Groundwater Contamination from Texas Coal Ash Dumps

New Data Reveal Pollution Leaking from 100 Percent of Coal Power Plants With Available Records

ENVIRONMENTAL INTEGRITY PROJECT

JANUARY 17, 2019

ACKNOWLEDGEMENTS

Written and researched by Abel Russ and Ari Phillips of the Environmental Integrity Project (EIP); Data gathering, analysis, and mapping by Keene Kelderman, Ben Kunstman, Hayley Roy, Namratha Sivakumar, Samantha McCormick, and Courtney Bernhardt at EIP, with editing assistance by Lisa Evans, Earthjustice. Made possible with help from Earthjustice and the Sierra Club.

ENVIRONMENTAL INTEGRITY PROJECT

The Environmental Integrity Project (environmentalintegrity.org) is a nonprofit, nonpartisan organization that empowers communities and protects public health and the environment by investigating polluters, holding them accountable under the law, and strengthening public policy.

CONTACT:

For questions about this report, please contact: Tom Pelton, Environmental Integrity Project, (202) 888-2703 or tpelton@environmentalintegrity.org

PHOTO CREDITS: Cover photo by Ari Phillips of EIP showing south Texas rancher Jason Peeler as he looks out over his family's land that has been contaminated by pollutants from the San Miguel Electric Plant in the background. Other photos by Ari Phillips; from EIP's Ashtracker website (www.ashtracker.org); Wikimedia Commons; and Google Earth.

Groundwater Contamination from Texas Coal Ash

EXECUTIVE SUMMARY

Texas is famous for its natural gas industry and is also the nation's leading generator of wind power. But the Longhorn State still obtains 24 percent of its electricity from an older and dirtier power source: coal.[1] Compared to other states, Texas mines the most lignite coal, which is the dirtiest and lowest-grade form of this fossil fuel.[2] One of the many negative side effects of continued investment in coal is the waste left behind after the fuel is burned. For decades power companies discarded tons of this toxic substance – commonly known as coal ash – in the most convenient, and affordable, way possible: by dumping it into nearby pits or lagoons. Since coal-fired power plants depend on a reliable water source for steam, these pits are often located near waterways. This makes it more likely that hazardous elements in coal ash, including heavy metals like arsenic and chromium (both carcinogens), as well as neurotoxins like lead and mercury, will leach into groundwater, poisoning drinking water aquifers and harming aquatic life in nearby surface waters.

Texas Power Plants Polluting Groundwater with Coal Ash

An Environmental Integrity Project examination of power company data made available for the first time in 2018 found that all (16 of 16) of the coal-fired power plants in Texas for which records are available are leaking unsafe levels of contaminants into groundwater.

U.S. coal plants produce around 100 million tons of ash every year from hundreds of sites across the country. For much of the last century, many utilities dumped this waste into unlined landfills and waste ponds, even though the lack of a barrier between the coal ash and groundwater left them vulnerable to leaks and contamination of underground water supplies. Only in recent years has the true scope of coal ash's threat come into public view, spurred by several high-profile failures of dikes separating ash ponds from rivers. These catastrophic spills revealed how much damage can be wrought when this toxic waste pours into the surrounding environment. Most notably, a 2008 coal ash spill in Kingston, Tennessee, led to the release of 5.4 million cubic yards of ash when a Tennessee Valley Authority power plant dike burst, destroying more than two dozen homes and killing or sickening scores of cleanup workers.[3]

This coal ash spill in Kingston, Tennessee, in 2008 helped spur action for the nation's first federal coal ash regulations.

Following that disaster and lawsuits against EPA by Earthjustice, the Environmental Integrity Project, and allied organizations, the agency in 2015 finalized the first federal regulation for the disposal of coal ash, often called the Coal Ash Rule.[4] Among other things, the Coal Ash Rule established groundwater monitoring requirements for coal ash dumps. The regulation mandated that power companies make their groundwater monitoring data available to the public for the first time in 2018.

The nonprofit Environmental Integrity Project (EIP) examined the 16 Texas power plants that are required to monitor groundwater under the Coal Ash Rule, and found that 100 percent of the coal plants (16 out of 16) are leaking contaminants, including arsenic, boron, cobalt, and lithium, into groundwater at levels that would be unsafe for human consumption. For a detailed discussion of our study's methods, see page 17. Some of the main findings include:

- Thirteen of the sixteen coal plants have unsafe levels of arsenic in groundwater, with concentrations sometimes exceeding 100 micrograms per liter – ten times higher than the EPA Maximum Contaminant Level for arsenic.
- Ten plants have unsafe levels of boron, which is toxic to both humans and aquatic life. Multiple wells at the San Miguel plant south of San Antonio have boron concentrations of more than thirty milligrams per liter, exceeding EPA's health advisory by ten-fold.
- Fourteen plants appear to be leaking unsafe levels of cobalt, which can harm the heart, blood, and other organs. The groundwater protection standard for cobalt is six micrograms per liter. At the San Miguel plant, Gibbons Creek facility northwest of Houston, and Welsh plant east of Dallas, cobalt in groundwater reaches more than 600 micrograms per liter, which is more than 100 times higher than safe levels.
- Lithium is associated with neurological effects and other health risks. Eleven Texas coal plants have unsafe levels of lithium in groundwater, with concentrations frequently exceeding 1,000 micrograms per liter, 25 times the health-based groundwater protection standard of 40 micrograms per liter.

In addition, with one or two exceptions, none of the coal ash ponds in Texas meet EPA requirements for liners, meaning that they lack underground barriers made of plastic or other waterproof materials that prevent them from leaking.

Groundwater contamination is a serious and long-term problem that poses a threat to human and ecological health. For a real-world example of the damage it can cause, see page 8, which describes a ranching family south of San Antonio whose farm is being damaged by leaking contaminants from a nearby coal ash waste pond.

South Texas ranchers Jason Peeler (left) and Alonzo Peeler Jr. (right) stand near land where all the vegetation has died, they believe because of contaminants leaking out of a coal ash waste pond behind this fence. "It's like losing a family member," Jason Peeler said of the family's fears that they could lose their ranch.

Even as accumulating evidence shows the need for stronger coal ash monitoring and cleanup standards, the Trump Administration is proposing to roll back protective requirements as part of a concerted effort to support coal-fired power at all costs. By weakening cleanup standards and pushing back site remediation deadlines, Trump's EPA is endangering communities and ecosystems near these toxic waste sites. In Texas and across the country, all it takes is a look at the evidence of contamination to see that more action is needed to protect public and environmental health. Instead, the Trump Administration is going all in on a losing battle to save coal at a cost that grows steeper with every passing day.

Part of this effort includes granting power to the states to oversee their own state-level coal ash programs in place of the 2015 federal Coal Ash Rule. Many states plan to take advantage of this opportunity. In 2018, neighboring Oklahoma became the first state with EPA approval to manage its own coal ash program, despite data showing that all of its coal plants are leaking toxic pollutants into ground water.

Texas has yet to finalize the details of its coal ash program. However, state regulators drafted a preliminary version of their own regulations in August 2018. The draft Texas proposal was deeply flawed because it would not restore groundwater or protect aquatic life, require the cleanup of all leaking ash dumps, ensure sufficient monitoring, or provide adequate public notification. (This proposal is discussed at more length on page 15 of this report.)

EPA and/or the Texas Commission on Environmental Quality (TCEQ) can address the coal ash threat in the following ways:

- Require coal-fired power plants to remediate coal ash contamination from any onsite ash dumps, regardless of whether these dumps are active or inactive.
- Prohibit the dumping or burying of coal ash in places where it remains in contact with groundwater. The only way to prevent contamination from coal ash is to keep the coal ash contained and dry. Ash ponds at the Monticello and Welsh plants east of Dallas are in contact with groundwater, and the owners of these plants are planning to close the ponds in place. Leaving ash in these ponds will result in ongoing, long-term contamination of groundwater.
- Require owners to post all groundwater monitoring data as soon as the data are collected, and require owners to follow the assessment monitoring schedule laid out in the Coal Ash Rule, not the creative interpretation suggested by industry groups and sanctioned by the Trump EPA. Assessment monitoring should begin no later than 90 days after finding statistically significant increases in detection monitoring, and the assessment monitoring data should be analyzed for significant increases within 90 days of initiating assessment monitoring.
- Require owners to select background monitoring wells that are unaffected by coal ash from any coal ash unit, regulated or unregulated. This is what the federal Coal Ash Rule requires, and EPA and Texas should strictly enforce this provision of the rule.
- Require testing of any residential or municipal drinking water wells within one-half mile of coal ash ponds and landfills.
- Consider environmental justice and avoid disproportionate impacts of coal ash disposal on low-income communities and communities of color.

Additional recommendations are provided in the conclusion of this report. We encourage the Texas Commission on Environmental Quality to consider these recommendations as the minimum set of additional safeguards that can effectively prevent ongoing environmental contamination.

Beyond Texas, the Environmental Integrity Project and Earthjustice are also examining coal ash contamination in other states across the U.S., including in Oklahoma, Illinois, and Georgia, with these other state reports available at www.environmentalintegrity.org. EIP is also compiling the results nationally on a growing website called Ashtracker, which can be found at www.ashtracker.org.

Contents:

A. Human Impact: This Land Is Coal Ash Land

Alonzo Peeler, Jr. stands on his ranch south of San Antonio. Some of his land has been contaminated by pollutants from the nearby San Miguel Electric Plant's coal ash waste pond.

Pollution from coal-fired power plants impacts humans in many ways; it dirties air, fouls water, and contributes to climate change. But for the Peeler family about an hour south of San Antonio, the effects are far more personal.

For more than a century, five generations of the Peeler family have raised cattle on their now 25,000-acre ranch. In 1975, the Peelers sold 330 acres of their land to allow for the construction of a 400-megawatt power plant.

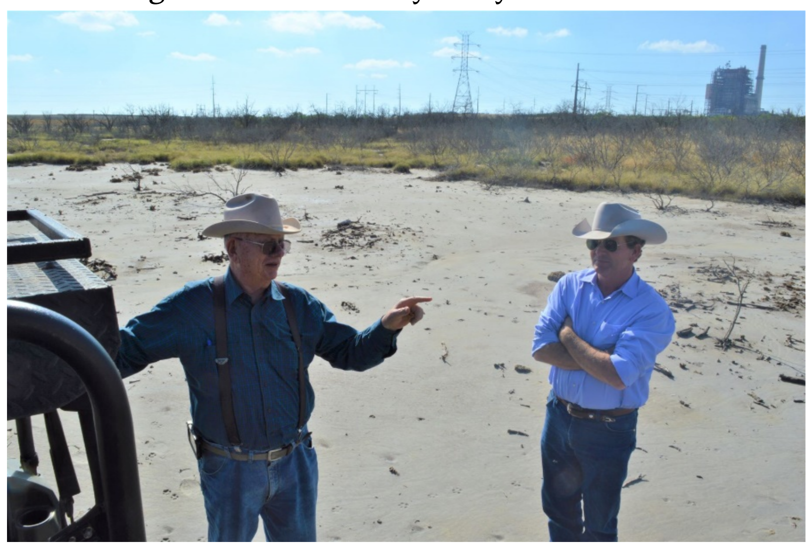
It is a decision they have come to regret, because coal ash from the plant's waste ponds is contaminating the groundwater beneath the ranch, polluting the soil, and killing vegetation.

In response to the family's efforts to halt the pollution of their land, the owner of the plant, the San Miguel Electric Co-Op, is in court threatening to seize almost one third of the ranch through eminent domain so the company can keep using the land as an ash dump.

"I wish I would have been fortunate enough 40 years ago to question this, 'cause then we wouldn't be having all these problems," said Alonzo Peeler, Jr., from his living room, where the power plant stacks stand just a few hundred yards away obstructing the view of the otherwise gently rolling landscape of the South Texas ranch. "But that's another story. We gotta go from today."

Mr. Peeler's downcast expression conveys the years he's had to witness the crisis unfold. Just downhill from the plant lie waste ponds, where coal ash — the toxic byproduct of coal-fired power plants — is temporarily stored before being trucked to large heaps also located on the Peelers' ranch.

