520	49	130	To	40,000
Titanium	0.01	1	<0.01	To	0.057
Vanadium	0.004	1	<0.004	To	0.240
Total Monitoring Wells Sampled		62			

Arsenic levels were as high as 0.73 mg/L, four and a half times the state action level of 0.16 mg/L and 73 times the federal primary MCL of 0.01 mg/L (NDEP, 2007). Selenium concentrations were up to 3 times the federal primary MCL of 0.05 mg/L. Nitrate levels of 13 mg/L exceeded the federal primary MCL of 10 mg/L. Chromium levels of 110 ug/L exceeded the federal primary MCL of 100 ug/L. The state has documented off-site contamination in Hogan Wash, and properties to the north, east, and south of the power plant (NDEP, 2009). Arsenic levels in one off-site well, IWM-16S, were as high as 0.31 mg/L, which is nearly

twice the state action level and 31 times higher than the federal primary MCL (NDEP, 2007). In response to the contamination, an NDEP enforcement action has ordered NV Energy to take corrective action.

Constituents Involved

Chloride, sulfate, TDS, nitrate, arsenic, boron, chromium, manganese, magnesium, molybdenum, selenium, sodium, vanadium, and titanium.

Incident and Date Damage Occurred / Identified

In 1997, NDEP issued an Administrative Order of Consent (AOC) requiring the plant to halt the migration of contaminants into groundwater. Current groundwater monitoring continues to detect high levels of ash constituents

Regulatory Actions

NDEP issued the 1997 AOC in response to evidence of groundwater contamination at the Reid Gardner Generating Station. In response to the order, NV Energy eventually developed a plan to close or install double liners for all the site's impoundments by 2010. To date, two impoundments have been closed and six have installed liners. NDEP and NV Energy are in the process of negotiating a remediation plan for the site, which is expected to be finalized in 2010 (NDEP, 2008).

Wastes Present

Flue gas desulfurization wastes and fly ash.

Type(s) of Waste Management Unit

Three ash settling ponds are operated on-site with wastewater from these ponds being discharged to five evaporation ponds. These impoundments were originally unlined, but in accordance with the closure plan were closed or had double liners installed. The plant also currently maintains a permitted solid waste disposal facility (NDEP, 2009).

Active or Inactive Waste Management Unit

Active and inactive units

Probable Cause(s)

Migration of contaminants from CCW leachate to groundwater from multiple impoundments.

Additional Narrative

Fly ash and flue gas desulfurization waste produced by AES' Reid Gardner Generating Station was sluiced to one of three unlined surface impoundments. Wastewater from the waste impoundments was discharged to one of five evaporation ponds. The operation is meant to be a closed system for recycling of the cooling water, and no surface water is discharged from the site.

SOURCES

Nevada Division of Environmental Protection (NDEP). 2007. DMRs, Permit No. NEV91022.

Nevada Division of Environmental Protection. (NDEP). 2008. Reid Gardner Station Closure Plan. *available at* http://ndep.nv.gov/BCA/file/reid_final_closure_plan.pdf .

Nevada Division of Environmental Protection (NDEP). 2009. Nevada Power Company- Reid Gardner Station, *available at* http://ndep.nv.gov/BCA/reid_gardner.htm (last visited Jan. 28, 2009).

ENTITY/COMPANY - LOCATION

Allegheny Energy – Mitchell Power Station
(Formerly owned/operated by West Penn Power Co.)
50 Electric Way
Courtney, PA 15067
Washington County
GPS Coordinates: 40°13'10.11"N, 79°57'59.36"W

Summary

In 1998, Allegheny Power initiated groundwater investigations of its Mitchell Power Plant CCW wastewater lagoons with the expectation that no impacts would be found and that no ongoing monitoring would be required. However, the investigation found degradation of groundwater downgradient from the two lagoons by multiple parameters. Most significantly, concentrations of arsenic were measured at twice the federal primary MCL and concentrations of boron reached more than twice the EPA Child Health Advisory of 3.0 mg/L. Groundwater monitoring data for the year 2007 shows that maximum levels of arsenic and boron are twice as high as the maximum levels found in 1998.

Determination

Demonstrated damage to groundwater moving off-site toward the Monongahela River.

Test of Proof

In 1997, Allegheny Power initiated preliminary groundwater investigations in the vicinity of the two CCW lagoons in response to a Pennsylvania Department of Environmental Protection (PADEP) letter requiring submission of a groundwater monitoring plan. The intent of the preliminary investigations was to demonstrate that groundwater monitoring was not necessary (Allegheny Power, 1997). However the initial groundwater investigations found that groundwater *was* being degraded by the impoundments (HMI, 1998):

Arsenic was below the detection limit in upgradient wells, but above the primary MCL in the two downgradient wells of Lagoon #2 (0.011 and 0.013 mg/L). Boron was reported at 1.9 mg/L and 3.7 mg/L at the two downgradient wells of Lagoon #2. Elevated levels of molybdenum and nickel were detected in some downgradient monitoring wells. Compared to surface water samples of the Monongahela River along the shoreline near the lagoons, twelve parameters were reported at consistently higher concentrations in the groundwater samples: specific conductance, total alkalinity, chemical oxygen demand, ammonia, chloride, sulfate, total dissolved solids, calcium, iron, potassium, magnesium, manganese and sodium.

As a result of Allegheny Energy's evidence of groundwater degradation by the lagoons, a groundwater monitoring plan was implemented with an upgradient well and two downgradient wells for each lagoon.

Analysis of quarterly monitoring data for samples collected from the two monitoring wells downgradient from ash Lagoon #2 in 2007 (GW-4 and GW-5) found the following (Earthjustice, 2008):

- Boron levels were more than twice the EPA's Child Health Advisory of 3.0 mg/L and much higher than boron levels in upgradient wells or at surface water monitoring points.
- Arsenic concentrations have been 1 to 2 times the primary MCL of 0.010 mg/L at downgradient wells and exceeded the highest concentrations for arsenic at upgradient points.
- Levels of nickel, molybdenum, and manganese have also been noticeably higher at downgradient than upgradient points.

Allegheny Energy does not monitor groundwater around the ash landfill that lies west of Mitchell power plant. Review of a topographic map of the landfill (PADEP, 2001) shows that surface drainage from the landfill flows toward Lagoon 1, and the position of the landfill with respect to Lagoon #2 creates the possibility that the upgradient monitoring wells from both lagoons could be affected by groundwater flowing from the ash fill.

The Utility Solid Waste Activities Group does not dispute the data presented above, but argues that groundwater data should be evaluated relative to Pennsylvania Statewide Health Standards of medium specific concentrations (MSCs) for non-residential, non-use aquifers which have not been exceeded (USWAG, 2008). This argument misses the point that degradation of groundwater moving off-site *has* occurred, and that this damage would not have been identified if PADEP had not required groundwater monitoring.

Constituents Involved

Arsenic, ammonia, boron, calcium, chemical oxygen demand, chloride, iron, molybdenum, magnesium, manganese, nickel, potassium, specific conductance, sodium, sulfate, total alkalinity and total dissolved solids.

Incident and Date Damage Occurred / Identified

In 1998, an evaluation of groundwater in the vicinity of two CCW residual waste storage impoundments found downgradient degradation of groundwater by arsenic above primary MCLs and boron above EPA's Child Health Advisory standard. A review of quarterly groundwater monitoring data for the year 2007 shows that levels of arsenic and boron were up to twice as high as found in the initial evaluation in 1998.

Regulatory Actions

In 2001, PADEP issued a Notice of Violation (NOV) to Allegheny Power for failure to minimize fugitive dust emissions from the landfill northwest of the power plant (PADEP, 2001). Requirements for ongoing monitoring of fugitive dust were discontinued in 2004.

Wastes Present

Fly ash, bottom ash (landfill) and CCW residuals in sludge and process water

Type(s) of Waste Management Unit

Mitchell Power Plant operates a 70-acre, unlined CCW landfill with a capacity of 5.6 million cu/yds, located northwest of the power plant (RTI, 2007). Information about this landfill does not appeal in the U.S. EPA's 2009 CCW impoundment and landfill survey. In addition, Mitchell Power Plant operates two Wastewater Treatment Lagoons (#1--.55 acres, and #2--.47 acres), located near the power plant that contain CCW. Both lagoons were constructed with concrete sides and a compacted in-situ soil base that is covered with one foot of bottom ash (HMI, 1999). The lagoons discharge water under NPDES permit PA0002895.

Active or Inactive Waste Management Unit

Active

Hydrogeologic Conditions

Ash Landfill: Mostly bedded sedimentary rock (alternating sandstone, limestone and shale with thin soil) and some Monongahela River alluvium with overbank deposits (RTI, 2007).
Ash Lagoons: Monongahela River alluvium with overbank deposits.

Probable Cause(s)

Seepage and groundwater flowing through the lagoons. There is a possibility that "upgradient" monitoring wells for the lagoons receive contaminants from the ash landfill to the west.

SOURCES

Allegheny Power, Letter from Randy Cain, Allegheny Power to Mr. Dave Eberle, PADEP (July 23, 1997).

Earthjustice. 2008. Comments on U.S. Environmental Protection Agency's Coal Combustion Waste Damage Case Assessment (July, 2007), Prepared in response to U.S EPA, Notice of Data Availability 72 Fed. Reg. 49714, RCRA Docket No. EPA-HQ-RCRA-2006-0796 (Aug. 29, 2007).

Hydrosystems Management, Inc (HMI). 1998. Ground-Water Evaluation, Wastewater Treatment Lagoons, Mitchell Power Station.

Hydrosystems Management, Inc (HMI). 1999. Proposed Ground-Water Monitoring Plan Allegheny Power, Mitchell Station Wastewater Treatment Lagoons #1 and #2. Prepared for Allegheny Power (March 1999).

Pennsylvania Department of Environmental Protection (PADEP). 2001. Mitchell Ash Landfill, Washington County ID No. 300809 Notice of Violation for failure to minimize fugitive dust emissions (Aug. 15, 2001)([Dustfall monitoring was discontinued October 2004).

RTI. 2007. Human and Ecological Risk Assessment of Coal Combustion Wastes. Prepared for USEPA Office of Solid Waste. Draft (Aug. 6, 2007).

Utility Solid Waste Activities Group (USWAG). 2008. Supplementary Information to Earthjustice Allegations of Additional CCW Damage Cases, Docket ID No. EPA-HQ-RCRA-2006-0796.

ENTITY/COMPANY - LOCATION

Orion Power Midwest (a subsidiary of RRI Energy) – Phillips Power Plant
Jordan Street
South Heights, PA 15081
Allegheny and Beaver Counties
GPS Coordinates: 40° 13" 20' N 79° 58" 14' W

Summary

In the late 1980s, two coal ash ponds at the Phillips Power Plant contaminated several public water wells operated by the Cresswell Heights Joint Authority with high levels of total dissolved solids (TDS) which were ruining residents' hot water heaters. Legal action initiated by the Pennsylvania Department of Environmental Protection (PADEP) in 1990 led to decommissioning the Ash Ponds and paying a $50,000 fine. Groundwater contamination was later identified at the Ash Landfill west of the Phillips Power Plant at sufficient levels to require ongoing groundwater monitoring after the landfill was closed in the 1990s. Ten years later, samples from wells located where the groundwater is moving off-site regularly exceed secondary Drinking Water Standards (DWS) for TDS, chloride, fluoride, manganese and aluminum.

Determination

Demonstrated off-site damage to public drinking water supply (ash ponds)
Demonstrated damage to groundwater moving off-site (ash landfill)

Test of Proof

In the late 1980s, several water supply wells of the Cresswell Heights Joint Municipal Water Supply in Beaver County, PA were contaminated with high levels of total dissolved solids (TDS) from two coal ash ponds at the Phillips Power Plant in adjacent Allegheny County. High TDS levels, far exceeding secondary MCLs, ruined hot water heaters and Municipal Water Supply customers had to frequently replace their hot water heaters (as often as once per year). The Municipal Water Supply undertook considerable monitoring to document the damage being done to its wells. This contamination of public water wells prompted PADEP to file a complaint against the Duquesne Light Company (DLC) claiming violations of total suspended solids (TSS) limits at an NPDES outfall and that the unlined ash ponds at the Phillips Plant were adversely impacting the groundwater aquifer used by the Cresswell Heights Joint Water Authority for public drinking water. A "Consent Order and Agreement" was signed on October 1990 that provided several options for DLC to remediate the source of contamination and included a $50,000 penalty for discharge violations (PAEHB, 1990). The two coal ash ponds were closed and the ash was reportedly removed from the site (USWAG, 2008). Closure of the coal ash ponds appears to have addressed problems with the Cresswell Heights public water supply.

In addition to the two coal ash ponds, the Phillips Plant placed coal ash and FGD sludge in a landfill west of the Plant from 1969 to 1991. This landfill covered about 157 acres, of which about 50 acres were used for coal combustion waste (CCW) disposal. In 1975, DLC received Solid Waste Disposal Permit No. 300440 from PADEP, which included requirements for an underdrain system to collect leachate from the landfill. As part of the decommissioning of the power plant, a landfill closure plan was submitted to PADEP in 1994 (SET, 1994). A groundwater assessment was conducted to determine whether the landfill was adversely affecting groundwater. As a result of the groundwater assessment, PADEP required groundwater monitoring to continue after final cover and grading of the landfill. A review of quarterly groundwater monitoring data from 2006 and 2007 found the following (EarthJustice, 2008):

- Groundwater discharging from the closed landfill has noticeably higher levels of chloride, sodium, and fluoride, and generally higher manganese, aluminum, sulfates, TDS and Specific Conductance.