The groundwater beneath the facility and the Peelers' ranch is the most contaminated in Texas from any coal plant, according to monitoring data released last year by the San Miguel Electric Co-Op under the requirements of the 2015 federal Coal Ash Rule. Three ash waste ponds, which are considered "unlined" under the regulations, and an ash landfill are leaching arsenic, selenium, mercury, thallium and other harmful pollutants.



Alonzo Peeler Jr. and son Jason on their ranch with the San Miguel Electric Co-Op coal-fired power plant in the background.

Among other things, the arsenic in the groundwater, as measured in 14 monitoring wells, exceeds EPA's Maximum Contaminant Level (MCL) by up to 12 times; beryllium exceeds its MCL in 17 wells, by up to 190 times; boron levels are unsafe for drinking in 25 wells; cadmium exceeds its MCL in 15 wells, by up to 130 times; and lithium and sulfate exceed health-based standards in every single onsite well, with lithium concentrations consistently at least 10 times higher than the lithium standard.

The impact of the pollution on their ranch is obvious. Mr. Peeler and his son Jason — a good-natured rancher who's taken on the battle to save his family's land — show a visitor the unnatural-looking seeps and soggy dead zones on their property during a bumpy ride down to the fence surrounding the coal ash waste pond.

Viewable in the distance are sprawling, mesa-like mounds of ash, which overflow carved-up areas where workers surface-mined lignite coal for the power plant on the Peeler ranch until 2004. Since then, coal has been mined from nearby ranches and trucked to the power plant, where the waste gets piled up high on the Peelers' property.

The Peelers signed the coal lease with the understanding that when the mining on their ranch ended, the company would clean up the mess and restore the land to its previous condition, with the pastureland grasses that thrive across the rest of the ranch.

Over the years, however, it has become clear to the Peelers that San Miguel is not holding up its side of the bargain. Instead of restoring the land after the surface mining stopped, the company turned it into a coal ash dump site, which the Peelers say is contaminating the groundwater and soil.

With their land suffering, the Peelers have taken to the courts to try and save what they can and reclaim as much of their ranch as possible. If the chemicals continue to leach into the groundwater, the family fears, the pollutants could eventually migrate to contaminate drinking water sources like the Atascosa River and Nueces River. Already, the Peelers suspect a fish kill on one of the ranch's ponds was caused by coal ash contamination.

Behind this fence is the coal ash pond near the Peeler ranch that is leaking contaminants into the groundwater.

On August 1, 2018, the family sent a notice of intent to sue the San Miguel Electric Co-Op for alleged violations of federal coal ash regulations. These include failing to construct structurally sound ash ponds and allowing the unlined ponds to leak pollutants into groundwater, and creating an "imminent and substantial endangerment to health and the environment," according to the legal notice.

The power company sued the Peelers on August 13, 2018 in Atascosa County, and the family counter-sued the next day, adding the mine operators as counter-defendants. The state court is scheduled to hold a hearing on a condemnation claim by San Miguel to try to use eminent domain, as a public utility, to seize over 7,300 acres of the Peelers' land.

Were this to happen, the Peelers would face losing their family heritage. "My family story here is that we've figured this out too late," said Jason Peeler. "It's like losing a family member."

Jason Peeler says he just wants San Miguel operators to do what they said they were going to do: Leave the land in a similar state to how they found it.

The power plant is under contract to run until 2037. It recently received a loan from the U.S. Department of Agriculture to help make improvements to enhance its longevity.

Records suggest the plant is one of the worst air polluters in the state.[5] Had the Obama Administration's Clean Power Plan moved forward, the plant likely would have been forced to shut down before its contract ran out, but the Trump Administration announced a rollback.[6] The Environmental Protection Agency recently found that air quality in Bexar County doesn't meet air quality standards for ozone, and San Miguel is the single highest local contributor to the pollutants that form ozone.

Jason Peeler said his family has learned the hard way that there needs to be more oversight and enforcement. He said he's as surprised as anyone to find himself on the same side as green groups like the Sierra Club when it comes to protecting natural resources on private property.

Mary Whittle, an attorney who is representing the Peelers, said that while she's talked about coal ash as a theoretical matter many times, seeing what's happening on the Peelers' property, and how poorly the ash has been managed, was a shock to her. The notion that the land could be condemned in order to avoid clean up obligations provides an even worse source of anxiety for the family.

"The idea that a company can use condemnation to get out of lease obligations that require cleanup is galling," said Whittle, with the firm of Guerrero & Whittle. "Why would you ever enter into a mineral lease with a company that can get out of its promises to you by simply taking away your land?"

B. Background and Statewide Overview

In 2015, the U.S. EPA finalized the federal Coal Ash Rule, which is also known as the "CCR Rule" (for "coal combustion residuals," another way of saying coal ash.)[7] The rule establishes design and operating criteria for owners and operators of certain coal ash ponds and coal ash landfills, and requires closure and/or corrective action at units that fail to meet the criteria. The Coal Ash Rule has been modified, most recently in 2018, and parts of the rule were recently struck down by the U.S. Court of Appeals for the D.C. Circuit as being inadequately protective. In short, the Coal Ash Rule is not fixed, but is constantly evolving.

In 2016, Congress gave states the authority to implement their own, state-level coal ash programs in lieu of the Coal Ash Rule. These state programs must be as protective as the Coal Ash Rule, and they must be approved by EPA. Texas has developed a state program that largely mirrors the original version of the Coal Ash Rule. This report shows that both the federal Coal Ash Rule and its proposed Texas equivalent are inadequately protective, and will not be able to restore groundwater quality or protect public health and the environment from the threats of coal ash.

I. Groundwater Monitoring and Corrective Action Under the Coal Ash Rule

One of the most important elements of the federal Coal Ash Rule is its groundwater monitoring program. Prior to 2015, there was no federal groundwater monitoring requirement. Some coal plant owners monitored their groundwater pursuant to state law, but many did not. The states that did require monitoring did not always require monitoring for all of the pollutants most likely to be associated with coal ash (e.g., boron, cobalt, molybdenum, sulfate), and each state had unique requirements. As a result, information about the groundwater impacts of coal ash was incomplete and inconsistent.

The Coal Ash Rule created a uniform national groundwater monitoring schedule and list of pollutants to be monitored, and it required that the data be publicly available. The first wave of data was posted online in March, 2018. For the first time, the public had access to a uniform national dataset of the groundwater impacts of coal ash.

The Coal Ash Rule sets up a two-phase groundwater monitoring program. The specifics of the program are complicated, and we will explain some of the details below, but to briefly summarize: Every regulated site is first required to perform "detection monitoring" for a list of pollutants known to be indicative of coal ash, including boron, sulfate, and five others. These pollutants are listed in "Appendix III" of the Coal Ash Rule. If detection monitoring shows significantly elevated concentrations of one or more pollutants, then the site progresses to phase two "assessment monitoring." The assessment monitoring pollutants, listed in Appendix IV of the Coal Ash Rule, include a longer list of toxic chemicals like arsenic, cobalt and selenium. The rule establishes groundwater protection standards for each one. If assessment monitoring finds pollution in excess of the groundwater standards, then the owner of the site must initiate corrective action to restore groundwater quality. If assessment monitoring finds elevated pollution near an unlined surface impoundment, then that surface impoundment can no longer be used and must be closed.

Monitoring Wells

The Coal Ash Rule requires a certain number of monitoring wells at each site, including at least one upgradient well (i.e., "upstream" from the regulated unit relative to groundwater flow), and at least three downgradient wells. This theoretically allows a statistical comparison between groundwater that is not affected by a coal ash unit (upgradient) and groundwater that may be affected (downgradient). The upgradient well must "accurately represent the quality of background groundwater that has not been affected by leakage from a CCR unit." 40 C.F.R. § 257.91(a)(1). This definition has created some confusion. Since there are often multiple coal ash units at a site, it is possible to have a monitoring well located upgradient of one coal ash unit, but downgradient of another unit. We have seen many upgradient wells installed in or near old, unregulated coal ash landfills, for example. These wells may be, strictly speaking, "upgradient" of a regulated coal ash unit, but any coal ash contamination in the upgradient well makes it much harder to identify leakage from the regulated unit. The language of the Coal Ash Rule seems to prohibit this practice –

if a well is "affected by leakage from a CCR (coal ash) unit[8]," regardless of whether that unit is regulated by the rule, it does not meet the standard set forth in section 257.91(a)(1). Yet many sites have ignored this provision, and many upgradient wells are contaminated by coal ash. This complicates the interpretation of monitoring results.

Detection Monitoring

In detection monitoring, the data from each downgradient well are compared to data from an upgradient well (or wells). Statistical evidence of elevated pollution levels in downgradient wells can lead to assessment monitoring. The term of art used in the Coal Ash Rule is "statistically significant increase," or SSI. A site may find one more SSIs for boron, for example, during detection monitoring. In most cases, that site would then have to initiate assessment monitoring.[9]

Generally speaking, each owner was required to conduct an initial round of sampling, consisting of eight samples from each well, by October 17, 2017. The exception is for roughly 100 ponds in the U.S. that were granted an extension after EPA closed a loophole for ash ponds on an early closure schedule.[10] For most coal ash units, the groundwater data became publicly available in March, 2018.

Assessment Monitoring

In assessment monitoring, like in detection monitoring, the data from downgradient wells are compared to upgradient data. However, in assessment monitoring, a "statistically significant increase" (or SSI) means something different. Each assessment monitoring pollutant is given a "groundwater protection standard." 40 C.F.R. § 257.95(d)(2), (h). The groundwater protection standard for each chemical is either an EPA-derived value, or "the background level," whichever is higher. The EPA-derived values for most assessment monitoring pollutants are Maximum Contaminant Levels (MCLs), which are national drinking water standards. EPA has not established MCLs for cobalt, lead, lithium, and molybdenum, so they set the groundwater protection standards for these pollutants using other benchmarks[11]

If a site finds SSIs during assessment monitoring, then the rule prescribes responses that depend on the nature of the regulated coal ash unit. For coal ash landfills, owners must initiate corrective action to restore groundwater quality. The same is true for impoundments that have EPA-approved liners (see next section). For unlined impoundments, owners must also stop using and close the impoundment within a set period of time.

Lined and Unlined Ponds

The Coal Ash Rule defines ash impoundments (or ponds) as unlined if they cannot meet the rule's liner design standards. New impoundments and landfills must have a composite liner, with a lower component made of two feet of compacted clay with a certain hydraulic conductivity, and an upper component made of geomembrane (plastic). 40 C.F.R §§257.70, 257.72. The original liner criteria for *existing* impoundments were less stringent, and considered impoundments with a clay liner to be "lined" even if they lacked the geomembrane component. 40 C.F.R. § 257.7. In 2018, the U.S. Court of Appeals for the D.C. Circuit struck down the provision that allowed for clay-lined impoundments to be considered lined.[12]

Owners of coal ash units are required to certify that their liner meets the rule's design criteria. According to the recent court order, this means that coal ash units must meet the composite liner criteria for new impoundments. If a liner does not meet the prescribed criteria, or if an owner fails to certify the liner, then the rule defines that ash pond as "unlined." In Texas, as in other states, virtually all coal ash ponds are either unlined or clay-lined, and must be treated as "unlined."

The recent D.C. Circuit Court decision also struck down the Coal Ash Rule to the extent that it allows unlined ponds to remain open.[13] Once EPA amends the Coal Ash Rule to comply with the Court's order, all unlined coal ash ponds – including virtually all of the coal ash ponds in Texas – will have to close, regardless of the current extent of groundwater contamination.

Other Criteria of the Coal Ash Rule

While this report focuses on groundwater monitoring, the Coal Ash Rule also sets other operating and design criteria. For example, coal ash units must be at least five feet above the highest underlying groundwater levels, cannot be in wetlands, and cannot be located in seismic impact zones or on other unstable terrain (e.g., soluble karst bedrock). Owners are required to evaluate structural integrity and close unstable impoundments. The rule has other criteria related to, for example, air emissions, and stormwater run-on and run-off. The rule requires planning for closure and post-closure care, and establishes criteria for both. Finally, the rule requires each owner to keep an operating record, and requires each owner to post most of the information that goes into the operating record on a public website.