- Levels of chloride frequently exceeded secondary drinking water standards (DWS) and high levels of sodium (exceeding 200 mg/L) were usually found in such samples.
- Levels of manganese, aluminum, and fluoride (2.0 mg/L) exceeded secondary DWS in many samples as well as many exceedances of the secondary DWS for TDS of 500 mg.

The Utility Solid Waste Activities Group argues that because no primary drinking water standards have been exceeded, this site should not be considered a damage case (USWAG, 2008). However, a public drinking water supply was damaged without any exceedance of primary drinking water standards.

Constituents Involved

Total dissolved solids (TDS), chloride, fluoride, manganese, and aluminum.

Incident and Date Damage Occurred / Identified

In the late 1980s, high TDS contamination was identified in several water supply wells of the Cresswell Heights Joint Municipal Water Supply in Beaver County, PA. In the mid 1990s, a groundwater assessment of the ash landfill west of the Phillips Power Plant found unanticipated degradation of groundwater.

Regulatory Actions

In 1990 a Consent Order and Agreement between Pennsylvania Department of Environmental Protection (PADEP) and Duquesne Light Company (DLC) was signed ordering DLC to stop contamination from the coal ash ponds and pay a $50,000 fine (PAEHB, 1990). As part of the closure plan for the Phillips Ash Landfill, PADEP required quarterly groundwater monitoring due to evidence of groundwater degradation.

Wastes Present

Coal ash, flue gas desulfurization (FGD) wastes, and process waters with coal ash and FGD wastes

Type(s) of Waste Management Unit

Two Coal Ash Ponds: Phillips Power Plant site plans dated December 2004 show two closed ash ponds ("No. 1" has a capacity of 13.5 million gallon, and "No. 2" has a capacity of 9 million gallons).
Coal ash and FGD Landfill: Covers about 157 acres, 50 acres of which were used for CCW from 1969 to 1991 (SET, 1994). About 75% of the landfill is in Allegheny County; 25% in Beaver County (BCPC, 1994).

Active or Inactive Waste Management Unit

Inactive. Phillips Power Plant was acquired from Duquesne Light Company in late 1990s and fully decommissioned in 2002. The two coal ash ponds were decommissioned in the early 1990s and the coal ash and FGD landfill was decommissioned in the late 1990s.

Hydrogeologic Conditions

The coal ash ponds were in Ohio River alluvium and overbank deposits.

Probable Cause(s)

Leaching of coal ash and FGD wastes into groundwater

SOURCES

Beaver County Planning Commission (BCPC). 1994. Comments by Robert Zapsic, Executive Director of BCPC on Phillips Ash Disposal Site Closure Plan and Supplemental Groundwater Material to Anthony Orland, PADEP (Oct. 28, 1994).

Commonwealth of Pennsylvania Environmental Hearing Board (PAEHB). 1990. Phillips Consent Agreement EHB Docket No. 88-481-CP-M (Oct. 24, 1990).

Earthjustice. 2008. Comments on U.S. Environmental Protection Agency's Coal Combustion Waste Damage Case Assessment (July, 2007), Prepared in response to U.S EPA, Notice of Data Availability 72 Fed. Reg. 49714, RCRA Docket No. EPA-HQ-RCRA-2006-0796 (Aug. 29, 2007).

SE Technologies, Inc. (SET). 1994. Closure Plan, PADEP Solid Waste Permit NO. 300440, Phillips Ash Disposal Site, Duquesne Light Company, Crescent Twp. Allegheny County, Hopewell Twp. Beaver County, Pennsylvania (Approved by PADEP Feb. 9, 1998).

Utility Solid Waste Activities Group (USWAG). 2008. Supplementary Information to EarthJustice Allegations of Additional CCW Damage Cases, Docket ID No. EPA-HQ-RCRA-2006-0796.

ENTITY/COMPANY - LOCATION

RRI Energy, Inc. (formerly Reliant Energy, Inc.) – Seward Generating Station
595 Plant Road
New Florence, PA 15944
Indiana County
GPS Coordinates: 40° 23' 56" N, 79° 02' 09"W

Summary

The Seward Generating Station's unlined coal ash and coal refuse pit, as well as its Closed Ash Sites No. 1 and No. 2, have leached and continue to leach many pollutants into the underlying aquifer at levels that far exceed both Pennsylvania and federal primary MCLs, and upgradient concentrations. The Pennsylvania Department of Environmental Protection (PADEP) has entered into numerous Consent Order and Agreements (COAs) with RRI and its predecessors in interest since at least 1982 to force remediation of groundwater contamination from the coal ash piles as well as surface water contamination from Outfall 012, yet the contamination persists.

Groundwater levels of antimony consistently exceeded the primary MCL of 0.006 mg/L, including a concentration of 0.1 mg/L (nearly 17 times the standard) at monitoring well MW-7 in the third quarter of 2008. Cadmium exceeded the primary MCL of 0.005 mg/L at 4 different monitoring wells, MW-5R, MW-6R, MW-7, and MW-8R, including a MW-7R reading of 0.041, over eight times the standard, in the second quarter of 2009.

In addition, 13 of the 16 quarters for which we have downstream surface water data from 2005 to 2009 contained at least one exceedance of Pennsylvania's Water Quality Criteria for Fish and Aquatic Life. There were 27 exceedances for aluminum, nickel, and zinc, including an aluminum exceedance of 5.3 mg/L (compared to a Criteria Maximum Concentration of 0.75 mg/L) and a nickel concentration of 30 µg/L (compared to a Criteria Continuous Concentration of 4.05 µg/L).

Also, pollutants including iron, manganese, pH, and aluminum are being discharged from the "remediated" coal ash and coal refuse pile directly into the Conemaugh River through NPDES permitted Outfall 012 in violation of permit limits.

Determination

Demonstrated off-site damage to surface water
Demonstrated on-site damage to groundwater moving off-site

Test of Proof

The No. 1 Ash Disposal Site was forced to be closed due to pollutants leaching from the ash pile. RRI's Final Remedial Investigation Report for the No. 1 Ash Disposal Site (2006) confirms that the ash pile was the source of groundwater contamination: "The source of inorganic constituents above naturally occurring concentrations is ash within the No. 1 Ash Disposal Site. Leachate containing inorganic constituents is produced through surface water infiltration and contact with groundwater in isolated areas." Aluminum, iron, and manganese were identified as the constituents of concern.

In addition, groundwater monitoring results continue to exceed Primary and Secondary Drinking Water Standards (MCL). These exceedances have been consistently documented since at least 2004. For example, groundwater monitoring data for only one year (the first two quarters of 2009 and the last 2 quarters of 2008) shows that:

- Primary MCL exceedances were documented in downgradient monitoring wells for many pollutants:
  - Antimony exceeded the federal primary MCL of 0.006 mg/L at least nine times, including a concentration of 0.1 mg/L at MW-7.
  - Arsenic was two times higher than the federal primary MCL of 0.01 mg/L at least twice with concentrations of 0.02 mg/L measured at (monitoring well) MW-6R.
  - Cadmium exceeded the federal primary MCL of 0.005 mg/L in at least 4 different monitoring wells, MW-5R, MW-6R, MW-7, and MW-8R, including a concentration of 0.041 mg/L at MW-7R.
  - Chromium exceeded the federal primary MCL at least four times, including a concentration of 0.33 mg/L, more than triple the primary MCL of 0.1 mg/L, at MW-8R.
  - Lead exceeded the primary MCL/Treatment Technique Action Level of 0.015 at least five times at various wells, including a concentration of 0.05 mg/L at MW-8R.
  - Selenium was detected above the primary MCL limit of 0.05 mg/L four times at MW-6R, MW-7R, and MW-8R.
  - Turbidity was recorded consistently above 5 NTU, including a reading of 75.3 NTU at MW-7R.
- Secondary MCLs were exceeded at very high levels in all downgradient wells in almost every quarter for a host of parameters. These include:
  - Aluminum levels were as high as 426 mg/L (MW-8R) and 403 (MW-7R), despite a secondary MCL of 0.05 mg/L.
  - Chloride was frequently measured well above 500 mg/L, double the secondary MCL of 250 mg/L.
  - Iron levels were over 7,100 times the secondary MCL of 0.3 mg/L, with concentrations as high as 2,120 mg/L (MW-8R) and 2,140 mg/L (MW-8R).
  - Manganese has a secondary MCL of 0.05 mg/L, yet was frequently reported at over 30 mg/L, including two readings over 100 mg/L at MW-5R.
  - Nickel was typically found at double the Superfund Removal Action Level (RAL) of 0.6 mg/L, with three of four MW-8R readings exceeding 3 mg/L.
  - Sulfate also frequently exceeded the secondary MCL of 250 mg/L at every well, including concentrations of 8,260 at MW-7R and 8,390 mg/L at MW-8R.
  - Total dissolved solids were continually found to exceed the secondary MCL of 500 mg/L, including a reading of 12,000 mg/L at MW-8R.
  - Zinc exceeded the secondary MCL of 5 mg/L at MW-7R and MW-8R several times with readings over 7 and 8 mg/L.

Surface water monitoring downstream of the ash sites contained 27 exceedances of Pennsylvania's Water Quality Criteria for Fish and Aquatic Life, with one or more exceedances occurring in 13 of the 16 quarters in downstream surface water data from 2005 to 2009. Exceedances were identified for aluminum, nickel, and zinc, including an aluminum exceedance of 5.3 mg/L (compared to a Criteria Maximum Concentration of 0.75 mg/L), a nickel concentration of 30 µg/L (compared to a Criteria Continuous Concentration of 4.05 µg/L), and a zinc concentration of 93 ug/L (compared to a hardness-adjusted Criteria Continuous Concentration of 48.5 ug/L).

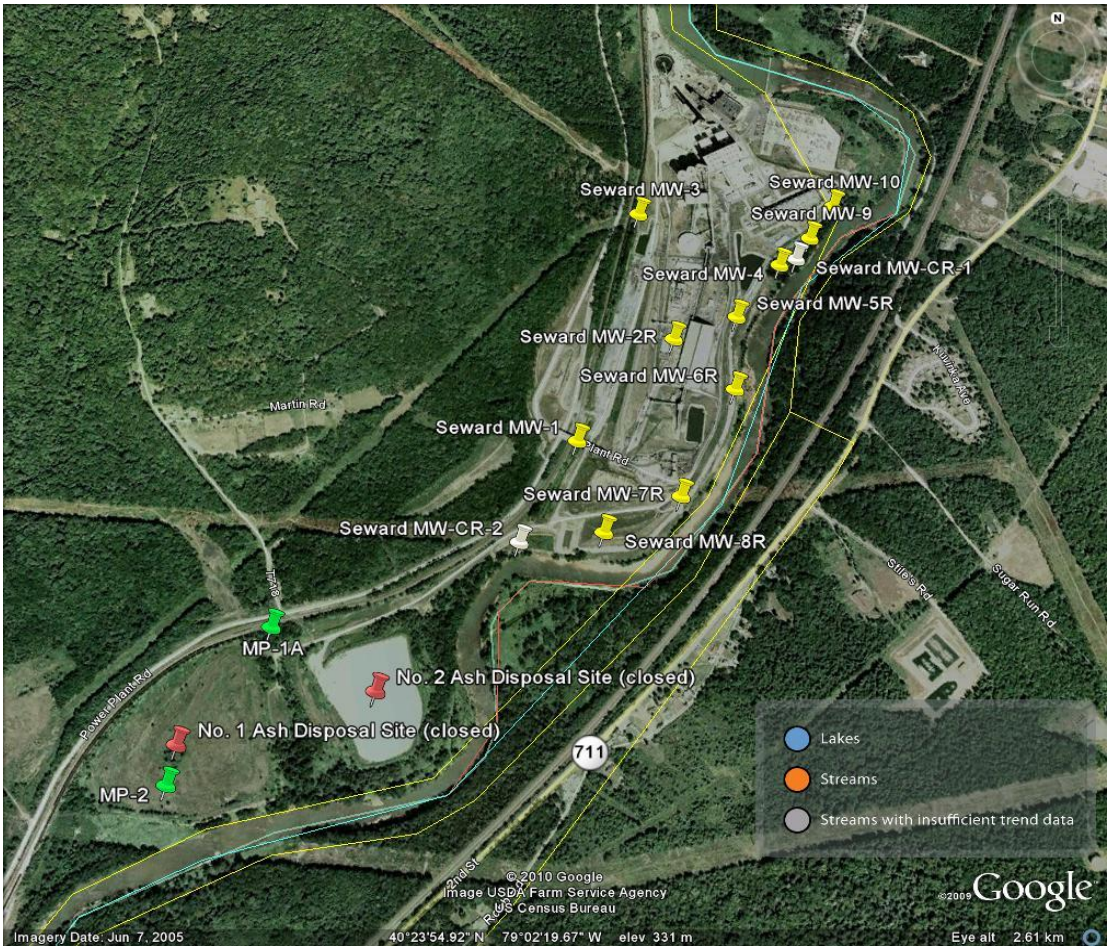
In addition, Outfall 012, which flows from the coal ash/coal refuse pile, has been discharging in violation of NPDES permit limits for iron, aluminum, manganese, and pH on a monthly basis for at least five years.

Constituents Involved

Aluminum, antimony, arsenic, cadmium, chloride, chromium, iron, lead, manganese, nickel, pH, selenium, sulfate, total dissolved solids, turbidity, zinc, sodium, calcium, barium, boron, fluoride, and magnesium.

Incident and Date Damage Occurred / Identified

Groundwater monitoring and discharge monitoring reports have shown high concentrations of numerous pollutants discharging from this site consistently for many years. PADEP forced RRI's predecessor in interest to close the No. 1 Ash Disposal site through a 1982 Consent Order and Agreement to stop the leaching of inorganic constituents from the ash into groundwater that had been occurring before that date. Recent groundwater monitoring data indicate that gross exceedances of primary and secondary MCLs and higher concentrations of ash constituents at downgradient than upgradient monitoring points continue to occur. RRI has discharged pollutants in excess of permit limits for iron, manganese, aluminum, and pH from Outfall 012, on a monthly basis for the past five years. A surface water monitoring point downstream of the site has recorded at least 27 exceedances of Pennsylvania's Water Quality Criteria for Fish and Aquatic Life in the last five years for aluminum, nickel, and zinc. In addition, this downstream point regularly recorded higher concentrations of sulfate, total dissolved solids and many other pollutants than concentrations of these pollutants recorded upstream of the site in this period.



Regulatory Actions

In 1982, the Pennsylvania Department of Environmental Protection (PADEP) entered into a Consent Order and Agreement with RRI (then Penelec) in which RRI was ordered to close the Seward No. 1 Ash Site, cease ash disposal at Seward, and pay a $308,000 fine for violations of the Solid Waste Management Act.

The No. 1 Ash Disposal Site was "remediated" by placement of a cap of three feet of flowable fill in accordance with a 2000 Consent Order and Agreement (COA) with PADEP. RRI filed its Notice of Intent to Remediate the site on November 2, 2001 pursuant to the COA. Along with the remediation, a Deed Restriction was placed on this property prohibiting any person from using any groundwater from the site for "human consumption, irrigation, or other purposes that might cause humans to ingest or be exposed to such groundwater."

In addition, RRI has been subject to several COAs to cease discharging pollutants from Outfall 012 although these actions have not proven successful because the discharges have not been addressed.

Wastes Present

Coal combustion waste including more recently (after 2004), CCW from fluidized bed combustion of waste coal which is co-disposed with coal refuse.

Type(s) of Waste Management Unit

Coal ash has been disposed of on-site since 1954, but the predecessors of RRI never secured a permit for this earlier disposal of ash. The ash has not been contained in either landfills or surface impoundments. There are two unlined "closed" former ash disposal sites, as well as the co-disposed coal ash and coal refuse site, atop of which the "repowered" Seward Generating Station, an FBC plant which also burns waste coal instead of traditional pulverized coal, was rebuilt in 2004. There is no evidence of liners beneath any of these ash disposal pits.

Active or Inactive Waste Management Unit

Inactive

Hydrogeologic Conditions

Description as of 1999 (before construction of the Seward Power Plant and its start-up in 2004): Over most of the site where the water table is 4 to 10 feet below the natural ground, the water table is within the silt loam. Closer to the river the depth to the water table below the co-disposed coal ash and coal refuse pile, is at 6 to 19 feet, which is typically in the sandy loam beneath the silt loam. At some of these wells the water table is in the gravelly, sandy loam beneath the sandy loam. The saturated thickness of the alluvial aquifer is approximately 12 feet near the River and up to 20 feet near the railroad tracks at the upgradient, west side of the site. The water table gradient averages 2 percent with groundwater flow generally perpendicular to the river. Several reports confirm that groundwater at the site discharges directly to the Conemaugh River.

Probable Cause(s)

Pollutants from the No. 1 ash disposal site have leached into groundwater. . As recently as 2006, the remedial investigation report found that, in some areas on-site, "the upper portion of the water table is within ash." In addition, leachate from the co-disposed coal ash and coal refuse site beneath the current plant is being discharged to surface water through the plant's Outfall 012 as well as leaching into the groundwater. This contamination then discharges directly to the Conemaugh River, which is classified as a Warm Water Fishery that is impaired for metals.

Additional Narrative

Hydrogeology reports prepared for RRI in 1999, 2001, and 2005 all confirm that leachate from the refuse pile has polluted groundwater and surface waters, namely the Conemaugh River, with pollutants including pH, iron, aluminum, manganese, and sulfate. Specifically, a 1999 hydrogeological report states that groundwater

"in the aquifer beneath the ash pile show[s] very high acidities and dissolved solids" and "discharges into the Conemaugh River and is responsible for reduced water quality in the river".

Aluminum, antimony, arsenic, cadmium, chloride, chromium, iron, lead, manganese, nickel, selenium, sulfate, total dissolved solids, turbidity and zinc were all present above Pennsylvania/federal primary MCLs (or, for nickel, above the Superfund RAL) in downgradient groundwater wells in 2008 or 2009 and higher in downgradient than upgradient wells. Sodium, calcium, barium, boron, fluoride, and magnesium were also detected in higher concentrations in downgradient monitoring wells than upgradient monitoring wells.

Many of these constituents have also been regularly detected at higher concentrations at a river monitoring site downstream of the site (CR-2) than at one identified as upstream (CR-1).

SOURCES

Rose, Arthur W. 1999. Geochemistry of Alluvial Aquifer Beneath Coal Refuse Piles, GPU Seward Station, Indiana Co., PA (July 1999).

Rose, Arthur W. 2001. Demonstration Plan: Modeling and Monitoring Acid Drainage from the Seward Coal Refuse Site, East Wheatfield Twp., Indiana Co., PA, Meiser & Earl, Inc. (Dec. 2001).

Rose, Arthur W. 2005. Results of Monitoring Acid Groundwater in the Alluvial Aquifer Beneath the Former Seward Coal Refuse Site, Indiana Co., PA, Meiser & Earl, Inc. (June 2005).
Arthur W. Rose, Ph.D., P.G.,

RRI Energy. 2004-2009. Form 14R Residual Waste Landfills and Disposal Impoundments Quarterly and Annual Water Quality Analyses submitted by RRI Energy to PADEP.

SE Technologies. 2006. Final Report: Remedial Investigation Report, No. 1 Ash Disposal Site, Seward

ENTITY/COMPANY - LOCATION

Orion Power Holdings, Inc. (subsidiary of RRI Energy, Inc) - Fern Valley Coal Combustion Waste (CCW) Landfill
c/o 30 Duquesne Light Way
Elrama, PA 15038
Jefferson Borough, Allegheny County
GPS Coordinates: 40°16' 53"N, 79°53' 20' W.

Summary

The Fern Valley CCW Landfill, on the west side of the Monongahela River across from Elizabeth PA, received coal ash from the Elrama Power Plant from 1989 to 2003. Arsenic levels 2.8 times higher than primary MCL (0.010 mg/L) were first noted in groundwater monitoring in 1995, and peaked in 2001 when the arsenic concentration was 36 times the primary MCL in one downgradient well and 29 times the primary MCL in another. Concentrations of boron, chloride, sulfate and total dissolved solids (TDS) in monitoring wells regularly exceeded health-based levels or secondary MCLs.

Leachate from the CCW landfill has degraded surface quality with high levels of arsenic, boron, chloride, sulfate and TDS compared to upstream surface waters. In 2001 and 2002, selenium levels downstream of the landfill were six to ten times the Pennsylvania surface water quality standard for the protection of aquatic life. While concentrations of arsenic have not exceeded water quality standards for aquatic organisms, they have been several times higher than the primary MCL in several measurements, and sulfate and TDS concentrations have commonly exceeded secondary MCLs by two or three times downstream of the landfill. These concentrations have been measured 200 feet downstream of the primary NPDES discharge point for the landfill before flowingi into a culvert that drains directly into the Monongahela River. One impact of the degradation of water quality has been a decrease in the species diversity of aquatic organisms in this tributary. The NPDES permit for the landfill has never included limits for arsenic, selenium, or other toxic pollutants that were known to be in surface water and groundwater discharges from the landfill.

Determination

Demonstrated damage to groundwater and surface water moving off-site

Test of Proof

Arsenic has been a troublesome contaminant in the groundwater at the landfill as have boron, sulfate, chloride, and TDS. (Data from GAI, 2002 and GAI 2002-2007)

- Total arsenic was identified in downgradient MW-20 in June 1995 at 0.028 mg/L, 2.8 times the primary MCL.
- Between 1995 and 2002 detects of total arsenic were sporadic in various monitoring points (or wells) with a peak in March 2001 when concentrations in four downgradient wells ranged from 0.121 to 0.363 mg/L, twelve to thirty-six times the primary MCL.
- Total arsenic concentrations at MW-12, a purported upgradient well, between1997 to 2006 either exceeded the primary MCL (0.015 to 0.24 mg/L) or were below the detection limit that was above the primary MCL.
- From 1997 to 2006 boron in MW-12 regularly exceeded 1 mg/L. Throughout this period,1 mg/L was equal to EPA's health advisories for boron. Although EPA relaxed those advisories to 3 mg/L in 2009, 1 mg/L is at or above health based standards for boron in drinking water used by other regulatory agencies such as the European Union (1.0 mg/L), World Health Organization (0.5 mg/L)

and Minnesota Department of Health (1.0 mg/L).. During the same time period concentrations of chloride, sulfate and TDS also regularly exceeded the secondary MCL in this well.

- From March 2006 to September 2007 chloride, sulfate and TDS concentrations in downgradient MW21 (near the NPDES discharge point) increased dramatically. Chloride increased from around 20 mg/l (levels measured since 1996) to 396 mg/l, well above the secondary DWS of 250 mg/l. Sulfate increased fivefold to 1010 mg/l, four times the secondary DWS. TDS increased four-fold to 2440 mg/, almost five time the secondary DWS. These values of chloride, sulfate and TDS are among the highest values measured at any monitoring well since1996.

Interpretation of groundwater monitoring data at the site is hampered by apparent mischaracterization of several monitoring wells as "upgradient" when a closer examination of the hydrogeology of the site indicates that they are probably receiving groundwater inflow from the CCW landfill. For example, "upgradient" MW-12 is located on the ridge between Fern Valley and the Monongahela River. This well is installed at a surface elevation of about 980 feet, 300 feet south of the lower constructed wetland, on the side of a sub-drainage into Fern Valley. It is completed at a depth whose elevation is between 838 feet and 853 feet, about 50 feet below the elevation of the original Fern Valley stream level. In other words, ash has been placed at elevations starting at least 50 feet above the level of the well screen. Water elevations in this well average 919 feet, about even with the elevation of the original Fern Valley stream level and below the level of the ashfill. MW-12 is completed in the Morgantown Sandstone at structural elevations below the nearest drainage in Fern Valley and above the Monongahela. The Morgantown Sandstone outcrops in the floor of Fern Valley and on the side of the ridge above the Monongahela River. Structural dip of the unit is toward the river. (Norris, 2002). The information on elevations and the likely mounding effect of groundwater moving outward from the landfill clearly do not support the identification of MW-12 as an upgradient well, nor has the data gathered from this well which suggests it is picking up contaminants draining from the landfill.

A review of the Fern Valley Disposal Site maps (DPL, 1996) and the recent satellite photographs of the final fill area, reinforces the concern that none of the designated "upgradient" monitoring wells (MW12, MW15 and MW5A) can be reliably considered upgradient. The closeness of these wells to the margins of the ash disposal area and the elevations of groundwater in the wells below the level of the filling created the potential for groundwater flow through the fill to the wells from the inception of filling.

An analysis of leachate data from the site as of 2002 concluded the following (Norris, 2002):

- Leachate that develops in the field and is collected in the underdrain system of the site routinely or episodically exceed use-or health-based standards such as primary and secondary MCLs or health advisories for some constituents. These include pH, total dissolved solids, sulfate, chloride, iron, manganese, arsenic, boron, and selenium. Others that were untested, or tested at inappropriate detection limits (e.g., Pb), may also be present above such standards. Field leachate concentrations frequently exceed, sometimes many-fold, the lab-test leachate concentrations.
- The discharge of leachate from the Fern Valley CCW landfill were allowed by the NPDES permit without chemical treatment (except for pH) and without monitoring or discharge limits for any chemical constituents except pH, aluminum, iron, oil and grease. The pH of the discharge would routinely exceed standards if not continuously treated and does so when treatment systems have failed. The discharges from the CCW disposal site that are anticipated or already observed by the operator exceed, or may exceed, use-based or health-based standards such as primary and secondary MCLs or health advisories for some constituents. These include, at least, total dissolved solids, sulfate, iron, aluminum, arsenic, lead, boron, and selenium.

Surface water quality (SW-2) has significantly degraded downstream from the CCW landfill compared to upstream water quality (SW-1). SW-2 is located well beyond the waste boundary of the landfill on a tributary 200 feet downstream of NPDES Outfall 001, the principal spillway for the leachate pond. This

sampling location is also right before the tributary enters a culvert that empties into the Monongahela River. From around 1997 to 2006 chloride, sulfate and TDS levels generally ranged two to five times higher at SW-2 than at upstream sampling locations (SW-1 and SW-3), and sulfate and TDS concentrations at SW-2 commonly exceeded the secondary MCL by two or three times. Arsenic concentrations were measured in three samples at SW-2 in 2001 and 2002 at levels from 2 to 9 times the primary MCL. Selenium was measured at SW-2 at 0.047 mg/L in March 2001 and 0.028 mg/L in February 2002, 10 times and 6 times higher respectively than the Pennsylvania water quality criteria for the protection of aquatic life from chronic toxicity effects of selenium (0.0046 mg/L). These concentrations were also many times over arsenic and selenium levels measured upstream of the landfill which were below levels of detection.