Problems with the Coal Ash Rule

One of the principal weaknesses of the Coal Ash Rule is that could be read as allowing utilities to close coal ash units in place, even if they are in contact with groundwater and leaking. The toxic pollutants in coal ash generally escape into the environment in one of three ways: Through physical movement (spills and other structural failures), in leachate generated by the movement of precipitation through the coal ash, or in leachate generated by the movement of groundwater through the coal ash. The Coal Ash Rule has a series of closure and post-closure requirements that are intended to reduce the risks of structural failures and the infiltration of precipitation. But the rule does nothing to prevent the ongoing movement of groundwater through coal ash. If a leaking, unlined coal ash dump is in contact with groundwater, then capping it in place will do nothing to reduce ongoing contamination. Although the rule technically requires owners closing ash dumps in place to "control, minimize or eliminate" the leaching of pollutants "to the maximum extent feasible," many owners are ignoring this requirement, or interpreting the word "feasible" to their own advantage.[14] In reality, if an old ash dump is in contact with groundwater, the only way to minimize or eliminate leaching is to excavate the ash.

The other major weakness of the Coal Ash Rule is that it does not regulate all coal ash units. The rule only applies to new landfills and impoundments, landfills and impoundments that were in active use in October 2015, and recently deactivated impoundments (impoundments that continued to hold water as of October 2015). It does not apply to any coal ash landfills that stopped receiving ash before 2015, or to any impoundments that were completely dewatered before 2015. Many coal plants have been burning coal and generating coal ash for decades, and frequently have one or more closed, unregulated coal ash dumps onsite, in addition to any active, regulated units. All of these units – active and inactive – are potential sources of groundwater contamination. Regulations aimed only at active units will very often fail to restore groundwater quality. The only way to effectively address ongoing contamination is to evaluate each coal plant comprehensively, identifying all onsite coal ash dumps, regardless of whether they are active or inactive.

The piecemeal approach of the Coal Ash Rule also creates problems with respect to groundwater monitoring. In practice, wells that are installed upgradient of active coal ash units often show signs of coal ash contamination coming from closed coal ash units located nearby. This makes it much harder to find statistically significant differences between up- and downgradient groundwater. Even if a regulated unit is leaking, the evidence may not be apparent against a background of pre-existing contamination. As a result, even where groundwater shows clear evidence of coal ash contamination, the Coal Ash Rule may fail to require any corrective action if (a) some of the contamination is coming from unregulated sources, and (b) the contamination from regulated units is statistically indistinguishable from the unregulated contamination.

2. State Rulemaking

Coal ash disposal in Texas is currently regulated by the federal Coal Ash Rule, but this could change. Texas may apply for EPA approval to operate a state-level program in lieu of the federal rule.[15] And, in fact, Texas has started to move in that direction: On August 17, 2018, the Texas Commission on Environmental Quality (TCEQ) released a proposed state-level "coal combustion residuals (CCR) management program."[16] Although the proposal has since been removed from TCEQ's website, presumably because the underlying federal regulation changed,[17] the proposal provides a window into what Texas's coal ash program could look like. The Texas proposal would in many ways simply incorporate the federal Coal Ash Rule by reference. However, it would not adequately protect human health and the environment, in part due to departures from the federal rule, and in part due to weaknesses that both the federal and state rules would share. Weaknesses of TCEQ's proposal include:

- **Authorization by registration, rather than by issuance of a permit**. TCEQ's proposed coal ash regulations would allow an owner or operator to obtain a "registration," rather than a permit.[18] It appears that TCEQ would be applying a standard set of "applicable characteristics and standards" to every unit, rather than creating individual permits tailored to account for site-specific characteristics. Such an approach could suffice if all the requirements were sufficiently stringent to reduce potential risks from all units, but as described in more detail below, there are other significant weaknesses in the program. As a result, a "registration" program will fail to account for site-specific risk factors, and will not be protective of human health or the environment.

- **Registration for life.** TCEQ proposes to have registrations last for the life of the facility, unless revoked for failure to meet minimum standards or for any other good cause.[19] Permits issued under federal and state solid waste laws typically last for a term of three to ten years, at which point a facility must obtain a permit renewal based on updated operating information, evidence of compliance with permit conditions, and updated regulatory requirements. Allowing a registration for life would fail to ensure that new requirements or a change in operations would be timely or adequately taken into account, potentially creating greater threats to health and the environment.
- **Applying alternative risk-based corrective action standards using the Texas Risk Reduction Program**. TCEQ suggested that it might replace the Coal Ash Rule's groundwater protection standards with the Texas Risk Reduction Program (TRRP), a regulatory program adopted in 1999 to provide for financial assurance and risk-based corrective action.[20] Some components of this program, including the financial assurance requirements, may result in increased health and environmental benefits. However, there are several parts of the TRRP program that do not meet the standard of being "at least as protective" as the federal program. Among other things, the TRRP is keyed to Texas's own benchmarks for remediation, and these benchmarks do not line up with the federal groundwater protection standards (and cleanup benchmarks) under the Coal Ash Rule. For example, the TRRP benchmark for cobalt in residential groundwater is 240 micrograms per liter – 40 times less protective than the groundwater protection standard in the Coal Ash Rule (6 micrograms per liter).[21]
- **Inadequate public participation provisions**. While the proposed regulations do provide for public comment, they also expressly state that the Executive Director is not required to respond, and there is no opportunity for a contested case hearing.[22] So if Texas issues a weak permit (or "registration"), it is much harder for citizens to do anything about it. This is a significant departure from the Coal Ash Rule, which empowers citizens to enforce the regulations in federal court. The Texas program will be unlawful unless it allows for meaningful public participation – including a requirement that TCEQ respond to comments and an opportunity for a contested case hearing.
- **Reduced sampling frequency**. The preamble to the proposed regulations states that TCEQ's Executive Director can approve a reduced sampling frequency - meaning that groundwater would only be sampled once per year – if site-specific characteristics show that the reduction is "necessary."[23] While the text of the proposed regulation does not actually include that language, such language, if finalized, would render the state program less protective than the Coal Ash Rule (which requires semi-annual sampling). Annual sampling would provide less data than the federal rule, would potentially fail to reflect seasonal fluctuations in groundwater, and would increase the time between any leak and its detection. In

addition, the use of the word "necessary," without further definition, could introduce the consideration of cost, which is not contemplated by the federal rule's groundwater monitoring scheme.

- **Notice to potentially exposed residents is inadequate.** The proposed regulations only required an owner or operator to notify those "actually or probably exposed" to a pollutant above groundwater protection standards within "60 calendar days."[24] By contrast, the federal rule requires notice to anyone living over a contamination plume, immediately after finding a statistically significant increase in assessment monitoring pollutants.[25] In 2018, notification can, and should, be required to be much sooner than 30 days and should include any residents living over a plume.
- **New developments must be factored into proposed regulations.** Since TCEQ released, and then withdrew, its proposed regulations, the Coal Ash Rule went through significant changes. Most notably, a federal appeals court ruled in August 2018 that EPA's 2015 Coal Ash Rule was not stringent enough.[26] Specifically, the court instructed EPA to change the Coal Ash Rule to require that: 1) all unlined ponds must be closed; 2) ponds that are only lined with clay must be closed; and 3) so-called "legacy ponds" – ponds at inactive power plants – must be regulated. Any state program proposed subsequent to this decision would have to incorporate these requirements to be "at least as protective" as the federal program.

If Texas re-proposes state regulations intended to operate in lieu of the federal Coal Ash Rule, the above-listed concerns will have to be addressed, especially given the extensive evidence of groundwater contamination shown in the balance of this report. A state program less stringent than the Coal Ash Rule would violate federal law and would not survive a legal challenge.

In addition, the Texas program shares some of the key weaknesses of the Coal Ash Rule. Among other things, both programs exempt abandoned coal ash units from regulation, even though they are often a major source of onsite contamination. Texas can – and should – go beyond the minimal requirements of the Coal Ash Rule to provide better protection to human health and the environment.

3. Methods

This report evaluates groundwater data in three ways. First, we compare groundwater data to health-based thresholds in order to determine whether the groundwater is unsafe. This determination includes both up- and downgradient wells because, as discussed above, many purportedly "upgradient" wells are affected by coal ash, either from a neighboring unit (regulated or unregulated), or in some cases from the unit being monitored. The thresholds that we used are shown in Table 3.1. For the most part, they are equal to EPA's presumptive groundwater protection standards for each pollutant. Boron and sulfate do not have groundwater protection standards under the Coal Ash Rule because they are not part of the assessment monitoring program (yet).[27] For these two pollutants, we used EPA drinking water advisories.[28]

We consider a pollutant to be present at unsafe levels if the mean value for a given well exceeds the relevant health-based threshold.[29]

Table 3.1: Groundwater Monitoring Pollutants and Thresholds Used in This Report

Pollutant	Health-based threshold	Presumptive groundwater protection standard under Coal Ash Rule[30]
Detection Monitoring, 40 CFR Part 257 Appendix III		
Boron	3 mg/L	
Calcium		
Chloride		
Fluoride		
pH		
Sulfate	500 mg/L	
Total Dissolved Solids (TDS)		
Assessment Monitoring, 40 CFR Part 257 Appendix IV		
Antimony	6 µg/L	6 µg/L
Arsenic	10 µg/L	10 µg/L
Barium	2 mg/L	2 mg/L
Beryllium	4 µg/L	4 µg/L
Cadmium	5 µg/L	5 µg/L
Chromium	100 µg/L	100 µg/L
Cobalt	6 µg/L	6 µg/L
Fluoride	4 mg/L	4 mg/L
Lead	15 µg/L	15 µg/L
Lithium	40 µg/L	40 µg/L
Mercury	2 µg/L	2 µg/L
Molybdenum[31]	40 µg/L	100 µg/L
Selenium	50 µg/L	50 µg/L
Thallium	2 µg/L	2 µg/L
Radium 226 and 228 combined	5 pCi/L	5 pCi/L

We also evaluated each detection monitoring pollutant to see whether downgradient concentrations are likely to exceed upgradient concentrations, producing a Statistically Significant Increase (SSI) and triggering assessment monitoring. In some cases, owners acknowledged detection monitoring SSIs, either explicitly, or by posting a notice of assessment monitoring. We did not attempt to calculate SSIs – each site has selected its own statistical method and the calculations would have been too onerous – but in order to get a sense of whether an SSI was likely, we compared the mean value of each pollutant in each downgradient well to the maximum upgradient value for the coal ash unit in question. We assume that when a pollutant is, on average, elevated above the maximum upgradient result, then that pollutant is significantly elevated. Monitoring results for detection monitoring pollutants are shown in **Attachment A.**

Finally, we evaluated assessment monitoring pollutants to get a sense of whether assessment monitoring is likely to find SSIs. Strictly speaking, each owner will be using new data for their assessment monitoring analyses (i.e., data collected after the eight initial samples required by the Coal Ash Rule). But we assume that groundwater quality will not improve significantly between, for example, 2016 and 2018, and that the initial sampling results provide a reliable indicator of current groundwater quality. If upgradient data for a given pollutant are all below that pollutant's groundwater protection standard, then we assume that the pollutant's groundwater protection standard is equal to the presumptive standard shown in Table 3.1 In this case, any downgradient result greater than the presumptive standard is a likely SSI. If upgradient data tend to exceed the presumptive groundwater standard for a given pollutant, then we assume that the standard for that pollutant will be set at background. In this case, we assume there will be an SSI if a mean downgradient concentration exceeds the upgradient maximum for that coal ash unit. Monitoring results for assessment monitoring pollutants are shown in **Attachment B.**

In addition, where EIP's ashtracker database provides additional information, we summarize the data in **Attachment C** and in the text. The ashtracker data generally predate the Coal Ash Rule, were collected pursuant to state law requirements, and have variable coverage from site to site.