The degradation of surface water quality downstream from the CCW landfill has had an adverse impact on aquatic organisms. A benthic study commissioned by the operator in 1995 found that for two key environmental indexes, mean species diversity and equitability, the downstream location (SW-2) was degraded relative to the upstream sampling location near SW-1 (Norris, 2002).

Norris (2002) noted a number of serious deficiencies in the NPDES permit and monitoring system for discharge from the Fern Valley CCW landfill:

- More than 90 percent of the water discharging from this site does not pass through controlled or monitored outlets.
- Neither the storm water system, nor the underdrain and runoff system for the CCW disposal area convey close to the amount of water they should.
- The storm drain system does not even convey to its mouth all of the water that enters it allowing water to infiltrate into the landfill and add to the leachate load.
- For water that does discharge from the controlled outlets, there are no discharge limits for arsenic,. selenium, lead and other toxic pollutants known to be present at concentrations of concern, and there are many more toxic pollutants that may be present but have never been monitored.

Constituents Involved

Aluminum, arsenic, boron, chloride, lead, selenium, sulfate, and TDS.

Incident and Date Damage Occurred / Identified

Higher arsenic, boron, chloride, sulfate, and TDS levels exceeding health and use-based standards have been measured in downgradient groundwater and downstream of the landfill from at least 1995 onward

Regulatory Actions

There were several PADEP notices of violations around 2002 for CCW placed beyond boundaries of the permitted landfill area and failure to report monitoring data. Water quality assessments have been required in response to citizen or regulatory concerns regarding elevated arsenic levels. Responses provided by the operator or consultants have satisfied regulators resulting in no further corrective regulatory actions. Ash disposal stopped in 2003. PADEP approved closure of the site on July 24, 2007, and will continue to require water quality monitoring through at least 2017.

Wastes Present

Primarily coal fly ash.

Type(s) of Waste Management Unit

Lined CCW landfill with leachate collection and drainage system.

Active or Inactive Waste Management Unit

Inactive. Disposal began in 1989 and stopped in the fourth quarter of 2003. The landfill officially closed in 2007 (PADEP, 2007). Water quality monitoring will continue until at least 2007.

Hydrogeologic Conditions

The CCW fill occupies a former natural valley formed in stratified sedimentary rock formations that dip steeply toward the Monongahela River. The original valley roughly paralleled and emptied into the Monongahela River valley. The limited available data suggest the CCW liner and fill appear to have altered the groundwater flows in the area. The lower terminal end of the CCW fill now lies within a few hundred feet of the River where the leachate from the landfill empties into a sedimentation/treatment pond. The effluent from that pond is discharged under a NPDES permit directly into the Monongahela River.

Probable Cause(s)

Leaching of contaminants from CCW in the landfill to groundwater and discharge of leachate to surface water.

Additional Narrative

This CCW disposal site occupies most of Fern Valley which was originally drained by an unnamed tributary to the Monongahela River. This tributary entered the river about ½ mile upstream of the SH 51/Hayden Blvd Bridge, off SH 837.

The site was designed as a lined facility. The liner was installed as a 3-foot thick layer of low permeability cementaceous material (primarily CCW) placed over a bottom ash bed and drain system. Locations of monitoring wells were presumably originally selected based on assumptions that the liner/drainage system would function as designed, and that the fill would not substantially alter groundwater flow patterns. During operation CCW was placed beyond the lateral boundaries and above the elevations of the permitted disposal area. It seems reasonable to assume that the CCW beyond the permit boundaries was also beyond the limits of the liner/drainage system.

SOURCES

Duquesne Light Company (DPL). 1996. Fern Valley Disposal Site Maps. Prepared by DLC Fossil Stations Engineering Department, March 15, 1995, approved April 15, 1996.

GAI Consultants, Inc. 2002. Ground Water Assessment Report, Fern Valley Disposal Site, Jefferson Borough, Allegheny County, Pennsylvania. Prepared for Reliant Energy Power Midwest, April 2002. [Summarizes arsenic monitoring data from September 1993 to February 2002].

GAI Consultants, Inc. 2002 to 2007. [2007 is the most recent year which was available for review locally.] Quarterly Monitoring Reports, Orion Power Midwest Elrama Power Station, Fern Valley Disposal Site.

PADEP. 2007. Fern Valley Disposal Site Closure Certification. Letter dated July 24, 2007 to Mr. Zane Snyder, Reliant Energy-Orion Power MidWest LLC, Elrama Power Plant from Michael Forbeck, PADEP Regional Manager Waste Management.

Norris, Charles H. 2002. Fern Valley Assessment. Geo-Hydro, Inc. Denver, CO.

ENTITY/COMPANY - LOCATION

UGI Development Company, UGI Hunlock Power Station
390 Route 11
Hunlock Creek, PA 18621
Luzerne County
GPS Coordinates: 41°12'5.54"N, 76° 4'10.73"W

Summary

A coal ash surface impoundment at this small power plant on the Susquehanna River has contaminated the underlying groundwater with concentrations of arsenic, iron, and manganese that are several to hundreds of times the primary MCLs. Dissolved arsenic has been found at 3 to 12 times primary MCLs in multiple downgradient wells. Iron has been measured at up to 131 times the secondary MCL and manganese up to 314 times the secondary MCL in downgradient water. While elevated iron and manganese have been found in wells recently installed next to coal storage areas, arsenic contamination is only being measured in wells downgradient of the ash impoundment. The evidence of ash contamination is reinforced by alkalinity that doubles and pH that increases by a unit in groundwater that moves from upgradient wells to downgradient wells. In January 2008, the Pennsylvania Department of Environmental Protection (PADEP) ordered the power plant to start assessment monitoring to delineate the source and scope of the contamination. Monitoring indicates the contamination is flowing into the Susquehanna River.

Determination

Demonstrated on-site damage to groundwater moving to off-site surface water.

Test of Proof

In the ten years since monitoring has taken place at the Hunlock impoundment, total arsenic levels have reached as high as 1.40 to1.60 mg/L in MW-5, a downgradient monitoring well at this site, although low dissolved components and high turbidity in these measurements indicate the arsenic is largely floating in suspension in the groundwater. However, numerous measurements of dissolved arsenic have been found at other downgradient monitoring points at levels exceeding the federal primary MCL for arsenic of 0.010 mg/L and often by several times. In all dissolved arsenic concentrations have exceeded the primary MCL 59 times at downgradient points from 1999 to 2009. Every one of 22 samples taken from MW-7 for the last three years has exceeded the primary MCL. Some 22 of the 59 total exceedances have also been at concentrations more than three times higher than the primary MCL including at least seven samples of dissolved arsenic in MW-6 from September 2002 through September 2008 that ranged from 6 to 12 times the primary MCL (maximum concentration was 0.119 mg/L in Sept. 2008). This compares to no exceedances of the primary MCL by dissolved arsenic at any of four upgradient monitoring wells. In fact since monitoring at the site began, arsenic has only been measured above a detection limit once at an upgradient well (0.006 mg/L in December 2000 at MW-4).

Iron and manganese concentrations have also jumped noticeably in wells impacted by the ash and to a lesser extent apparently by runoff from coal storage areas. Iron concentrations have been found as high as 39.2 mg/L in the original downgradient ash monitoring wells (measured in MW-7 in April, 2009). This is 436 times higher than the highest iron concentration measured in the sole original upgradient well (0.090 mg/L in MW-4) and 131 times higher than the secondary MCL for iron (0.30 mg/L). Since PADEP required additional monitoring wells to be installed to assess the contamination, iron has been found at upgradient MW-9 next to the coal storage area at concentrations ranging as high as 2.870 mg/L. This is far over the standard but still dwarfed by maximum iron concentrations at downgradient ash wells (which are 13-14 times higher).

Similarly, manganese concentrations have continually exceeded the secondary MCL (0.050 mg/L) in downgradient ash wells. Highest manganese measurements have occurred more recently in MW-7 ranging from 12.9 to 15.7 mg/L, some 314 times the standard and the highest manganese measured at upgradient MW-4. However manganese has been measured next to the coal storage area in upgradient MW-9 at levels as high as 13.0 mg/L in September 2009. PADEP staff indicates that MW-9 may be seeing some mounding effects from groundwater flowing laterally from the ash impoundments.

Concentrations of barium, boron and lithium are also noticeably higher downgradient of the ash impoundment than at upgradient monitoring points although none are exceeding any health based standards.

In addition, the pH of upgradient water including water influenced by the coal storage areas is less than the pH of water downgradient of the ash impoundment usually by at least one pH unit (an order of magnitude). Lab pH readings between 5.0 and 6.0 Standard Units are found with few exceptions at upgradient points compared to a lab pH of 6.0 to 7.0 Standard Units and sometimes higher for all wells downgradient of the ash. In addition, the average alkalinity at downgradient wells is approximately twice that measured at upgradient wells. In fact when wells that are marginally downgradient or upgradient are removed from the comparison, average alkalinity increases by 5-6 times as water moves from upgradient to downgradient monitoring points. This chemistry indicates the chemical interaction of CCW with site groundwaters. While the monitoring data in downgradient wells appears to change as the flow patterns of coal ash slurry have changed within the impoundment, the evidence of this interaction is most pronounced presently at MW-7, which is the closest well to where surface water discharges from the impoundment into a small canal that in turn discharges to the Susquehanna River.

Assessment wells document that the contamination is migrating off-site into the Susquehanna River. All 11 monitoring wells at the Hunlock site (four original wells and seven added to assess the contamination in 2009) are screened in the shallow alluviam measuring groundwater that is moving into the Susquehanna River.

While UGI Hunlock maintains there is natural clay lining the impoundment, this clay may have been excavated entirely in parts of the impoundment resulting in ash being placed as much as eight feet under the water table allowing for ready migration of contaminants from the site. One of the assessment wells, MW-11, is approximately 240 feet downgradient of the waste boundary and very close to the Susquehanna River. Every one of six samples taken from downgradient MW-11 have measured arsenic exceeding the primary MCL by two to three times (0.024 to 0.0342 mg/L) since samples were first taken from this well in April 2009.

Furthermore, surface water samples taken from Outfall 005 which discharges from the impoundment to the Susquehanna River contained total arsenic concentrations of 0.0111 mg/L in May 2009 and 0.0249 mg/L in December 2009. The dissolved concentration in the December sample was 0.0149 mg/L. These levels are well under surface water quality standards that protect aquatic life. Nevertheless, depending upon how many other sources of arsenic are discharging to the Susquehanna, given the authorized volume of this discharge is 1500 gallons per minute (2.16 million gallons per day), such concentrations of arsenic from a discharge this large, combined with arsenic in contaminated groundwater discharging from the impoundment to the River may contribute to an arsenic loading problem in downstream surface waters.

Constituents Involved

Arsenic, iron, manganese, barium, boron, and lithium.

Incident and Date Damage Occurred / Identified

Contamination of downgradient wells with arsenic was first documented in September, 2000.

Regulatory Actions

Due to concentrations of arsenic, iron and manganese exceeding background concentrations in upgradient MW-4 and Statewide health standards, PADEP ordered a groundwater assessment to be conducted at this site by UGI Utilities on January 10, 2008 pursuant to 25 Pa. Code Chapters 299.144(a)(5) & 289.266. Seven additional monitoring wells were installed to sample groundwater per this assessment starting in April, 2009. The facility is planning to close in May, 2010 although PADEP has found a plan for closing the site submitted in November 2007 on behalf of UGI Utilities to be inadequate. Presently PADEP staff are assessing monitoring data to determine if they have sufficient wells in sufficient locations to fully determine groundwater impacts in order to determine the scope of abatement necessary under closure.

Wastes Present

Fly ash and bottom ash from burning anthracite coal, and to a lesser extent waste anthracite coal (culm) and bituminous coal.

Type(s) of Waste Management Unit

Two small coal ash basins that have become one surface impoundment due to slurrying operations. The fly ash and bottom ash that were previously maintained in these separate basins are now co-managed in the impoundment. There is an insitu (natural) clay liner of unknown thickness at the site although parts of it have reportedly been excavated.

Active or Inactive Waste Management Unit

Active but requesting closure by May, 2010

Probable Cause(s)

Leaching of contaminants in CCW into groundwater. The groundwater is discharging into the Susquehanna River

Additional Narrative

There is no solid waste permit for this facility which is called an "ash storage impoundment" although the facility is regulated under the Pennsylvania Residual Waste Regulations (Chapt. 287.112) for storage facilities. PADEP staff indicates the impoundment contains 204,400 cubic yards of "Top Ash" (a.k.a. fly ash) and 154,500 cubic yards of bottom ash. Assuming one cubic yard is roughly equivalent to one ton of ash, this would mean 358,900 tons of coal ash are being "stored" at this site. Since the Hunlock Station started operation in 1959, most of its CCW has eventually been shipped off-site to undisclosed "landfills" and for placement in Pennsylvania coal mines. There is a NPDES Permit (PA0008664) for the impoundment outfall that contains limits for iron, manganese, oil and grease, Total Suspended Solids and pH but no limits or monitoring requirements for trace metals. There is no off-site monitoring underway around this site, although PADEP staff maintains that there are no human receptors such as public water supply intakes or private residential wells along the Susquehanna River downstream of this power plant (within several miles).

SOURCES

Pennsylvania Department of Environmental Protection (PADEP). 1999-2009. Monitoring data from the Hunlock Power Station Storage Impoundment for the period 12/29/1999 – 9/23/2009 transcribed by PADEP, from Form 14R Residual Waste Landfills and Disposal Impoundments Quarterly and Annual Water Quality Analyses submitted by UGI Hunlock to PADEP.

Pennsylvania Department of Environmental Protection (PADEP). 2008. Letter from Tracey L. McGurk, Facilities Supervisor, Waste Management Program, Pennsylvania Department of Environmental Management, Northeast Regional Office to Mr. Jeffrey Steeber, UGI Utilities, Re: Groundwater Monitoring Results/Closure Work Plan, Ash Storage Impoundment Groundwater Assessment, UGI Utilities, Inc. Hunlock Power Station, Hunlock Township, Luzerne County (January 10, 2008).

Pennsylvania Department of Environmental Protection (PADEP). 2010. Phone discussions with PADEP Waste Management Program Staff, Northeast Regional Office, Wilkes Barre, PA. (February 11,12,16 and 18, 2010).

Quad Three Group, Inc. 2009. SITE PLAN, HUNLOCK POWER PROJECT, SR. 0011, HUNLOCK CREEK, LUZERNE COUNTY, PA, Drawing No. C-1, Date: 12/03/2009, (Site Map) in Report to Harrisburg, Mr. Laura Henry, 5-year Time Trend Analysis, 2003-2008, Dec 1, 2009.

ENTITY/COMPANY - LOCATION

RRI Energy, Inc. (formerly Reliant Energy, Inc.) —
Portland Generating Station's Bangor Quarry Ash Disposal Site
PA Route 512
Bangor, PA 18013
Upper Mount Bethel Township, Bangor Borough, Northampton County
GPS Coordinates: 40°52' 11"N; 75° 12' 00"W

Summary

Groundwater concentrations in downgradient wells at this landfill exceed primary and secondary MCLs and groundwater standards for arsenic, aluminum, fluoride, boron, iron, manganese, sulfate, and total dissolved solids (TDS), and the landfill's consultant concedes that the landfill is responsible for the degradation.

Surface water discharges from the landfill are sending concentrations of boron, cadmium, hexavalent chromium, and selenium into Brushy Meadow Creek that are notably higher than Pennsylvania's Water Quality Criteria Continuous Concentration for Fish and Aquatic Life (CCC). In some instances the exceedances are extreme. For example, boron was measured from Outfall 001 at 86.6 mg/L, more than 54 times the state's CCC of 1.600 mg/L. Selenium was measured at 41.3 µg/L from this Outfall, almost nine times the PA CCC of 4.6 µg/L (adjusted for a hardness of 400). These discharges were not authorized by RRI's NPDES permit for this site.

Trona "test" ash was disposed of on-site despite having failed two of nine leachability tests for arsenic.

Determination

Demonstrated on-site damage to groundwater

Test of Proof

A GAI Consultants 2006 Annual Evaluation Summary of this site, describing results collected from downgradient monitoring wells during 2006, states: "Analytical results for dissolved iron, dissolved manganese, pH(field), pH(lab), sulfate, and total dissolved solids exceed the USEPA [MCLs].".

Furthermore, results from GAI Consultants' trend analysis of data collected after July 1, 1995 and prior to January 1, 2007 state:

> Upward trends for dissolved arsenic, dissolved boron, and dissolved potassium and downward trends for pH (field) and pH (lab) are unique to downgradient monitoring wells and may be the result of actions occurring at Bangor. At downgradient monitoring wells there are three parameters, dissolved arsenic, dissolved barium, and pH (field and lab), with a drinking water standard and an upward trend. Monitoring well BMW-6D exceeded in pH (field and lab) during the last quarter of 2006. These exceedances have occurred before in the years 2001 through 2002. The predicted time for drinking water standard exceedance ranges from 1 year for dissolved arsenic to 1127 years for dissolved barium.

GAI Consultants' 2005 Annual Evaluation found downgradient MCL exceedances for dissolved aluminum, fluoride, dissolved iron, dissolved manganese, sulfate, and TDS. The 2005 trend analysis from July 1, 1995 to January 1, 2006 found upward trends in downgradient wells for dissolved arsenic, dissolved boron, chloride, pH (lab), and dissolved potassium.

The ash that has been dumped at this landfill has sometimes been more toxic than regulations allow. A letter from RRI to PADEP in 2007 reports that of nine composite samples of trona ash (a "test ash") disposed of at this site, two samples exhibited high levels of leachable arsenic in excess of Pennsylvania Class II landfill limits. Specifically, the Class II landfill limit for leachable arsenic is 0.5 mg/L; however leach test results measured arsenic at 1.61 mg/L (more than three times the limit) and 2.02 mg/L (more than four times the limit).

In addition to the contamination of on-site groundwater, unpermitted discharges of boron, cadmium, hexavalent chromium, and selenium into Brushy Meadow Creek from Outfall 001 exceeded the Pennsylvania water quality standard for the protection of aquatic life from pollutant concentrations that are chronically toxic (Criteria Continuous Concentration or CCC) in samples analyzed in October 2006:

- Boron was measured at 8.6 mg/L, more than 54 times the PA CCC of 1.6 mg/L.
- Cadmium was measured at 1 µg/L, exceeding the PA CCC of 0.64 µg/L (adjusted for a hardness of 400).
- Hexavalent chromium was measured at 11 µg/L, exceeding the PA CCC of 10 µg/L.
- Selenium was measured at 41.3 µg/L, almost nine times the PA CCC of 4.6 µg/L (adjusted for a hardness of 400).

Unpermitted discharges of boron, cadmium, and selenium into Brushy Meadow Creek from Outfall 002 also exceeded the PA CCC in samples analyzed in November 2006. Specifically:

- Boron was measured at 1.780 mg/L, exceeding the PA CCC of 1.6 mg/L.
- Cadmium was measured at 1 µg/L, exceeding the PA CCC of 0.64 µg/L (adjusted for a hardness of 400).
- Selenium was measured at 10 µg/L, exceeding the PA CCC of 4.6 µg/L by more than double.

Constituents Involved

Arsenic, barium, boron, cadmium, hexavalent chromium, potassium, pH, selenium, iron, manganese, sulfate, total dissolved solids, aluminum, fluoride, and chloride.

Incident and Date Damage Occurred / Identified

Exceedances of PA MCLs in groundwater on-site have occurred in 2001, 2002, 2005, and 2006, with an upward trend detected between 1995 and 2006. Exceedances of PA CCC were documented in unpermitted discharges to surface waters in 2006.

Regulatory Actions

None.

Wastes Present

Coal combustion waste, including fly ash, bottom ash, and "Trona Test Ash" (ash produced during a PADEP-approved Trial Burn utilizing injection of a substance intended to reduce air emissions) from the Portland Generating Station.

Type(s) of Waste Management Unit

The Bangor Ash Disposal Site is a lined landfill constructed in a quarry. The liner includes a 60 mil LLDPE geomembrane over a 6" fly ash sub base.

Outfall 001 receives wastewater from the Stormwater Ash Leachate Pond. Leachate from above the liner is discharged to a leachate collection system, which drains into a leachate pond. "When the pond fills to near capacity, it is sampled and analyzed. When the results are acceptable the pond is drained" via Outfall 001. The drain is a 6-inch PVC pipe that eventually discharges through a 12-inch PVC pipe at Outfall 001 into an open channel and into Brushy Meadow Creek.

Outfall 002 receives wastewater from the Stormwater Sedimentation Pond, which flows from the ash site. Outfall 002 also discharges into Brushy Meadow Creek (see PADEP, Flow Diagrams of NPDES Permit No. PA00063606 Outfalls 001 and 002).

Active or Inactive Waste Management Unit

Active

Probable Cause(s)

Constituents are leaching from the disposal site into groundwater, as well as being discharged off-site into Brushy Meadow Creek through Outfalls 001 and 002.

Additional Narrative

There are least two public water supply wells approximately ¾ mile away from the site—Hartzell's Auction Inc. serves three families and Meadowbrook Mobil Home Park serves approximately 98 individuals.

SOURCES

GAI Consultants, 2006. 2005 Annual Evaluation Summary, Bangor Ash Disposal Site (May 16, 2006).

GAI Consultants. 2007. 2006. Annual Evaluation Summary, Bangor Ash Disposal Site (May 21, 2007).

Pennsylvania Department of Environmental Protection (PADEP). 2003. NPDES Permit No. PA0063606 for Bangor Quarry Ash Disposal Facility (issued to RRI on Jan. 8, 2003). See, also Flow Diagrams of NPDES Permit No. PA00063606 Outfalls 001 and 002.

RRI Energy. 2006. Geochemical Testing, Laboratory Results of Aqueous Matrix from Bangor Outfall 001 and 002, (conducted on Nov. 14, 2006 & Oct. 19, 2006).

RRI Energy. 2007. Letter from Stephen B. Dixon, Principal, Waste Management, Reliant Energy, to Robert C. Wallace, Chief, Engineering and Facilities Section, Waste Management Program, PADEP, Portland Generating Station Bangor Ash Disposal Site Solid Waste Permit # PA 300002, Coal Ash Analyses: (1) Central Appalachian Coal (2) Trona Test Ash (July 17, 2007).

RRI Energy. 2009. Form 26R: Chemical Analysis of Residual Waste, Annual Report by the Generator, Portland Generating Station Bangor Ash Site Outfall 001 (Feb. 27, 2009).

ENTITY/COMPANY - LOCATION

South Carolina Electric and Gas (SCE&G) – Wateree Station
142 Wateree Station Road
Eastover, SC 29044
Richland County
GPS Coordinates: 33°49'35.04"N, 80°37'22.08"W

Summary

Groundwater monitoring around the Wateree Station's coal ash impoundment has measured arsenic at 18 times the federal MCL (Fretwell, 2009a). The South Carolina Department of Health and Environmental Control (SC DHEC) cited the plant in 2001 for violations of state groundwater standards, but did not take any further regulatory action over the contamination. Recent evidence shows that the arsenic contamination has migrated to an adjacent property and is being accumulated in biota in the Wateree River.

Determination

Demonstrated on-site damage to groundwater moving off-site.
Demonstrated off-site damage of surface waters and fish.

Test of Proof

On-site groundwater monitoring found arsenic contamination up to 18 times the federal MCL (Fretwell, 2009a). Private testing has found that seeps leaking off-site from the impoundment contain arsenic levels 5 times the state standard for arsenic (Bartelme, 2009). Fish living in the Wateree River in close proximity to the plant were found to have elevated tissue levels of arsenic in comparison to upstream and downstream populations. One catfish was found to have arsenic tissue levels of 500 parts per billion (Fretwell, 2009b).

Constituents Involved

Arsenic.

Incident and Date Damage Occurred / Identified

Arsenic contamination was first detected in the late 1990's. In response, the SC DHEC cited the plant for violating state groundwater standards, but did not take any further action after the plant agreed to take action to reduce contamination from the impoundment (Fretwell, 2009a). Recent evidence shows that arsenic contamination continues to be a concern.

Regulatory Actions

DHEC cited the plant for violations of state groundwater standards in 2001.

Wastes Present

Fly ash and bottom ash.

Type(s) of Waste Management Unit

An unlined surface impoundment.

Active or Inactive Waste Management Unit

Active.

Probable Cause(s)

Migration of contaminants from coal ash leachate to groundwater and eventual discharge to surface water.

Additional Narrative

Coal combustion wastes produced at Wateree Station are dumped into an unlined 80-acre impoundment, which has a capacity of 52,272,000 cubic feet. Data from two on-site wells show arsenic at levels 18 times the primary MCL, and leaks have been found in the containment wall between the impoundment and the river that have arsenic levels of 1.9 mg/L, 190 times the primary MCL (Fretwell, 2009a). Testing on an adjacent property found arsenic levels at 5 times the state limit (Bartelme, 2009). Fish tissue samples taken near the impoundment indicate that the arsenic is being accumulated in the biota of the Wateree River with one catfish having arsenic tissue levels of 500 parts per billion (Fretwell, 2009b). The site is upstream of the Congaree National Park, which is reportedly one of the largest contiguous sections of floodplain forest in North America. Neighboring landowners have filed a lawsuit to stop the contamination on their property.

SOURCES

Fretwell, Sammy. 2009a. *Arsenic draining into Wateree River*, The State. *available at* http://www.thestate.com/local/story/970356.html (Oct. 4, 2009).

Tony Bartelme. Oct. 5, 2009. *Watchdog update: More contamination found at SCE&G Wateree coal plant*, The Post and Courier. *available at* http://www.postandcourier.com/news/2009/oct/05/05ashwatchweb/

Fretwell, Sammy. 2009b. *Judge Won't Drop Landfill Pollution Case*. The State. *available at* http://www.thestate.com/local/story/975392.html?RSS=local (Oct. 8, 2009).

ENTITY/COMPANY - LOCATION

SCANA, dba South Carolina Electric & Gas Company (SGE&G) – Urquhart Station
100 Urquhart Drive
Beech Island, SC 29842 (near Augusta, Georgia)
Aiken County
GPS Coordinates: 33°25'59" N, 81°54'41" W

Summary

Groundwater contamination has been reported at a coal ash landfill and two ash settling basins adjacent to the Urquhart Station. The landfill is located approximately 300 feet from the Savannah River, and the ash basins are located approximately 100 feet from the river. Arsenic and nickel concentrations have been greater than their South Carolina drinking water standards and the federal primary MCL for arsenic in at least one well at the coal ash landfill. Arsenic concentrations have also been greater than the state drinking water standard and federal MCL in one well at the ash basins.