4. Statewide Summary of Groundwater Monitoring Data

The bulk of this report describes the data for each regulated and monitored coal plant.[32] It is worth making a few observations about the Texas coal plants as a group. First, the groundwater is contaminated with unsafe levels of multiple toxic coal ash pollutants at all 16 monitored coal plants in Texas (Table 4.1). It is worth noting that monitoring found excessive levels of arsenic in the groundwater at 13 of the 15 power plant sites. Arsenic is both a powerful carcinogen and a neurotoxin. The ubiquitous contamination shows that the both the industry and Texas regulators have consistently failed to protect Texas groundwater. Second, with one or two exceptions, none of the coal ash ponds in Texas meet EPA's liner design criteria – they are all effectively unlined (Table 4.2). Third, almost all coal ash disposal units should have shown significant evidence of contamination during phase I "detection monitoring," and should therefore be in phase II "assessment monitoring." Owners and operators have not consistently complied with this part of the Coal Ash Rule, but our analysis finds that most coal ash disposal units in Texas would show significant evidence of contamination during assessment monitoring, and should therefore be on their way to corrective and remedial action (Table 4.2).

Table 4.1: Groundwater Is Unsafe Across the State

Site	Pollutants with mean concentrations greater than health-based thresholds in one or more monitoring wells
Big Brown	arsenic, cobalt, lithium, selenium
CPS Energy Calaveras	beryllium, boron, cadmium, chromium, cobalt, lead, lithium, radium, selenium, sulfate, thallium
Coleto Creek	arsenic, boron, cobalt, lead, manganese, mercury, molybdenum, nickel, thallium
Fayette	arsenic, cobalt, lithium, manganese, molybdenum, nickel, selenium, sulfate
Gibbons Creek	antimony, arsenic, beryllium, boron, cadmium, cobalt, lead, mercury, sulfate, thallium
Limestone	boron, fluoride, sulfate, and likely others
Martin Lake	arsenic, beryllium, boron, cadmium, cobalt, lead, lithium, manganese, mercury, nickel, strontium, sulfate
Monticello	arsenic, beryllium, boron, cadmium, cobalt, lithium, molybdenum, selenium, sulfate
Oak Grove	chromium, cobalt, lithium, selenium
Pirkey	arsenic, beryllium, boron, cadmium, cobalt, lithium, mercury, radium, sulfate
San Miguel	arsenic, beryllium, boron, cadmium, cobalt, fluoride, lithium, mercury, radium, selenium, sulfate, thallium
Sandow	arsenic, chromium, cobalt, lead, lithium, mercury, sulfate, thallium
Sandy Creek	arsenic, boron, cobalt, lead, lithium, selenium, sulfate
Twin Oaks	arsenic, cobalt, radium, thallium
W.A. Parish	arsenic, boron, chromium, fluoride, manganese, molybdenum, strontium, sulfate, and likely others
Welsh	arsenic, beryllium, cobalt, lead, lithium, radium, sulfate

Table 4.2: Assessment Monitoring. If and when each site goes through assessment monitoring, this table shows the likely results based on the data collected to date.

Site	Unit	For impoundments, are they lined or unlined?	Pollutants with likely SSIs[33]
Big Brown	Ash Disposal Area II		Barium, cobalt, chromium, lithium, selenium, radium
	Bottom Ash Ponds	Unlined	-
Calaveras	Sludge Recycle Holding Ponds	Unlined	-
	Bottom Ash Ponds	Unlined	Cobalt
	Fly Ash Landfill		Cobalt, lead, radium
	Evaporation Pond	Unlined	Beryllium, cadmium, cobalt, mercury, selenium
Coleto Creek	Primary Ash Pond	Unlined	Mercury, molybdenum
Fayette	Combustion Byproducts Landfill		Lithium
Gibbons Creek	Ash Ponds	Unlined	Arsenic, beryllium, cadmium, cobalt, fluoride

Site	Unit	For impoundments, are they lined or unlined?	Pollutants with likely SSIs[33]
	Scrubber Sludge Pond	Unlined	Beryllium, cadmium, cobalt, lead, radium, thallium
	Site F Landfill		Arsenic, beryllium, cadmium, cobalt, lead, lithium, mercury, radium, sulfate, thallium
Limestone	Landfill		Insufficient data
	E Pond	Unlined	
	Secondary E Pond	Unlined	
	ST-18	Unlined	
	K Pond	Unlined	
Martin Lake	Landfill		Arsenic, cadmium, cobalt, lead, lithium
	Ash Pond Area	Unlined	Arsenic, beryllium, cobalt, selenium
	PDP 5	Unlined	Arsenic, beryllium, cobalt, lithium, mercury, radium
Monticello	Ash Ponds	Unlined	Arsenic, beryllium, cadmium, chromium, selenium
Oak Grove	FGD Ponds	Both lined and unlined	Cobalt and selenium
	Landfill		Arsenic, chromium, cobalt, radium
Pirkey	East Bottom Ash Pond	Unlined	Arsenic, beryllium, chromium, cobalt, lead, lithium, mercury, radium
	West Bottom Ash Pond	Unlined	Cobalt and radium
	Landfill		Arsenic, cadmium, cobalt, lead, lithium, radium
	Stackout Pad		Arsenic, beryllium, cobalt, chromium, mercury, radium
San Miguel	Ash Ponds	Unlined	Antimony, mercury, radium
	Equalization Pond	Unlined	Lithium
	Ash Pile		Arsenic, beryllium, cadmium, fluoride, lithium, radium, selenium
Sandow	AX Landfill		Chromium and lithium
Sandy Creek	Landfill		Arsenic, chromium, cobalt, lead, selenium
Twin Oaks	CCR landfill		-
W.A. Parish	Landfill cell 1C, 2A, 2B, and 3		Insufficient data
	FGD Emerg. Pond	Unlined	
	Air Preheater Pond	Unlined	
Welsh	Primary Bottom Ash Pond	Unlined	Arsenic, beryllium, cadmium, chromium, cobalt, fluoride, lead, lithium, radium, thallium
	Landfill		
	Bottom Ash Storage Pond	Unlined	

Table 4.3: Closure Plans

Site	Unit	Closure method
Big Brown	Ash Disposal Area II	In place
	Bottom Ash Ponds	
Calaveras	Sludge Recycle Holding Ponds	Clean closure
	Bottom Ash Ponds	Clean closure
	Fly Ash Landfill	In place
	Evaporation Pond	Clean closure
Coleto Creek	Primary Ash Pond	In place
Fayette	Combustion Byproducts Landfill	In place
Gibbons Creek	Ash Ponds	In place
	Scrubber Sludge Pond	
	Site F Landfill	
Limestone	Landfill	In place
	E Pond	Clean closure
	Secondary E Pond	Clean closure
	ST-18	Clean closure
	K Pond	Clean closure
Martin Lake	Landfill	In place
	Ash Pond Area	
	PDP 5	
Monticello	Ash Ponds	In place[34]
Oak Grove	FGD Ponds	In place
	Landfill	
Pirkey	East Bottom Ash Pond	In place
	West Bottom Ash Pond	In place
	Landfill	In place
	Stackout Pad	Clean closure
San Miguel	Ash Ponds	In place
	Equalization Pond	In place
	Ash Pile	Clean closure
Sandow	AX Landfill	In place
Sandy Creek	Landfill	In place
Twin Oaks	CCR landfill	In place
W.A. Parish	Landfill cell 1C, 2A, 2B, and 3	In place
	FGD Emergency Pond	Clean closure
	Air Preheater Pond	Clean closure
Welsh	Primary Bottom Ash Pond	In place
	Landfill	
	Bottom Ash Storage Pond	

C. Groundwater Contamination Data and Coal Ash Rule Compliance by Plant

1. Big Brown

The Big Brown Power Plant in Fairfield, once one of the largest sources of sulfur dioxide in the United States, closed down in February 2018 after nearly 50 years of burning coal. The site still has a large coal ash footprint. For purposes of complying with the Coal Ash Rule, Luminant monitors the groundwater around two ash disposal areas: "Ash Disposal Area II," northeast of the power plant, and a pair of bottom ash ponds west of the power plant.[35] The bottom ash ponds at Big Brown are lined with clay; according to a recent decision from the U.S. Court of Appeals for the D.C. Circuit, these pounds must be considered "unlined" for purposes of the Coal Ash Rule.[36] Luminant is planning to close both areas by leaving the ash in place. There are presumably other ash disposal areas on the site (for example, we assume that there is an Ash Disposal Area I). There is a coal mine (the Big Brown Mine) immediately north of the plant and its disposal areas.

The wells that Luminant designated as "upgradient" appear to be impacted by coal ash. Well FMW-4R, which is purported to be upgradient of Ash Disposal Area II, is located on the southwestern edge of the disposal area, and has high concentrations of boron, the leading indicator of coal ash contamination (with concentrations up to 3.9 mg/L). Well BAP-57 is the designated upgradient well for the bottom ash ponds, but it's located immediately adjacent to the ponds.

Table 1.1 shows Big Brown groundwater has unsafe levels of multiple coal ash pollutants:

Table 1.1: Unsafe Groundwater at Big Brown

Well	Pollutant	Health threshold	Mean concentration	Maximum concentration
AMW-21	Cobalt (µg/L)	6	8.3	9.7
	Selenium (µg/L)	50	128.3	152.0
AMW-22	Cobalt (µg/L)	6	10.9	23.9
AMW-23	Cobalt (µg/L)	6	12.2	15.9
BAP-57*	Lithium (µg/L)	40	60.9	206.0
BAP-61	Cobalt (µg/L)	6	6.6	8.9
BAP-62	Lithium (µg/L)	40	41.6	45.1
BAP-63	Arsenic (µg/L)	10	11.9	17.7

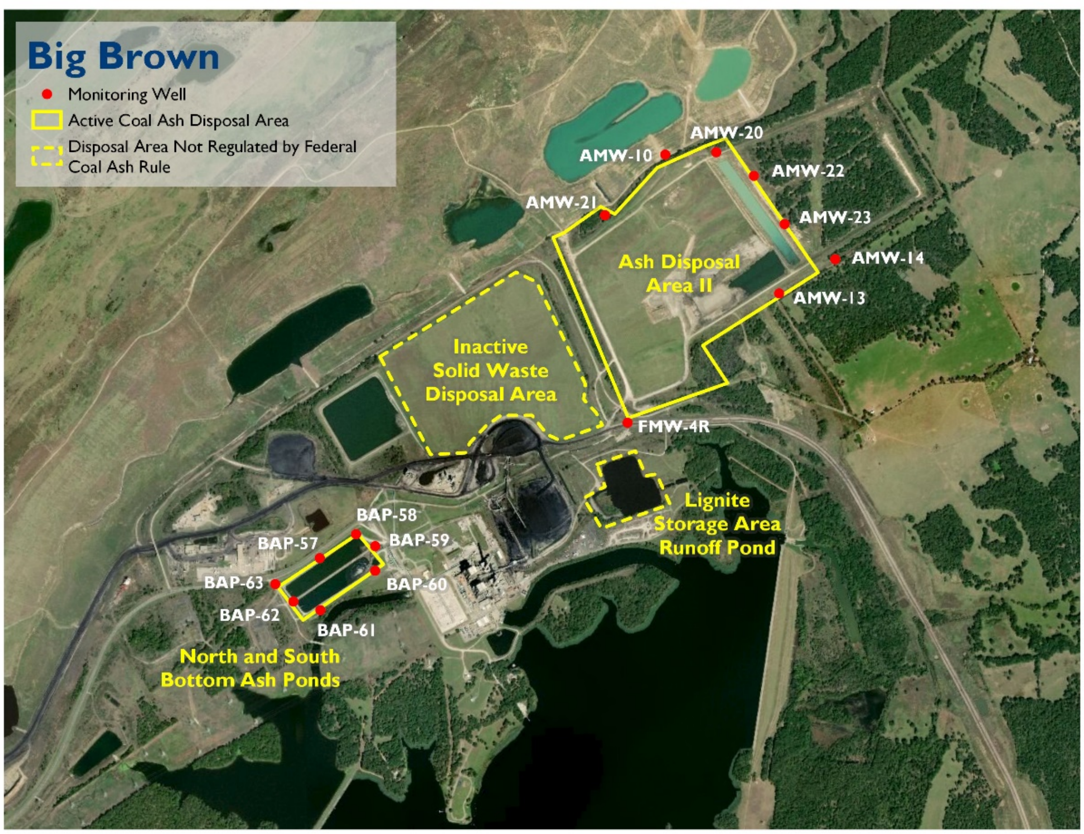
* *Upgradient well*

The monitoring data for detection monitoring pollutants show several likely SSIs (statistically significant increases). For example, looking specifically at boron results for the Bottom Ash Ponds, the maximum upgradient concentration is 0.46 mg/L. All downgradient wells have average concentrations greater than 0.46 mg/L, four of the six downgradient wells have mean concentrations greater than 1 mg/L, and concentrations range as high as 3.7 mg/L. Only two downgradient wells have ever reported concentrations below the upgradient maximum. Any legitimate statistical test would find a significant difference between up- and downgradient monitoring results. At Ash Disposal Area II, there would be no statistical difference for boron, but only because the purportedly upgradient wells are also affected by boron contamination.