At least one of the contaminated landfill monitoring wells is in a wetland indicating that contaminated shallow groundwater discharges to the wetland. Further, monitoring activities at that well indicate that coal ash is present in the soil through which the well was drilled revealing that coal ash was placed in the wetland. No formal assessment activities have been required because the exceedances of arsenic and nickel have been sporadic, and well results nearest the river have not exceeded a drinking water standard. Similarly no off-site monitoring has been required.

Determination

Demonstrated on-site damage to groundwater.

Test of Proof

SCE&G reported in November 2006 that previous groundwater monitoring results for the coal ash landfill showed arsenic concentrations greater than the 0.01 mg/L MCL and state drinking water standard and that other "elevated metals" existed (SCE&G, 2006) in the site groundwater. South Carolina Department of Health and Environmental Control (SC DHEC) confirmed that arsenic and nickel have been detected at concentrations greater than the drinking water standards (Collinsworth, 2010). The landfill is located approximately 300 feet southeast of the Savannah River at the southern end of the plant property. SCE&G tried to explain to SC DHEC in November 2006 that the arsenic was due to wells being placed in ash disposal areas and wells that were improperly constructed. Sampling of a replacement (Well 3B to replace Well 3A) positioned near a wetland gave the same result – arsenic was again greater than the 0.01 mg/L standard. This result therefore indicates that groundwater adjacent to the wetland is contaminated. SCE&G requested that the replacement well in the wetland area be abandoned because the presence of "surface ash" in the area skewed the results suggesting that ash was historically placed in the immediate area of a wetland. SC DHEC denied that request (Collinsworth). No further assessment activities are required because the wells nearest the Savannah River have not exceeded any drinking water standard (Collinsworth).

"Elevated" concentrations of arsenic in groundwater (actual concentrations were not given) were reported for the ash settling basins and their associated NPDES permit (#SC0000574) since at least 2007 (SCANA, 2007). Arsenic has been detected in at least one ash basin area well at a concentration greater than the 0.01 mg/L drinking water standard (Adams). The two (2) coal ash basins are located within approximately 100 feet of the Savannah River at the northern end of the plant property.

Constituents Involved

Arsenic and nickel

Incident and Date Damage Occurred / Identified

A Comprehensive Ground Assessment was performed for the coal ash landfill area sometime before November 2006 (SCE&G, 2006). "Elevated" concentrations of arsenic in groundwater were reported for the ash settling basins at least since 2007 (SCANA, 2007).

Regulatory Actions

The site is listed on the South Carolina Groundwater Contamination Inventory (2008) for arsenic contamination exclusively associated with the ash basins (SC DHEC, 2008). A Comprehensive Groundwater Assessment has been performed for the landfill area (SCE&G, 2006). SCE&G is currently required to complete another assessment to determine the nature and extent of the contamination associated with the ash settling basins (Adams). Those assessment activities are considered to be an "informal" action, and no violations or orders have been issued to the owner (Adams). The second assessment is due on March 1, 2010.

Wastes Present

Coal combustion waste (undifferentiated) in the coal ash landfill. CCW and runoff/wash down from the ash silo area in the ash settling basins (SCANA, 2007).

Type(s) of Waste Management Unit

Coal ash landfill dating to at least the late 1980s (SCE&G, 2006). Two (s) ash settling basins.

Active or Inactive Waste Management Unit

Active

Hydrogeologic Conditions

The site is located adjacent to the Savannah River, and it is assumed that the localized groundwater flows towards the Savannah River (Adams). When discussing the ash settling basins proximity to the river, SC DEHC concluded that no off-site monitoring has been performed in the past because the ash settling basins are located adjacent to the Savannah River. SCE&G will be required to ensure that no off-site migration is occurring as part of the assessment that is due March 1, 2010.

Probable Cause(s)

Leachate from coal combustion wastes in the landfill and the settling basins.

SOURCES

Adams, Stacey, SC DHEC, telephone conversation with Mark Quarles, Global Environmental, LLC (Jan. 27, 2010).

Collinsworth, Keith, SC DHEC, Manager, Bureau of Land and Waste Management, Solid Waste Groundwater, telephone conversation with Mark Quarles, Global Environmental, LLC (Feb. 2, 2010).

SCANA Services, Inc., letter to Stacey Adams, Bureau of Water, SC DHEC, from Mike Moore, SCANA (Sept. 19, 2007).

South Carolina Electric and Gas (SCE&G), letter from Mike Moore, SCE&G to Roger Schweitzer of Bureau of Land and Waste Management, SC DHEC (Nov. 16, 2006).

South Carolina Department of Health and Environmental Control (SC DHEC), Groundwater Contamination Inventory, 2008, *available at* http://www.scdhec.gov/environment/water/gwci/gwci.pdf.

ENTITY/COMPANY - LOCATION

Santee Cooper, dba South Carolina Public Service Authority (SCPSA) – Grainger Generating Station
1605 Marina Drive
Conway, SC 29526
Horry County
GPS Coordinates: 33°49'51", 79°02'33"

Summary

Leachate from fly ash ponds used by the Grainger Generating Station has contaminated groundwater near the Waccamaw River with arsenic at up to 91 times the drinking water standard. Assessment activities are just now being required to define the nature and extent of the contamination – ten (10) years after the contamination was first reported. Surface water sampling of the Waccamaw River has been performed twice – once in 2001 and later in 2006, after SC DHEC "recommended" that additional samples be collected. The results of those two surface sampling events did not find arsenic above the drinking water standard (0.01 mg/L equal to the MCL) – the apparent standard used by SC DHEC to determine if an adverse effect had occurred to the receiving stream.

Determination

Demonstrated on-site damage to groundwater.

Test of Proof

Santee Cooper reported in 2000 that groundwater monitoring results for a sampling event on October 10, 2000 showed arsenic concentrations greater than the 0.01 mg/L drinking water standard. In particular, two wells had extremely high concentrations above the drinking water standard – 0.418 mg/L in Well 4R and 0.917 mg/L in Well 3. A surface water investigation performed in March 2001 did not indicate that arsenic was leaching into the Waccamaw River. SC DHEC "recommended" five (5) years later that another investigation be conducted (SC DHEC, 2006). The results of that investigation did not find arsenic concentrations above the 0.01 mg/L drinking water standard (Adams). The SC DHEC apparently did assess if more restrictive arsenic standards for protection of human health by consumption of contaminated water and organisms (0.000018 mg/L) or organisms only (0.00014 mg/L) were being exceeded.

Constituents Involved

Arsenic.

Incident and Date Damage Occurred / Identified

The contamination was found in October 2000.

Regulatory Actions

Santee Cooper / South Carolina Public Service Authority (SCPSA) is currently required to complete an assessment to determine the nature and extent of contamination associated with the ash ponds, to determine if off-site impacts are likely, and to determine if the adjacent Waccamaw River has been affected (Adams). That assessment is due in April 2010. The site is listed on the South Carolina Groundwater Contamination Inventory (2008) for undifferentiated metals contamination, and the site is listed as being in a "remediation" phase (SC DHEC, 2008). However a telephone conversation with SC DHEC indicated that no remediation associated with the ponds is being conducted (Adams). Assessment activities are considered to be an "informal" action, and no violations or orders have been issued to the owner. Groundwater monitoring is a condition of the pond NPDES permit.

Wastes Present
Fly ash.

Type(s) of Waste Management Unit
Fly ash ponds.

Active or Inactive Waste Management Unit
Active

Hydrogeologic Conditions
The site is located adjacent to the Waccamaw River. Shallow water table aquifer conditions are assumed to exist, and that the localized groundwater flow is towards the Waccamaw River (Adams). SC DHEC believes the river acts as a discharge boundary and therefore off-site migration beyond the river is not likely (Adams).

Probable Cause(s)
Fly ash leachate constituent migration from the ash ponds.

Additional Narrative

Discharge from the ponds is covered under an NPDES permit (permit number not determined). The file review did not indicate what, if any, additional parameters are required to be monitored or the numerical limits associated with the discharge(s).

Surface water sampling conducted in 2006 apparently used the arsenic MCL as the standard for determining harm (SC DHEC, 2006) (Adams). The Waccamaw River in the area of the Grainger Station has a "Freshwater" designated use (S.C. Classified Waters, R.61-69). Further, according to S.C. water use classification standards, the allowable concentrations for arsenic in a freshwater stream range from 0.000018 mg/L for human consumption of water and organisms, to 0.00014 mg/L for consumption of organisms only, to 0.01 mg/L for drinking water consumption (S.C. Water Classifications). Sole use by SC DHEC of the 0.01 mg/L standard for arsenic in the Waccamaw River does not prevent the adverse risks posed to people consuming fish from the river if arsenic concentrations in the water exceed 0.00014 mg/L.

SOURCES

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South Carolina Department of Health and Environmental Control (SC DHEC). 2000. Letter from Chris Forrest of SC DHEC to Melanie Hill, Santee Cooper (Nov. 14, 2000).

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S.C. Classified Waters, R.61-69, *available at* http://www.epa.gov/waterscience/standards/wqslibrary/sc/.

S.C. Water Classifications and Standards, Regulations 61-68, June 25, 2004, *available at* http://www.epa.gov/waterscience/standards/wqslibrary/sc/.

ENTITY/COMPANY - LOCATION

Tennessee Valley Authority (TVA) – John Sevier Fossil Plant
611 Old Highway 70
Rogersville, TN 37857
Hawkins County
GPS Coordinates: 36.363029, -82.986844

Summary

Data from groundwater monitoring wells located between John Sevier Fossil Plant's coal combustion waste (CCW) surface impoundment and the Holston River show that cadmium levels exceed the U.S. EPA primaryMCLs and aluminum, manganese and sulfate levels exceed secondary MCLs for drinking water. In addition, arsenic and manganese exceed EPA National Recommended Water Quality Criteria (WQC) for human health, and cadmium levels exceed both chronic and acute levels for freshwater aquatic life. For example, groundwater monitoring reports from May 2009 show arsenic levels at 2.2 µg/L, more than 15 times higher than EPA's human health criteria for fish consumption; and manganese levels at 5700 µg/L, over 50 times higher than EPA's human health criteria for fish consumption. Boron levels of 18,000 µg/L are far above EPA Superfund Removal Action Levels (RAL) of 3,000 µg/L and 900 µg/L and exceed EPA's Drinking Water Health Advisory levels of 3,000 and 6,000 µg/L. In addition, strontium measured at 5,300 µg/L exceeds EPA's health advisory level for strontium of 4,000 µg/L.

All of these pollutants were measured in shallow groundwater wells adjacent to surface waters. TVA states that site groundwater discharges to surface waters including the Holston River, and tributaries such as Dodson Creek and Polly Branch. Tennessee applies surface water quality standards to such groundwater.

Determination

Demonstrated damage to groundwater moving off-site to surface waters.

Test of Proof

Data shows that cadmium levels exceed EPA's primary MCL in recent samples (May 2009, December 2008) from groundwater monitoring wells located on the banks of the Holston River downgradient from the CCW surface impoundment. For example, TVA measured cadmium levels at 6.8 µg/L and 6 µg/L, above the EPA MCL for cadmium of 5 µg/L, at groundwater monitoring wells at the property boundary adjacent to the Holston River. Aluminum, manganese and sulfate also exceed secondary MCLs. For example, data shows aluminum levels 8 times higher than the highest secondary MCL for aluminum; manganese levels over 100 times higher than the secondary MCL for manganese; and sulfate levels 7 times higher than EPA's secondary MCL in groundwater wells adjacent to the Holston River.

TVA states that its unlined CCW impoundments are upgradient from the Holston River and its tributaries such as Dodson Creek and Polly Branch and that groundwater from the John Sevier site discharges directly into these surface waters.

In Tennessee, groundwater that enters a stream or other surface water is subject to water quality criteria and treated as surface water. A comparison of EPA WQC to recent groundwater data from monitoring wells along the Holston River (May 2009, Dec. 2008) show that arsenic and manganese exceed criteria for human health; and cadmium levels exceed both chronic and acute levels for freshwater aquatic life. For example, groundwater monitoring reports from May 2009 show arsenic levels at 2.2 µg/L, 15 times higher than EPA's human health criteria for fish consumption; and manganese levels at 5.7 mg/L, over 50 times higher than EPA's human health criteria. Depending on the hardness of the water and the amount of metal dissolved in the water, cadmium levels may well have been over 3 times higher than the criteria that protects aquatic life

from acute toxicity and more than 24 times higher than the criteria that protects aquatic life from chronic toxicity.

Groundwater data from wells at the banks of the Holston River also show high levels of boron (11 mg/L and 18 mg/L in May 2009 and Dec. 2008 respectively) and strontium (5.3 mg/L and 3.7mg/L in May 2009 and Dec. 2008 respectively). Boron levels at John Sevier are far above EPA's Superfund Removal Action Levels (RAL) of 3.0 mg/L and .900 mg/L, and handily exceed EPA's Child Health Advisory of 3.0 mg/L and Life-time Health Advisory of 6.0 mg/L for consumption of boron in drinking water. They are even further above health-based standards for boron in drinking water used by regulatory agencies such as the World Health Organization, Minnesota Department of Health and in the European Union that range from .5 to 1.0 mg/L. Strontium measured at 5.3 mg/L also exceeds the EPA's Life-time Health Advisory for strontium of 4.0 mg/L.

Constituents Involved

Aluminum, arsenic, cadmium, manganese, boron, strontium, and sulfate.

Incident and Date Damage Occurred / Identified

Contaminated groundwater entering off-site surface waters as documented in 2008-2009 groundwater monitoring data and TVA reports.

Wastes Present
Bottom Ash and Fly Ash.

Type(s) of Waste Management Unit
Two Surface Impoundments.

Active or Inactive Waste Management Unit
Active

Hydrogeologic Conditions
John Sevier Fossil Plant rests on the present Holston River floodplain. Topography at John Sevier currently slopes and drains to the Holston River, Dodson Creek, and to a stream flowing generally northeastward across the eastern end of disposal area and sedimentation pond. Alluvial deposits generally mantle the entire site, and consist of unconsolidated sandy, clayey silt with interspersed pebbles and cobbles.

Groundwater is derived from infiltration of precipitation through the soil overburden and from lateral groundwater inflow originating in upland recharge areas to the southeast. Groundwater originating at John Sevier Fossil Plant discharges to the Holston River and its local tributaries, Dodson Creek and Polly Branch. The principal aquifer in the site locality is the Sevier shale consisting of thinly bedded, slightly calcareous shale with interbedded limestone layers. Eighteen private water-supply wells are within 1 mile of John Sevier, and most wells obtain water from the Sevier shale or possibly the alluvial deposits.

Probable Cause(s)
CCW leachate contaminating groundwater, which discharges to the Holston River, Dodson Creek and Polly Branch.

Additional Narrative
In the 1950s, TVA built a 90-acre, unlined surface impoundment on the bank of the Holston River to store coal combustion waste (CCW) from the John Sevier coal plant. Since 1987, John Sevier has stacked dry CCW (bottom ash and fly ash) on top of this existing 90-acre dewatered ash pond, including in an area known as "the bathtub." TVA states that groundwater originating within the John Sevier Fossil Plant boundaries discharges to the Holston River and its local tributaries, the Dodson Creek and Polly Branch. Specifically, shallow groundwater originating on-site from natural recharge or artificial sources (e.g., ash sluice water) generally flows northward to the Holston River. In addition, TVA states that leachate from the CCW disposal area discharges directly to the Holston River.

As of May 2009, TVA had not quantified the potential impacts of CCW leachate-affected groundwater entering the Holston River, Dodson Creek or Polly Branch, but groundwater monitoring wells on the banks of the Holston River, show levels of CCW pollutants in excess of both EPA MCLs and EPA National Recommended Water Quality Criteria (WQC).

The Persia Water Utility operates a water supply intake from the Holston River, less than two miles downstream from John Sevier Fossil Plant and serves a local population of 4,395. In addition, Morristown operates a municipal water intake 31 miles downstream on the Holston River and serves approximately 31,000 people.

John Sevier Fossil Plant also operates another unlined 41-acre CCW pond for its bottom ash and fly ash. Although 26 acres of this pond are an active disposal site, there is no landfill permit for this impoundment as is

usually required for surface impoundments in Tennessee. Data about the environmental or public health impacts of this impoundment are unavailable.

SOURCES

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Tennessee Valley Authority (TVA). 2006, Final Environmental Assessment, John Sevier Fossil Plant Units 1 through 4 Control Systems for Reduction of Nitrogen Oxide, Hawkins County, Tennessee (March 2006).

TVA. 2008. John Sevier Fossil Plant, Operations Manual, Dry Fly Ash Stacking Facility (revised Aug. 2008).

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TVA. 2009a. Draft Environmental Assessment, Installation of Flue Gas Desulfurization System on John Sevier Fossil Plant, Hawkins County, Tennessee (May 2009).

TVA. 2009b. Letter from Anda Ray, TVA to Mr. Richard Kinch, EPA, response to EPA request for information about TVA's coal-combustion impoundments (Mar. 25, 2009) *available at* http://www.epa.gov/waste/nonhaz/industrial/special/fossil/surveys/tva-fossil.pdf

U.S. EPA. 2010. Safe Drinking Water Information System (SDWIS), Persia Utility District and Morristown Water System (Jan. 2010).

ENTITY/COMPANY - LOCATION

Trans-Ash, Inc. – CCW Landfill
Bivens Cypress Creek Road
Camden, TN 38320
Benton County
GPS Coordinates: 36° 2'25.54"N, 88° 4'22.25"W

Tennessee Valley Authority, Johnsonville Fossil Plant (source of CCW)
535 Steam Plant Road
New Johnsonville, TN 37134

Summary

Since 2002, Trans-Ash, Inc. has placed coal ash from the Tennessee Valley Authority (TVA) Johnsonville Fossil Plant directly into quarries at a former gravel mine in Camden, Tennessee. Trans-Ash was supposed to install a 0.25 inch thick geosynthetic clay liner (GCL) because quarry mining activities penetrated groundwater at numerous locations within the quarry and altered groundwater flow patterns (TVA, 2002). In 2005, Tennessee Department of Environment and Conservation (TDEC) assessed a $160,000 penalty against Trans-Ash, Inc when inspections revealed that Trans-Ash did not install a liner in the entire landfill, and improperly installed the GCL in portions of the landfill, leaving the GCL "saturated with water" (TDEC 2005). In addition, TDEC found that Trans-Ash released coal ash into surface waters, allowed coal ash to "run off" the site with storm water, and disposed of ash in unlined areas, putting ash into direct contact with groundwater.

In 2009, EPA took emergency action due to mercury contamination of a drinking water well near the landfill. Despite these problems, TDEC recently allowed Trans-Ash, Inc. to expand its landfill to accommodate more coal ash from Johnsonville Fossil Plant. However, since the Trans-Ash landfill operates without a Clean Water Act (NPDES) permit, Trans-Ash and TVA transport CCW leachate from the Trans-Ash landfill by truck, across the Tennessee River, for disposal at the Johnsonville Fossil Plant (TVA 2009b). To date, the Trans-Ash CCW landfill has affected surface water, groundwater, and private drinking wells.

Determination

Demonstrated on-site damage, and demonstrated off-site damage to surface water, groundwater, and two private residential drinking water wells.

Test of Proof

The Trans-Ash CCW landfill operates by filling quarries at a former gravel mine with coal ash, and gravel from the quarry was mined from the Camden Formation, one of the region's principal aquifers. In early 2009, in response to a complaint by a resident with two private water wells ("Gibson wells"), TDEC tested the wells and found mercury ranging from 0.011 to 0.013 mg/l - 5.5 to 6.5 times higher than the federal MCL for drinking water. In July 2009, the U.S. EPA confirmed high levels of mercury and then initiated an Emergency Removal Action to connect the residence to the Camden city water supply. Sixteen private wells are located within a one-mile radius of the landfill, and at least eight wells supply nearby residents with drinking water (TVA 2009a).

Although TVA admits that levels of CCW constituents, such as sulfate and boron, in groundwater are associated with coal ash leachate from the landfill, TVA has argued that the mercury in the Gibson wells is not associated with its coal ash. TVA's arguments are not valid for the following reasons:

- TVA argues that CCW does not contain mercury, yet EPA Toxic Release Inventory data from 2004 to 2008 report that TVA's Johnsonville Fossil Plant disposed of over 1,220 pounds of mercury at an off-

site land disposal facility. The only approved, off-site land disposal facility for Johnsonville Fossil Plant is the Trans-Ash, Inc. CCW Landfill.

- TVA presented leaching results (indicating no detectable mercury) from analytical methods that are not appropriate to estimate or determine metal leachability in the disposal setting (NAS, 2006). Further, some data were reported as "non-detectable" but the detection limit (<0.01 mg/L) was 5 times higher than the mercury MCL (0.002 mg/L) for drinking water.
- TVA argues that the Gibson well is cross gradient or upgradient to the landfill. However, the shallow water table aquifer likely mimics the ground surface, and the landfill is positioned on the highest topography of the area - therefore making it possible for groundwater to flow in all directions from the landfill. Further, neither MW-5 (placed between the landfill and the Gibson well) nor the Gibson wells have been used to determine the combined potentiometric surface / groundwater flow direction.
- The highest mercury concentrations in groundwater were found in the Gibson wells (up to 0.013 mg/L, 6.5 times the primary MCL, March 2009) and in MW-5 (0.00748 mg/l mercury, 3.7 times the primary MCL, April 2009) located on the western perimeter of the landfill.
- Trans-Ash, Inc. placed coal ash in the quarry prior to determining statistical background concentrations for CCW pollutants, including mercury. As a result, TVA lacks the relevant background concentrations for CCW pollutants to compare to recent data, and TVA's data is not representative of pre-landfill conditions. (TDEC, 2005)
- TVA has argued that CCW leachate from the landfill is representative of coal ash, yet piezometers were not drilled deep enough to sample groundwater conditions on top of the landfill liner and within the drainage blanket constructed of bottom ash. Bottom ash and fly ash contain metals and other toxic pollutants.
- TVA has argued that the mercury in the Gibson well is naturally occurring and not the result of contamination from the Trans-Ash, Inc. landfill. Yet TDEC's sampling data of 19 domestic water supply wells near the landfill show that the highest mercury concentration in any well other than the Gibson wells was 0.000087 mg/L – or 126 times less than the lowest concentration reported in a Gibson well. Mercury was not detected at any concentration in 15 wells (79%). As a result, the sampling data does not support TVA's argument that the mercury in the Gibson wells is naturally occurring.

Groundwater monitoring wells at the Trans-Ash landfill also show historical levels of arsenic (27 times the federal primary MCL); chromium, lead, mercury, nickel, and silver at orders of magnitude higher than federal MCLs for drinking water (TriAD). TVA acknowledges that 10 percent of the water percolating through the landfill seeps through the liner and the "geologic" buffer that lies beneath the CCW (TVA, 2009a). In addition, downgradient groundwater monitoring (MW-4) located in a wetland area has "exhibited increasing trends of boron and sulfate" over the last two (2) years and "these results indicate that groundwater quality in the Phase I landfill vicinity is likely being influenced by leachate from the Phase I landfill" (TVA 2009a; TriAD). In April 2009, on-site groundwater samples showed up to 9.39 mg/L of boron and 739 mg/L of sulfate. Since March 8, 2007, boron concentrations in groundwater monitoring well (MW-4) steadily increased from <0.05 to 0.648 mg/L, and sulfate concentrations have steadily increased from 27.2 to 79.5 mg/L (TriAD).

TDEC collected sediment, surface water, and groundwater samples at 37 locations within and around the Trans-Ash CCW landfill. TDEC data shows that the highest sediment mercury concentration (0.28 mg/kg) was from the sediment pond at the landfill (TVA 2009a). TDEC required Trans-Ash to install a new groundwater monitoring well (MW-5) on the western side of the landfill, between the landfill and the Gibson well. The results of a sample collected from this well in April 2009, when it was first installed, showed 0.00748 mg/L, or 3.7 times primary MCL for mercury (TVA 2009a; TriAD). Samples taken from this well from April to October 2009 also show iron levels ranging from 1.25 to 13.8 mg/L, up to 46 times the 0.3 mg/l secondary MCL for iron.

Surface water has also been affected by CCW disposal at the Trans-Ash landfill. TDEC's Division of Water Pollution Control sent Trans-Ash three notices of violation for releasing CCW in an unlined portion of the landfill; releasing CCW into an unnamed tributary to Cypress Creek; and a failure to timely report violations or take corrective action. TVA acknowledges that the CCW-affected leachate from the Trans-Ash landfill discharges to groundwater or discharges to surface water along the eastern side of the landfill (TVA 2009a).

Constituents Involved

Mercury, iron, boron, and sulfate

Incident and Date Damage Occurred / Identified

TDEC received a complaint from Ms. Nalgene Gibson on February 3, 2009. She complained of burning skin sensations when bathing in the well water (EPA 2009b). Sampling by TDEC on February 25, 2009 first indicated mercury in the Gibson well at a concentration greater than the primary MCL. Discharges of leachate to groundwater east of the landfill have been documented since at least March 8, 2007.

Regulatory Actions

In 2005, TDEC issued an Order and assessed a $160,000 penalty against Trans-Ash, Inc. for numerous violations of environmental laws. In 2009, EPA initiated an Emergency Removal Action to construct a water service line to the Gibson residence due to mercury contamination in their wells (EPA 2009b).

Wastes Present

Fly ash and bottom ash from the Tennessee Valley Authority, Johnsonville Fossil Plant.

Type(s) of Waste Management Unit

The Trans-Ash landfill is a former quarry which is filled with CCW.

Active or Inactive Waste Management Unit

Active. TDEC recently approved an expansion of the Trans-Ash landfill.

Hydrogeologic Conditions

The landfill uses the former Bivens Quarry, which was previously mined for chert gravel from an outcrop of the Camden formation. The Camden represents one of the region's principal aquifers and generally consists of thinly bedded, sharply fragmented chert with occasional thin inter-bedded clay seams and pods. (TVA 2009a). Depth to groundwater is near the surface in wetland areas to the east and west, and is expected to flow into a series of lakes adjacent to the landfill. On-site monitoring wells indicate mounding of groundwater within the landfill (TVA 2009a; TriAD 2009).

Probable Cause(s)

Leachate, run-off and discharges from the disposal of CCW in a former quarry.

SOURCES

Tetra Tech. 2009. Letter to Steve Spurlin from James Carothers, Tetra Tech Geologist (Sept 24, 2009).

TriaAD Environmental Consultants. 2009. Report of Semi-Annual Groundwater Monitoring, Bivens Industrial Park (Dec. 23, 2009).