Since detection monitoring found significantly elevated concentrations of coal ash pollutants, both of the disposal areas at Big Brown are now in assessment monitoring.[37] In assessment monitoring, Luminant is likely to find SSIs for multiple pollutants at Ash Disposal Area II. The statistical comparison at the Bottom Ash Ponds, where both up- and downgradient wells have unsafe levels of cobalt, lithium, and other pollutants, is unlikely to show assessment monitoring SSIs.

Table 1.2: Wells with Likely Assessment Monitoring SSIs at Big Brown

Downgradient well	Pollutants exceeding likely groundwater standard
Ash Disposal Area II	
AMW-10	Barium, cobalt, radium, selenium
AMW-13	Chromium
AMW-14	Chromium, lithium
AMW-21	Cobalt, radium, selenium
AMW-22	Cobalt
AMW-23	Cobalt



2. Calaveras

The Calaveras Power Station includes two coal plants stations near San Antonio, operated by CPS Energy, the municipal utility serving San Antonio. The two plants, known as J.T. Deely and J.K. Spruce, share a common set of coal ash storage and disposal units. For purposes of the Coal Ash Rule, CPS Energy is monitoring four coal ash units:

- The North and South Sludge Recycle Holding Ponds ("SRH Ponds"), which receive wastewater from "scrubbers" that remove sulfur dioxide from exhaust gas;
- The North and South Bottom Ash Ponds ("bottom ash ponds"), built in 1977;
- A fly ash landfill built in 1992;
- An evaporation pond, which was built as a landfill in 1990 then converted to a "fly ash impoundment" in 1996, and now receives boiler chemical cleaning waste and other wastes.[38]

None of the ash ponds meet the liner criteria of the Coal Ash Rule and are therefore "unlined" for purposes of the rule.[39]

The groundwater at Calaveras is unsafe, with multiple pollutants exceeding their respective health-based thresholds in multiple wells. The wells that CPS has designated as "upgradient" are among those showing unsafe levels of contamination. These purportedly upgradient wells are all very close to the coal ash units and generally show elevated concentrations of coal ash indicators including boron and sulfate. It therefore appears that these wells are affected by the regulated units, are not in fact upgradient, and are not reliable background wells.

Table 2.1: Unsafe Groundwater at Calaveras

Well	Pollutant	Health threshold	Mean concentration	Maximum concentration
JKS-31	Beryllium (µg/L)	4	8.1	8.9
	Cobalt (µg/L)	6	25.4	62.3
	Lithium (µg/L)	40	479.1	615.0
	Radium (pCi/L)	5	7.2	10.8
	Sulfate (mg/L)	500	632	1,130
JKS-33	Lithium (µg/L)	40	125.1	255.0
	Sulfate (mg/L)	500	1,903	3,170
JKS-36	Beryllium (µg/L)	4	16.2	26.1
	Cadmium (µg/L)	5	7.9	11.8
	Cobalt (µg/L)	6	141.6	220.0
	Lithium (µg/L)	40	245.9	379.0
	Radium (pCi/L)	5	5.9	9.1
	Selenium (µg/L)	50	55.0	69.7
	Sulfate (mg/L)	500	551	775
JKS-45*	Lithium (µg/L)	40	63.5	93.5
	Radium (pCi/L)	5	7.0	9.9

Well	Pollutant	Health threshold	Mean concentration	Maximum concentration
	Sulfate (mg/L)	500	504	770
JKS-46	Beryllium (µg/L)	4	4.1	4.9
	Cobalt (µg/L)	6	36.7	42.5
	Lead (µg/L)	15	18.1	27.1
	Lithium (µg/L)	40	67.9	107.0
	Sulfate (mg/L)	500	588	800
	Thallium (µg/L)	2	3.0	3.6
JKS-47*	Lithium (µg/L)	40	56.0	79.9
	Selenium (µg/L)	50	60.5	85.4
JKS-48	Lithium (µg/L)	40	42.7	70.0
JKS-49*	Boron (mg/L)	3	3.0	3.3
JKS-50R	Boron (mg/L)	3	5.0	5.9
JKS-51*	Lithium (µg/L)	40	54.5	95.8
JKS-52	Lithium (µg/L)	40	47.2	82.7
JKS-53	Lithium (µg/L)	40	78.7	125.0
JKS-54	Lithium (µg/L)	40	51.0	71.2
JKS-55	Cobalt (µg/L)	6	6.1	7.5
JKS-56	Boron (mg/L)	3	3.9	4.6
	Cobalt (µg/L)	6	6.6	7.7
JKS-57*	Boron (mg/L)	3	3.1	3.5
	Lithium (µg/L)	40	495.0	733.0
	Sulfate (mg/L)	500	2,484	3,610
JKS-60	Cobalt (µg/L)	6	39.4	115.0
	Sulfate (mg/L)	500	978	1,480
JKS-62	Selenium (µg/L)	50	196.3	222.0
JKS-63*	Chromium (µg/L)	100	408	1,490
	Cobalt (µg/L)	6	40.2	80.2
	Lithium (µg/L)	40	531.0	1,150.0
	Radium (pCi/L)	5	9.6	17.6
	Sulfate (mg/L)	500	1,617	1,970

* *Purportedly upgradient well*

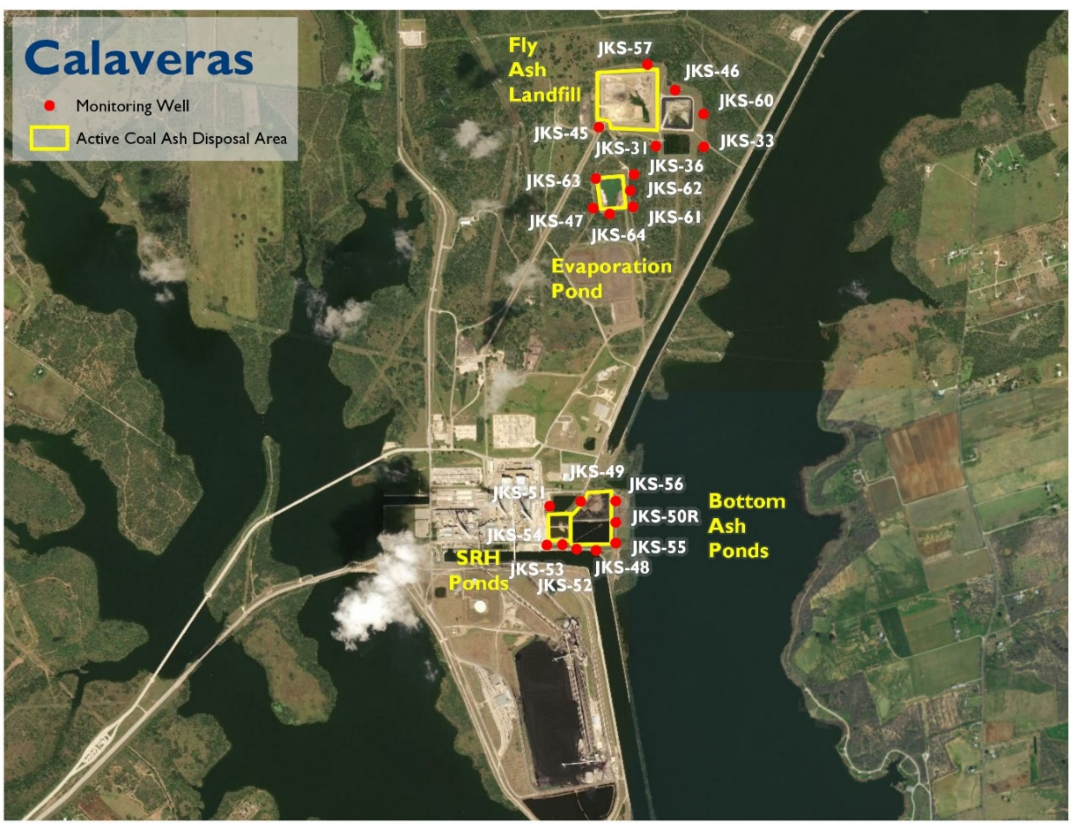
As mentioned above, the "background" wells selected by CPS Energy do not appear to be upgradient of the regulated coal ash units, and are not reliable comparison wells. This means that CPS Energy is unlikely to find statistically significant differences between background wells and compliance wells during either detection monitoring or assessment monitoring. Yet even with this inherent statistical bias, the data for several detection monitoring constituents do show evidence of downgradient exceedances. These include boron and fluoride at the Bottom Ash Ponds; pH at the Evaporation Pond; calcium, chloride, and pH[40] at the fly ash landfill; and pH at the Sludge Recycle Holding Ponds. And in fact, CPS acknowledges finding SSIs (statistically significant increases) for most of these pollutants.[41] However, CPS has now officially concluded that all of this contamination is "naturally occurring," and has therefore decided not to initiate assessment monitoring. *Id.* This conclusion, particularly in light of the fact that the background wells are contaminated by coal ash, is simply incorrect. The groundwater contamination at Calaveras is not naturally occurring, but is instead coming from onsite coal ash.

In short, CPS Energy installed inappropriate background wells, which is a violation of the Coal Ash Rule, and then ignored its statistical results using a plainly dubious interpretation of the data, which is also a violation of the Coal Ash Rule.

If CPS Energy were to perform assessment monitoring at Calaveras, it would likely find SSIs at the Bottom Ash Ponds, the Fly Ash Landfill, and the Evaporation Pond:

Table 2.2: Wells with Likely Assessment Monitoring SSIs at Calaveras

Downgradient well	Pollutants exceeding likely groundwater standard
Bottom Ash Ponds	
JKS-55	Cobalt
JKS-56	Cobalt
Evaporation Pond	
JKS-36	Beryllium, cadmium, cobalt, mercury,
JKS-62	Selenium
Fly Ash landfill	
JKS-31	Cobalt, radium
JKS-46	Cobalt, lead
JKS-60	Cobalt



3. Coleto Creek

The Coleto Creek Power Station in Fannin has been in operation since 1980 and was purchased by Dynegy in 2017. The site has one, 190-acre regulated ash pond known as the "primary ash pond." The site also has a small (10-acre) "secondary ash pond" immediately adjacent to the primary ash pond. The groundwater monitoring network surrounds both ponds. Neither pond meets EPA liner criteria, so both are "unlined" for purposes of the Coal Ash Rule.[42]

The data produced for the Coal Ash Rule cover the ash ponds at the site, but monitoring data for the rest of the site (available on EIP's Ashtracker website) show more widespread contamination.

The groundwater at Coleto Creek is unsafe to drink. The upgradient and background wells near the primary ash pond site show very high concentrations of arsenic and cobalt, which may be from a source other than the ash ponds. Some downgradient wells in this area also show unsafe levels of arsenic and cobalt, though at lower concentrations than in upgradient wells. In addition to arsenic and cobalt, wells downgradient of the primary ash pond show unsafe levels of boron, cobalt, mercury and molybdenum.

The additional data, dating from the 2010-2015 time period, come mainly from the area near the power plant itself, up- and downgradient of what appears to be a coal pile within a rail loop. These data show a similar pattern, with unsafe arsenic, cobalt, lead, and nickel in both up- and downgradient wells, and unsafe levels of additional pollutants exclusively in downgradient wells (including antimony, boron, manganese, and molybdenum).

The pattern of contamination suggests that either the coal pile is contaminating groundwater, or there are old coal ash disposal areas somewhere outside of the primary ash pond.

Table 3.1: Unsafe Groundwater at Coleto Creek

Well	Pollutant	Health threshold	Mean concentration	Maximum concentration
Primary Ash Pond (CCR rule data)				
BV-5*	Cobalt (µg/L)	6	47.9	49.9
BV-21*	Arsenic (µg/L)	10	120.7	180.0
	Cobalt (µg/L)	6	8.2	8.8
MW-8*	Cobalt (µg/L)	6	65.3	314.0
MW-4	Cobalt (µg/L)	6	7.3	8.5
MW-9	Arsenic (µg/L)	10	21.9	107.0
	Boron (mg/L)	3	3.2	3.4
	Mercury (µg/L)	2	2.0	4.3
	Molybdenum (µg/L)	40	96.7	113.0
MW-10	Arsenic (µg/L)	10	14.4	16.0
	Boron (mg/L)	3	7.7	9.2
	Molybdenum (µg/L)	40	100.6	121.0
MW-11	Arsenic (µg/L)	10	19.7	23.7

Well	Pollutant	Health threshold	Mean concentration	Maximum concentration
	Mercury (µg/L)	2	3.4	11.3
Other onsite wells (ashtracker data)				
BV-01*	Arsenic (µg/L)	10	11	17
	Cobalt (µg/L)	6	498	578
	Lead (µg/L)	15	37	79
	Nickel (µg/L)	100	206	235
MW-03*	Arsenic (µg/L)	10	16	27
	Cobalt (µg/L)	6	129	161
MW-01	Antimony (µg/L)	6	7	25
	Arsenic (µg/L)	10	13	19
	Boron (mg/L)	3	3.4	4.1
	Cobalt (µg/L)	6	320	452
	Nickel (µg/L)	100	150	189
	Thallium (µg/L)	2	2	10
MW-02	Boron (mg/L)	3	3.0	3.6
	Cobalt (µg/L)	6	390	1,170
	Lead (µg/L)	15	17	27
	Nickel (µg/L)	100	103	128
MW-07	Cobalt (µg/L)	6	25	102
PS-2	Cobalt (µg/L)	6	8	62
PS-3	Arsenic (µg/L)	10	12	32
	Manganese (µg/L)	300	550	2,160

*upgradient well

Luminant has acknowledged finding SSIs during detection monitoring and has initiated assessment monitoring. In assessment monitoring, Luminant is likely to find SSIs for mercury and molybdenum.

4. Fayette

The Fayette Power Project Plant, also known as the Sam Seymour Plant, is a 1,600 MW plant co-owned by the Lower Colorado River Authority (LCRA) and Austin Energy, located outside of La Grange, Texas. The station has been in operation since 1979. While the owners may have disposed of coal ash in multiple areas in the past, it is currently disposing of coal ash in a landfill known as the "combustion byproducts landfill." This is the only coal ash unit that the owners monitor for purposes of compliance with the Coal Ash Rule. EIP's Ashtracker website contains older data (from 2011) for several other wells located elsewhere at the site.

The groundwater at Fayette is unsafe. The wells around the landfill show unsafe levels of lithium (which may be naturally occurring) and sulfate (which is higher downgradient of the landfill and is therefore probably not naturally occurring). The 2011 data from other onsite wells show unsafe levels of arsenic, cobalt, manganese, molybdenum, nickel, selenium, and sulfate. It is unclear whether and to what extent these pollutants are coming from coal ash.

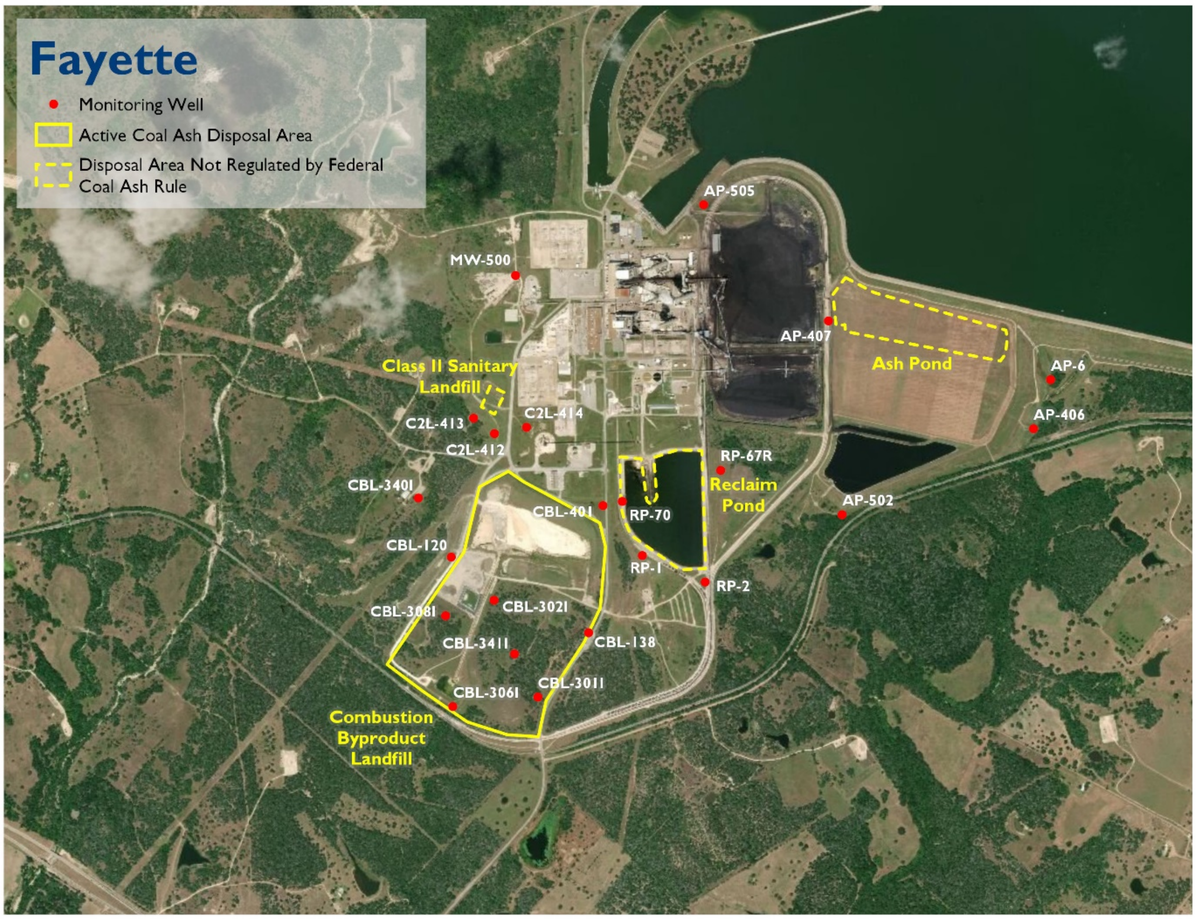
Table 4.1: Unsafe Groundwater at Fayette

Well	Pollutant	Health threshold	Mean concentration	Maximum concentration
Combustion Byproducts Landfill				
CBL-340I*	Lithium (µg/L)	40	84.3	101.0
	Sulfate (mg/L)	500	652	715
CBL-301I	Lithium (µg/L)	40	94.5	116.0
CBL-302I	Lithium (µg/L)	40	49.6	61.1
	Sulfate (mg/L)	500	1,109	1,230
CBL-308I	Lithium (µg/L)	40	115.7	134.0
	Sulfate (mg/L)	500	1,483	1,580
CBL-341I	Lithium (µg/L)	40	86.2	91.2
Other onsite wells (2011 ashtracker data)				
CBL-401*	Cobalt (µg /L)	6	12	15
	Manganese (µg /L)	300	506	546
AP-407*	Selenium (µg/L)	50	181	193
AP-406	Cobalt (µg/L)	6	24	41
	Molybdenum (µg/L)	40	234	247
	Nickel (µg/L)	100	129	170
	Sulfate (mg/L)	500	1,327	1,730
AP-6	Manganese (µg /L)	300	602	813
	Sulfate (mg/L)	500	513	619
C2L-412	Arsenic (µg/L)	10	24	31
	Molybdenum (µg/L)	40	87	132
CBL-138	Cobalt (µg/L)	6	33	38
	Manganese (µg /L)	300	841	872
RP-67R	Sulfate (mg/L)	500	525	607
RP-70	Sulfate (mg/L)	500	1,245	1,330

*upgradient well

The groundwater data for the landfill show downgradient concentrations of boron, calcium, chloride, lithium, sulfate, and total dissolved solids that appear to be significantly greater than the concentration in background well CBL-340I. Most of these pollutants are notably elevated in well CBL-308I, which is on the western downgradient edge of the landfill. The data show that Fayette should be in assessment monitoring. Yet LCRA has not posted a notice of assessment monitoring. Failure to initiate assessment monitoring upon finding detection monitoring SSIs, or a failure to post a notice of assessment monitoring, would be a violation of the Coal Ash Rule.

Once in assessment monitoring, LCRA is likely to find SSIs for lithium, particularly in well CBL-308I. Any lithium SSIs would trigger corrective action.



5. Gibbons Creek

The Gibbons Creek Steam Electric Generating Station is located in Anderson, Texas, and owned and operated by the Texas Municipal Power Agency (TMPA). For purposes of complying with the Coal Ash Rule, the owners monitor three coal ash units: a landfill (the "Site F ash landfill"), a "Scrubber Sludge Pond," and a set of three adjacent ash ponds (Ash Ponds "A, B and C"). All of the ash ponds were constructed in 1977; none of them meets the liner criteria of the Coal Ash Rule, so they are formally considered "unlined."[43]

All three coal ash units are on or close to the shore of Gibbons Creek Reservoir. The reservoir provides cooling water for the power plant, but is also a recreational fishing area. All three coal ash units are contaminating the groundwater (as described in detail below); most or all of the contaminated groundwater eventually discharges into Gibbons Creek Reservoir, where it threatens aquatic life and human health (through any fish that are caught and consumed).

The groundwater around each unit is clearly contaminated, with unsafe levels of one or more pollutants in all downgradient wells. As shown in Table 5.1, many pollutants are present at unsafe levels, including arsenic, beryllium, boron, cadmium, cobalt, lead, mercury, and thallium. Multiple wells have beryllium levels that are 10, 20 or even 30 times greater than the MCL. Similarly, cobalt concentrations are quite high in several wells, at times 50 or 100 times greater than the health-based cobalt standard. The problem is not limited to one part of the site. Wells AP MW-5 (at the ash ponds), SSP MW-3 (at the scrubber sludge pond) and MNW-15 (at the landfill) all show dramatically elevated concentrations of multiple coal ash pollutants.

Groundwater also shows unsafe levels of lithium and sulfate in all monitoring wells; lithium levels in multiple wells at each disposal site exceed the health-based standard by 20 times or more. However, these include both up- and downgradient wells, and the pattern is hard to interpret. For example, the highest lithium and sulfate concentrations at the ash ponds and scrubber sludge ponds are in the upgradient well. That well (SSP/AP MW-1) is located very close to the ash ponds and may not be truly upgradient – it may instead be contaminated by radial groundwater flow from the ash ponds. On the other hand, the lithium and sulfate may be coming, at least in part, from a non-ash source.

At the landfill, the upgradient well (MNW-15) shows elevated and unsafe levels of both lithium and sulfate, but there are downgradient wells with even higher concentrations, suggesting that the landfill is responsible for at least some of the contamination.