Tennessee Department of Environment and Conservation (TDEC). 2005. In the Matter of Trans-Ash, Inc., Commissioner's Order, Case No. 04-0399 (Apr. 11, 2005).

Tennessee Department of Environment and Conservation (TDEC). 2009. Sampling data from the Trans-Ash CCW Landfill (37 locations) from February 2009 – May 2009.

Tennessee Valley Authority (TVA). 2002. Final Environmental Assessment, Johnsonville Fossil Plant: Development of a Long-Term Ash Management Strategy (February 2002).

TVA. 2009a. Supplemental Environmental Assessment, Johnsonville Fossil Plant, Ash Disposal Site Expansion (May 2009).

TVA. 2009b. Johnsonville Fossil Plant (JOF) – NPDES Permit No. TN 0005444 – Amendment to Application for Renewal (Dec. 17, 2009) (The amendment reflects "pumping and hauling ash landfill leachate from the Trans-Ash landfill to the JOF ash pond for treatment and discharge via Outfall 001").

U.S. EPA. 2009a. US EPA Region IV, Pollution Report, from Steve Spurlin (OSC) to Matt Taylor (ERRB), subject Gibson Mercury Well (Sept. 18, 2009), *available at* http:// www.epaosc.org/GibsonMercuryWell

U.S. EPA. 2009b. US EPA $250,000 Emergency Action Memo, from Steve Spurlin (OSC) to Regional Response Center, subject Gibson Mercury Well Site (Sept. 25, 2009).

U.S. EPA. 2004-2009. Toxic Release Inventory (TRI), Off-site Reported Disposed of or Otherwise Released (in pounds), for Mercury and Mercury Compounds, Johnsonville Fossil Plant in Humphreys County, Tennessee (2004-2008), *available at* http://www.epa.gov/tri/.

ENTITY/COMPANY - LOCATION

American Electric Power, dba Appalachian Power – John Amos Plant
Little Scary Creek Fly Ash Impoundment
1530 Winfield Road
Winfield, WV 25213
Putnam County
GPS Coordinates: 38°28'13", -81°49'18"

Summary

Selenium is considered toxic to aquatic life at concentrations above .005 mg/L. The facility's NPDES discharge permit authorizes much higher selenium discharges from the Little Scary Creek impoundment (0.062 mg/L), and even these generous limits have been exceeded at least twice since November 2005. The result is that average selenium concentrations in Little Scary Creek exceed the West Virginia water quality standard that protects aquatic life from acute toxicity and more than 6 times higher than the state's standard that protects aquatic life from chronic toxic effects to selenium exposure in surface waters. In addition, fish taken from this receiving stream in 2006 had selenium concentrations in their tissue that were 7 times higher than EPA's proposed selenium fish tissue criterion for the protection of aquatic life, and 14 times higher than the threshold value established by a selenium expert at the USDA Forest Service and exceeded the West Virginia advisory for fish consumption.

Determination

Demonstrated off-site damage to surface waters and aquatic life.

Test of Proof

Appalachian Power holds an NPDES permit (WV0001074) that regulates discharges from the Little Scary Creek fly ash impoundment. The permit contains a site-specific numerical limit for selenium, which is 0.062 mg/L. Violations of this limit occurred in November and December 2005 when selenium was discharged at 0.073 mg/L and 0.063 mg/L respectively (Janes). Discharges in September, October and November 2007 were 0.016 to 0.027 mg/L (EPA, a) respectively. The average selenium concentration in Little Scary Creek in eight water samples taken from April 2006 through April of 2007 was 0.0315 mg/L, 1.5 times higher than the state's water quality standard for protection of aquatic life from acutely toxic selenium concentrations (0.020 mg/L) and more than 6 times higher than the state's standard for protection of aquatic life from concentrations of selenium that engender chronic toxic effects (0.005 mg/L), (WVDEP, 2009).

Fish tissue data from September 2006 showed an average selenium fish tissue concentration of 58.02 mg/kg (Janes, 2006). These levels exceed EPA's proposed selenium fish tissue criterion of 7.9 mg/kg for the protection of aquatic life by 7 fold (EPA, b). These levels also greatly exceed the threshold value of 4 mg/kg established by a selenium expert at the USDA Forest Service (Lemly, 2002). In addition, fish containing 58.02 mg/kg selenium should trigger a West Virginia fish consumption advisory restricting consumption to no more than 6 meals a year (West Virginia Guide).

Constituents Involved

Selenium for the Little Scary Creek impoundment.

Incident and Date Damage Occurred / Identified

Surface water NPDES discharge data for the Little Scary Creek impoundment showed violations of permit limits that have occurred since at least 2005. Water quality data and fish tissue analyses have documented deleterious concentrations of selenium in Little Scary Creek in 2006 and 2007.

Regulatory Actions

The West Virginia Department of Environmental Protection (WV DEP) granted site-specific variances from the statewide numeric criteria for selenium (0.062 mg/L) and copper (0.105 mg/L daily max, 0.049 mg/L 4-day average) for the Little Scary Creek fly ash impoundment discharge.

Wastes Present

Fly ash and bottom ash disposed in impoundments.

Type(s) of Waste Management Unit

Appalachian Power stores fly ash in the Little Scary Creek impoundment which is located approximately 0.6-mile west of the main power plant property; the storage capacity is 11,160 acre-feet; the height of the dam is 223 feet; and the hazard rating potential is High (WVDEP, 2009). The impoundment is reported to be 175 acres (Wood).

Five additional impoundments used to store bottom ash are located at the power plant. Those ponds were commissioned in 1971; cover 30 acres; have a total storage capacity of 357 acre-feet; have a dam height of 24 feet; and the hazard rating potential is Significant (WVDEP, 2009) (Wood).

A landfill located on the northeast corner of the property was recently constructed and permitted (NPDES WV0116254) (WVDEP, 2009).

Active or Inactive Waste Management Unit

Active.

Hydrogeologic Conditions

Not determined.

The file review did not indicate if groundwater monitoring wells exist around the six (6) fly ash and bottom ash surface impoundments that total 205 acres and are located immediately adjacent to Little Scary Creek and the Ohio River.

Probable Cause(s)

Leachate from the fly ash stored in the Little Scary Creek impoundment.

SOURCES

Lemly, Dennis, A. 2002. *Selenium Assessment in Aquatic Ecosystems, A Guide for Hazard Evaluation and Water Quality Criteria*. Springer. New York.

Janes, Margaret. 2009. Appalachian Center, data request response from West Virginia Department of Environmental Protection (WVDEP).

U.S. EPA. 2004. Draft Aquatic Life Criteria for Selenium, *available at* http://www.epa.gov/waterscience/criteria/selenium/.

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U.S. EPA. 2009. Coal Combustion Waste Surveys, American Electric Power, John Amos Station, *available at* http://www.epa.gov/waste/nonhaz/industrial/special/fossil/surveys/survey-amos.pdf

West Virginia Department of Environmental Protection (WVDEPb) 2009. Selenium Bioaccumulation Among Select Stream and Lake Fishes in West Virginia.

West Virginia Department of Environmental Protection (WVDEP). 2009 , Division of Waste Management, Fly Ash Dam / Landfill Conditions Evaluation (Nov. 2009), *available at* http://www.dep.wv.gov/WWE/ee/ds/Documents/Status_WV_Fly_Ash_Dams_Landfills_Nov609.pdf

West Virginia Department of Health and Human Resources (WVDHHR). 2007. West Virginia Sport Fish Consumption Advisory Guide, 2nd Ed. (Dec. 12, 2007).

ENTITY/COMPANY - LOCATION

American Electric Power (AEP) dba Ohio Power Company – Mitchell Generating Station
Route 2 South
Moundsville, WV 26041
Marshall County
GPS Coordinates: 39°49'49", -80°48'58"

Summary

Since 2005, average concentrations of selenium in surface water discharges from the unlined, 71-acre Conner Run fly ash impoundment have been more than 23 times higher than EPA's recommended water quality criterion for selenium. As a result, average concentrations of selenium in Conner Run have been more than twice as high as West Virginia's acute water quality standard and nearly 10 times higher than the state's chronic standard for selenium. This fly ash impoundment is located adjacent to the Ohio River. Seepage of pond leachate has also been identified in the abutment of the impoundment. Fish tissue testing in the receiving stream (Conner Run) has exceeded EPA's proposed selenium fish tissue criterion by 3 to 4 times and has also exceeded the recommended value established by an expert at the USDA Forest Service. The high selenium tissue results are high enough to trigger a West Virginia human fish consumption advisory. Groundwater monitoring data since 2005 have reported exceedances of standards in on-site groundwater for antimony, arsenic, sulfate, sodium, and zinc. The file review did not indicate what, if any, assessment has been required on or off-site to determine the nature and extent of the groundwater or surface water contamination.

Determination

Demonstrated on-site damage to groundwater moving off-site.
Demonstrated off-site damage to surface waters and aquatic life.

Test of Proof

Since 2005, effluent discharges from the Conner Run fly ash impoundment to Conner Run Creek have exceeded the site-specific variance selenium limit (0.062 mg/L) with values ranging from 0.063 to 0.254 mg/L – and with an average value of 0.118 mg/L (EPA, 2004). The maximum value exceeds the EPA's national recommended Criteria Continuous Concentration (CCC) water quality standard for selenium by more than 50 times, and the average value exceeds the CCC by more than 23 times. Not surprisingly given the several million gallon per day volume of the discharge, average selenium concentrations in 14 water samples taken downstream of the discharge in Conner Run from November 2005 through April 2007 were 0.0478 mg/L (WVDEP, 2009b). This is more than twice as high as the state's water quality standard for protection of aquatic life from acutely toxic selenium concentrations (0.020 mg/L) and nearly 10 times higher than the state's standard for protection of aquatic life from concentrations of selenium that engender chronic toxic effects (0.005 mg/L which is the same as EPA's CCC).

Data from an April 2006 WVDEP report stated that Conner Run Creek had an average fish tissue selenium concentration of 24.4 mg/kg. A later WVDEP data set indicated an average selenium fish tissue concentration of selenium of 31.5 mg/kg (Janes, 2009). These concentrations exceed EPA's proposed selenium fish tissue criterion of 7.9 mg/kg for the protection of aquatic life by 3 and 4 fold respectively (EPA, 2007). These levels also greatly exceed threshold values of 4 mg/kg established by the USDA Forest Service (Lemly, 2002). In addition, fish containing 31.5 mg/kg selenium should trigger a West Virginia human fish consumption advisory restricting consumption to just one meal a month (WVDHRR).

Seepage of pond leachate has also been identified in the abutment of the impoundment.

Groundwater monitoring for the Conner Run fly ash impoundment, required by an NPDES permit showed moderate exceedances (numerical criteria not given) of the arsenic groundwater criterion downgradient from the impoundment in March, July, September, and December 2005; and March and June 2006 (Janes, 2008). Monitoring data for 2008 (4th quarter) and 2009 (1st quarter) also showed exceedances (concentrations not given) - in temperature, sulfate, zinc, and sodium in one (1) well, and antimony in another well. Exceedances (no concentrations given) for arsenic were also reported in the past (dates not given) for three wells: MW-H1, MW-U3, and MW-L3.

Constituents Involved

Arsenic, antimony, sulfate, selenium, zinc, sodium, and temperature.

Incident and Date Damage Occurred / Identified

Incidences of surface water discharges above the site variance concentrations allowed in the permit have occurred since at least 2005. Violations of numeric water quality criteria in Conner Run have been documented continuously from late 2005 through the spring of 2007. Fish tissue test results indicate exceedances of safe levels of selenium in fish occurring at least in 2006. Groundwater data indicate exceedances dating from at least 2005.

Wastes Present

Mixed wastes, including fly ash and bottom ash slurries received from two (2) plants (AEP Mitchell and AEP Kammer) and unspecified "coal mining wastes" from the Consol McElroy Mine (WVDEP, 2009). A 2008 annual report showed that 440,665 tons of wastes were received from the Mitchell Plant; 42,555 tons received from the Kammer Plant; and 672,000 tons received from the Consol McElroy Mine. No information was provided relative to the Bottom Ash Impoundment that is also located on-site.

Type(s) of Waste Management Unit

The plant operates two (2) impoundments (EPA, 2009). The Conner Run fly ash impoundment was commissioned in 1971; has a capacity of 13,500 acre-feet; covers 71 acres; and holds 48 million cubic yards of fly ash (EPA, 2009). The dam height was not reported because the pond was currently being enlarged. The pond was rated as a High Hazard.

According to AEP in their report to EPA, the bottom ash pond was commissioned in 1975; has a capacity of 262 acre-feet; covers 17.5 acres; and the dam is approximately 30 feet tall. The capacity of that pond conflicts with the 464 acre-feet capacity reported by WVDEP (WVDEP, 2009). The pond was rated as a Significant Hazard.

At least one impoundment is unlined (Janes, 2009).

Active or Inactive Waste Management Unit

Active. The Conner Run fly ash impoundment was recently expanded.

Hydrogeologic Conditions

The power plant is located on land adjacent to the Ohio River. The bottom ash impoundment is located "more or less parallel" with the Ohio River (WVDEP, c). Shallow alluvial aquifer conditions are assumed due to the proximity to Conner Run Creek, Fish Creek, and the Ohio River.

Probable Cause(s)

Effluent discharges from Conner Run impoundment to Conner Run Creek and contaminates the receiving stream and its fish with selenium. Leachate from Conner Run impoundment also contaminated groundwater.

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