Table 5.1: Unsafe Groundwater at Gibbons Creek[44]

Well	Pollutant	Health threshold	Mean concentration	Maximum concentration
AP MW-1D	Boron (mg/L)	3	4.7	4.9
	Cobalt (µg/L)	6	81.3	580.0
AP MW-3	Boron (mg/L)	3	3.8	4.2
	Cobalt (µg/L)	6	45.7	50.0
AP MW-4	Beryllium (µg/L)	4	10.9	84.0
	Cobalt (µg/L)	6	42.5	180.0
AP MW-5	Arsenic (µg/L)	10	11.9	20.0
	Beryllium (µg/L)	4	85.4	90.0
	Boron (mg/L)	3	3.4	3.7
	Cadmium (µg/L)	5	7.4	10.0
	Cobalt (µg/L)	6	166.3	200.0
SSP MW-2	Beryllium (µg/L)	4	22.8	40.0
	Cobalt (µg/L)	6	61.3	70.0
SSP MW-3	Beryllium (µg/L)	4	113.9	121.0
	Cadmium (µg/L)	5	64.0	81.0
	Cobalt (µg/L)	6	593.8	620.0
	Thallium (µg/L)	2	6.4	10.0
SSP MW-4	Cobalt (µg/L)	6	13.8	40.0
MNW-15	Beryllium (µg/L)	4	72.3	77.0
	Boron (mg/L)	3	9.2	9.7
	Cadmium (µg/L)	5	94.8	116.0
	Cobalt (µg/L)	6	285.0	300.0
	Thallium (µg/L)	2	2.9	5.0
SFL MW-2	Cobalt (µg/L)	6	21.3	60.0
SFL MW-3	Beryllium (µg/L)	4	37.5	40.0
	Cadmium (µg/L)	5	6.4	8.0
	Cobalt (µg/L)	6	73.8	100.0
	Lead (µg/L)	15	27.5	30.0
	Mercury (µg/L)	2	2.1	3.0
	Thallium (µg/L)	2	5.6	7.0
SFL MW-4	Cobalt (µg/L)	6	13.8	40.0
	Thallium (µg/L)	2	3.5	6.0
SFL MW-5	Beryllium (µg/L)	4	10.1	12.0
	Boron (mg/L)	3	3.8	4.2
	Cobalt (µg/L)	6	55.0	70.0
SFL MW-6	Arsenic (µg/L)	10	10.6	20.0
	Beryllium (µg/L)	4	48.9	56.0
	Cadmium (µg/L)	5	10.1	13.0
	Cobalt (µg/L)	6	113.8	130.0
	Thallium (µg/L)	2	3.9	5.0

Detection monitoring revealed SSIs for multiple constituents at each disposal area, and all three are now in assessment monitoring. Assessment monitoring is likely to find SSIs for many pollutants:

Table 5.2: Wells with Likely Assessment Monitoring SSIs at Gibbons Creek

Downgradient well	Pollutants exceeding likely groundwater standard
Ash Ponds	
AP MW-1D	Cobalt
AP MW-3	Cobalt
AP MW-4	Cobalt
AP MW-5	Arsenic, beryllium, cadmium, cobalt, fluoride
Scrubber Sludge Pond	
SSP MW-2	Beryllium, cobalt, lead
SSP MW-3	Beryllium, cadmium, cobalt, lead, radium, thallium
SSP MW-4	Radium
Site F Landfill	
MNW-15	Beryllium, cadmium, cobalt, mercury
SFL MW-2	Cobalt, lithium
SFL MW-3	Beryllium, cadmium, cobalt, lead, mercury, radium, sulfate, thallium
SFL MW-4	Cobalt, radium, thallium
SFL MW-5	Beryllium, cadmium, cobalt, lithium
SFL MW-6	Arsenic, beryllium, cadmium, cobalt, lead, lithium, sulfate, thallium

6. Limestone

The Limestone Electric Generating Station near Jewett is operated by NRG Texas Power, LLC (NRG). The site has five active, regulated coal ash units: a large landfill (known simply as "the Landfill"), and four smaller coal ash ponds known as "E Pond," "Secondary E Pond," "ST-18," and "K Pond." The site also has an impoundment that used to collect stormwater from the landfill; NRG believes that this stormwater pond is not subject to the Coal Ash Rule.

The four coal ash ponds have liners made of compacted soil. These liners met the original Coal Ash Rule criteria for existing impoundments (40 C.F.R. § 257.71), and NRG certified that the ponds were lined.[45] However, the U.S. Court of Appeal for the D.C. Circuit recently struck down the criteria in question, holding that existing impoundments must, like new impoundments, have "composite" liners, meaning liners constructed with geomembrane (plastic) on top of compacted soil.[46] Since liners at Luminant lack the upper component of a composite liner, the ponds should be considered unlined.

The most glaring problem with the annual groundwater reports for Limestone is that NRG has failed to provide any monitoring data for Appendix IV assessment monitoring pollutants (antimony, arsenic, beryllium, etc.). This is a clear violation of the Coal Ash Rule.

Still, the limited available dataset shows that the site is contaminated, with unsafe levels of at least 3 of the Appendix III pollutants:

Table 6.1: Unsafe Groundwater at Limestone

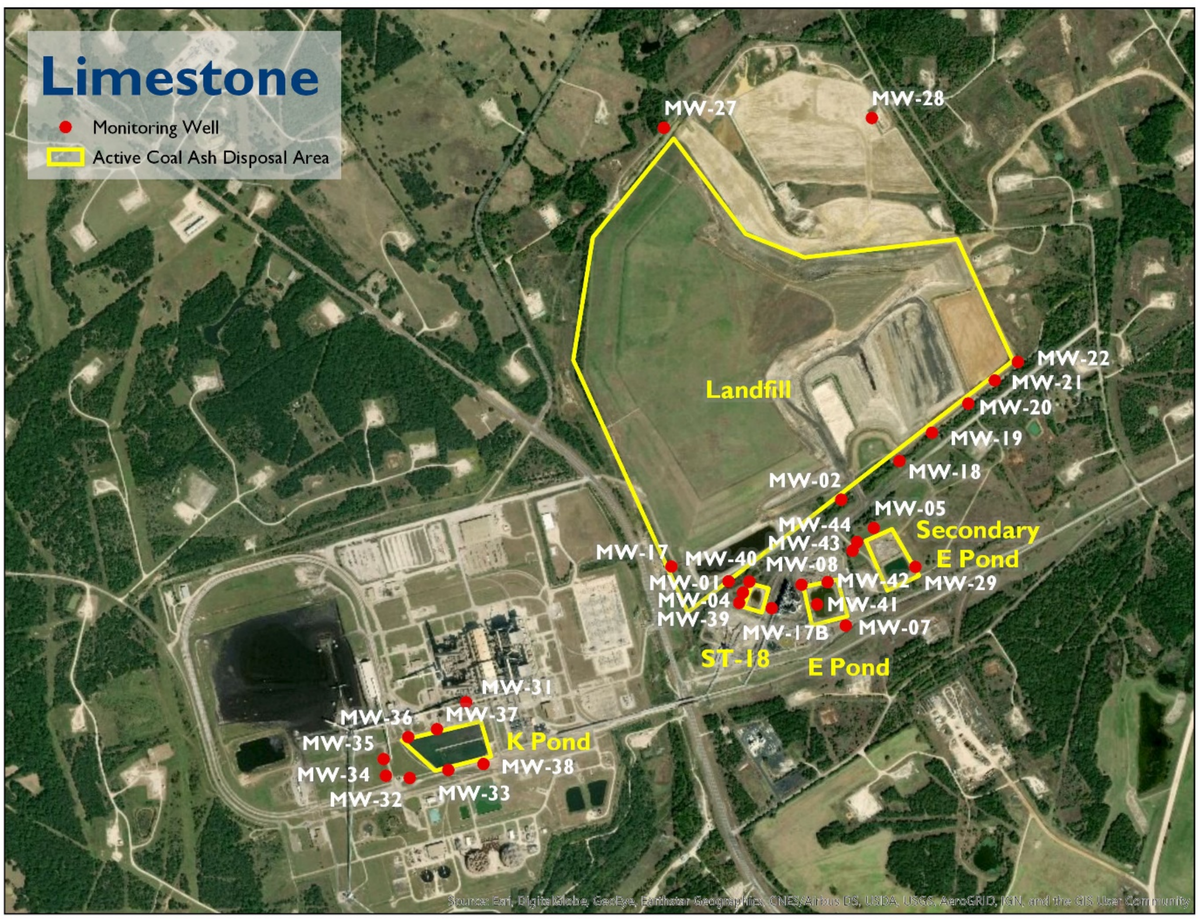
Well	Pollutant	Health threshold	Mean concentration	Maximum concentration
MW-28*	Sulfate (mg/L)	500	970	1,590
MW-33*	Fluoride (mg/L)	4	8.3	23.0
MW-17B*	Sulfate (mg/L)	500	1,706	2,050
MW-04	Sulfate (mg/L)	500	1,182	2,180
MW-08	Sulfate (mg/L)	500	944	1,160
MW-30	Fluoride (mg/L)	4	7.0	52.3
MW-31	Sulfate (mg/L)	500	1,011	1,500
MW-32	Sulfate (mg/L)	500	626	1,230
MW-35	Fluoride (mg/L)	4	5.3	21.0
	Sulfate (mg/L)	500	643	720
MW-36	Sulfate (mg/L)	500	756	960
MW-37	Sulfate (mg/L)	500	682	850
MW-38	Sulfate (mg/L)	500	665	740
MW-39	Sulfate (mg/L)	500	914	1,200
MW-41	Boron (mg/L)	3	6.0	11.0
	Sulfate (mg/L)	500	994	1,300

* upgradient well

The E Pond, the Secondary E Pond, and the K pond should all be in assessment monitoring. At the small pond known as ST18, the purportedly upgradient well (MW-17B) is more contaminated than the downgradient wells. MW-17B may be affected by other nearby coal ash units (it is down- or sidegradient of the E Pond, for example) or it may be affected by ST18. In any case, it does not provide a reliable indicator of background, and ST18 should also be in assessment monitoring. Similarly, the two purportedly upgradient wells at the landfill (wells MW-27 and MW-28) have higher boron and sulfate concentrations than the downgradient wells, suggesting that they are affected by coal ash from the landfill or some other source.

Since NRG has failed to provide any data for assessment monitoring pollutants, we do not know what those data would show. However, given the evidence of contamination shown above, we presume that other coal ash constituents are also elevated in groundwater, and NRG will eventually have to take corrective action at the site to clean up the groundwater.

Regardless of whether each unit is required to go through assessment monitoring, NRG was required to post initial sampling results for all pollutants, including assessment monitoring pollutants, earlier this year. By failing to do so, NRG has violated federal law.



7. Martin Lake

Luminant operates the Martin Lake Steam Electric Station near Tatum. For purposes of CCR rule compliance, Luminant monitors the groundwater around three coal ash disposal areas: a landfill, a set of three ash ponds (the "Ash Pond Area"), and a stormwater pond known as "Permanent Disposal Pond 5," or "PDP 5." PDP 5 was built in 2010 on top of three closed and capped landfills (PDPs 1, 2 and 3), and adjacent to a fourth closed and capped landfill (PDP 4). The ponds in the Ash Pond Area are officially unlined. Pond PDP 5 has a clay liner; according to a recent decision from the U.S. Court of Appeals for the D.C. Circuit, this pond should also be considered unlined.[47]

The groundwater beneath all three disposal areas is contaminated with unsafe levels of multiple coal ash pollutants. The eastern side of the Ash Pond Area, on the shore of Martin Lake, has exceptionally high levels of multiple pollutants including boron, cobalt, and manganese, with concentrations that are frequently 10 or 20 times greater than health-based thresholds. See, for example, wells H-19B, H-22B, H-28, H-31, and H-32 in the following table.

Table 7.1: Unsafe Groundwater at Martin Lake

Well	Pollutant	Health threshold	Mean concentration	Maximum concentration
Landfill				
BMW-19	Cobalt (µg/L)	6	13.9	16.6
	Lithium (µg/L)	40	58.1	71.1
	Sulfate (mg/L)	500	2,258	2,390
BMW-20	Cobalt (µg/L)	6	44.4	78.6
BMW-21	Lithium (µg/L)	40	61.6	67.5
BMW-22	Boron (mg/L)	3	3.2	3.5
	Lithium (µg/L)	40	72.6	84.7
	Sulfate (mg/L)	500	864	949
BMW-23	Lithium (µg/L)	40	88.5	103.0
	Sulfate (mg/L)	500	521	577
BMW-24	Cobalt (µg/L)	6	11.8	23.8
BMW-26	Arsenic (µg/L)	10	12.1	32.8
	Cobalt (µg/L)	6	27.8	236.0
	Lithium (µg/L)	40	71.3	99.0
	Sulfate (mg/L)	500	572	1,210
BMW-27	Cobalt (µg/L)	6	137.4	255.0
	Lead (µg/L)	15	82.3	738.0
	Lithium (µg/L)	40	53.7	93.3
	Sulfate (mg/L)	500	965	1,280
BMW-28	Lithium (µg/L)	40	207.5	1,000.0
	Sulfate (mg/L)	500	1,233	1,460
Ash Pond Area (2015-2017 CCR rule data)				
H-26*	Cobalt (µg/L)	6	23.7	38.5
H-27*	Lithium (µg/L)	40	53.9	62.4
H-33*	Cobalt (µg/L)	6	30.3	64.4

Well	Pollutant	Health threshold	Mean concentration	Maximum concentration
	Lithium (µg/L)	40	126.5	182.0
H-28	Boron (mg/L)	3	6.5	10.3
	Cobalt (µg/L)	6	145.2	201.0
	Lithium (µg/L)	40	122.1	159.0
	Sulfate (mg/L)	500	734	1,080
H-31	Beryllium (µg/L)	4	9.4	19.7
	Boron (mg/L)	3	21.5	24.1
	Cobalt (µg/L)	6	151.8	434.0
	Lithium (µg/L)	40	158.5	198.0
	Sulfate (mg/L)	500	2,394	2,870
H-32	Beryllium (µg/L)	4	4.8	6.1
	Cobalt (µg/L)	6	190.4	208.0
	Lithium (µg/L)	40	80.9	87.0
Ash Pond Area (2010-2014 ashtracker data)				
H-1B	Manganese (µg/L)	300	600	777
H-2B	Boron (mg/L)	3	8.6	9.8
	Manganese (µg/L)	300	724	1,170
	Sulfate (mg/L)	500	1,217	1,480
H-12B	Manganese (µg/L)	300	512	1,050
	Sulfate (mg/L)	500	507	749
H-13B	Manganese (µg/L)	300	897	1,310
H-15B	Boron (mg/L)	3	5.2	6.7
	Manganese (µg/L)	300	1,450	2,010
	Sulfate (mg/L)	500	851	1,060
H-16B	Manganese (µg/L)	300	2,180	3,080
	Nickel (µg/L)	100	223	285
	Sulfate (mg/L)	500	550	652
H-17B	Boron (mg/L)	3	4.0	7.7
	Manganese (µg/L)	300	2,100	4,400
	Sulfate (mg/L)	500	960	1,470
H-19B	Boron (mg/L)	3	19.5	26.8
	Manganese (µg/L)	300	8,340	11,600
	Nickel (µg/L)	100	239	318
	Strontium (mg/L)	4	5.4	5.6
	Sulfate (mg/L)	500	2,467	3,340
H-21B	Manganese (µg/L)	300	702	1,510
H-22B	Boron (mg/L)	3	58.7	69.0
	Cadmium (µg/L)	5	11	19
	Manganese (µg/L)	300	27,100	39,800
	Nickel (µg/L)	100	981	1,560
	Strontium (mg/L)	4	12.8	13.4
	Sulfate (mg/L)	500	3,539	4,700
H-25B	Manganese (µg/L)	300	474	794
Permanent Disposal Pond 5				
MW-17A	Cobalt (µg/L)	6	7.8	8.7
MW-18A	Mercury (µg/L)	2	23.6	61.0
MW-19	Arsenic (µg/L)	10	10.0	25.9

Well	Pollutant	Health threshold	Mean concentration	Maximum concentration
PDP-22	Lithium (µg/L)	40	69.7	184.0
PDP-24	Beryllium (µg/L)	4	4.3	4.9
	Boron (mg/L)	3	3.4	4.0
	Cobalt (µg/L)	6	79.6	90.1
PDP-25	Cobalt (µg/L)	6	10.8	11.4
	Lithium (µg/L)	40	129.7	176.0

**upgradient well*

The Landfill and Ash Pond Area at Martin Lake are both in assessment monitoring.[48] At PDP5, Luminant has not identified any upgradient or background wells.[49] This is a violation of the Coal Ash Rule. It also makes it impossible for Luminant to perform an adequate statistical analysis. Specifically, there is no way of showing whether any of the downgradient monitoring data are statistically elevated over either background (during detection monitoring) or over groundwater protection standards (during assessment monitoring). For purposes of this report, we assume that all assessment monitoring pollutants will have groundwater protection standards equal to the default standards shown in Table 1.

During assessment monitoring, Luminant will likely find SSIs for the following pollutants:

Table 7.2: Wells with Likely Assessment Monitoring SSIs at Martin Lake

Downgradient well	Pollutants exceeding likely groundwater standard
Landfill	
BMW-19	Cobalt
BMW-20	Cobalt
BMW-21	Lithium
BMW-22	Lithium
BMW-23	Lithium
BMW-26	Arsenic, cobalt, lithium
BMW-27	Cadmium, cobalt, lead
BMW-28	Lithium
Ash Pond Area	
H-28	Beryllium, cobalt
H-29	Selenium
H-31	Arsenic, beryllium, cobalt, selenium
H-32	Arsenic, beryllium, cobalt
PDP 5	
MW-17A	Cobalt
MW-18A	Mercury
MW-19	Arsenic
MW-20A	Cobalt, mercury, radium
PDP-22	Arsenic, cobalt, lithium
PDP-24	Beryllium, cobalt, mercury
PDP-25	Cobalt, lithium

An additional issue of concern at Martin Lake is selenium, which is toxic to fish at concentrations as low as 1.5 micrograms per liter.[50] Groundwater at Martin Lake has selenium levels that are frequently much higher than 1.5 micrograms per liter, and as high as 327 micrograms per liter.[51] The lake itself is a popular fishing spot, and the Martin Creek Lake State Park is located just half a mile across the water from the coal plant, so the threat posed by selenium is very real.

8. Monticello

The Monticello Steam Electric Station in Mount Pleasant was retired in January, 2018. The site is owned and operated by Luminant. For purposes of Coal Ash Rule compliance, Luminant monitors the groundwater around a single coal ash unit consisting of three adjacent coal ash ponds. These ponds are lined with clay, which is, according to recent federal court decision, not good enough.[52] For purposes of the Coal Ash Rule, these ponds are unlined. The site also has three closed coal ash units, including "A Ash Area," a "Scrubber Sludge Decant Area," and an "Inactive Scrubber Pond." Luminant does not believe that any of these areas are subject to the coal ash rule, but they may still contain ash and may present an ongoing threat to groundwater quality. The Monticello ash ponds are in contact with groundwater,[53] which greatly facilitates the leaching of pollutants. The groundwater beneath the ash ponds migrates into Lake Monticello, a recreational fishing lake.

The groundwater at Monticello is unsafe to drink. All of the onsite wells have unsafe levels of boron and sulfate, and one or more wells also have unsafe levels of arsenic, beryllium, cadmium, cobalt, and/or lithium. The nominally "upgradient" wells appear to be contaminated, and that contamination may be coming from the closed "A Ash Area" just east of the ash ponds, or it may be coming from the ponds themselves (the upgradient wells are just feet away from the ash ponds). In any event, even though the upgradient wells are contaminated, the downgradient wells are even more contaminated, showing that the ash ponds are leaking and are at least part of the problem.

Again, every well at Monticello shows unsafe levels of multiple pollutants:

Table 8.1: Unsafe Groundwater at Monticello

Well	Pollutant	Health threshold	Mean concentration	Maximum concentration
W31*	Beryllium (µg/L)	4	6.8	10.2
	Boron (mg/L)	3	3.4	3.9
	Cobalt (µg/L)	6	295.0	403.0
	Sulfate (mg/L)	500	599	808
W32*	Boron (mg/L)	3	6.1	7.0
	Sulfate (mg/L)	500	927	1,210
W33*	Boron (mg/L)	3	6.4	7.5
	Sulfate (mg/L)	500	849	1,080
W29	Beryllium (µg/L)	4	4.6	7.8
	Boron (mg/L)	3	5.1	6.5
	Cobalt (µg/L)	6	278.3	468.0
	Lithium (µg/L)	40	51.1	62.2
	Sulfate (mg/L)	500	856	1,150
W30	Beryllium (µg/L)	4	33.6	81.3
	Boron (mg/L)	3	6.7	8.5
	Cadmium (µg/L)	5	18.9	71.5
	Cobalt (µg/L)	6	332.3	357.0
	Selenium (µg/L)	40	79.4	177.0

Well	Pollutant	Health threshold	Mean concentration	Maximum concentration
	Sulfate (mg/L)	500	860	925
W34	Arsenic (µg/L)	10	30.8	61.8
	Boron (mg/L)	3	3.6	6.1
	Cobalt (µg/L)	6	157.3	230.0
	Sulfate (mg/L)	500	610	937
W35	Boron (mg/L)	3	6.2	6.9
	Cobalt (µg/L)	6	236.3	254.0
	Sulfate (mg/L)	500	837	863

In assessment monitoring, even though the purportedly upgradient wells are contaminated, Luminant is likely to find SSIs for arsenic, beryllium, cadmium, chromium, and/or selenium in wells W29, W30 and W34. In order to restore groundwater quality, Luminant would almost certainly have to consider any contamination coming from the closed onsite coal ash units in addition to the contamination coming from the ash ponds.

Finally, Luminant is planning to close the currently active ash ponds in place. This will do nothing to restore groundwater quality because the ash ponds are in contact with groundwater. The only environmentally sensitive way to close these ash ponds is to remove the ash.

9. Oak Grove

Luminant's Oak Grove Steam Electric Station in Franklin is a relatively new coal plant, in operation since 2010. The site has three impoundments that store flue gas desulfurization (FGD) waste and coal ash, and a coal ash landfill. For purposes of complying with the Coal Ash Rule, Luminant monitors the groundwater around the ponds as a single unit (the "FGD Ponds"), and monitors the groundwater around the landfill as a separate unit. Two of the ash ponds are lined, meaning that they have a composite liner with both clay and plastic components.[54] One of the ash ponds (FGD-A) has only a clay liner; according to a recent decision from the U.S. Court of Appeals for the D.C. Circuit, FGD-A will have to be considered "unlined."[55]

The wells that Luminant has selected as "upgradient" are unlikely to be reliable background wells. Wells FGD-8 and FGD-11 are the wells that Luminant selected for the FGD Ponds. FGD-8 appears to be downgradient, not upgradient, of ash pond FGD-C, and FGD-11 appears to have been installed in an area of fill or disturbed soil on the edge of ash pond FGD-C.[56] The upgradient wells for the landfill (AL-10 and MW-02) appear to have been installed on the edge of, or even within, the landfill.[57]

The groundwater at Oak Grove is contaminated with unsafe levels of multiple coal ash pollutants, mainly lithium, but also cobalt, chromium, and selenium:

Table 9.1: Unsafe Groundwater at Oak Grove

Well	Pollutant	Health threshold	Mean concentration	Maximum concentration
FGD Ponds				
FGD-8*	Cobalt (µg/L)	6	8.8	15.8
	Lithium (µg/L)	40	46.7	149.0
FGD-3	Cobalt (µg/L)	6	32.0	43.6
	Lithium (µg/L)	40	124.1	176.0
	Selenium (µg/L)	50	55.8	90.7
FGD-5	Lithium (µg/L)	40	119.4	164.0
FGD-6	Lithium (µg/L)	40	48.2	170.0
Landfill				
MW-02*	Lithium (µg/L)	40	51.2	100.0
MW-05	Lithium (µg/L)	40	51.5	114.0
MW-08	Chromium (µg/L)	100	159.2	399.0
	Lithium (µg/L)	40	78.8	113.0
MW-08R	Lithium (µg/L)	40	60.1	92.7
MW-09	Lithium (µg/L)	40	58.1	63.6

Detection monitoring at both units should have found SSIs for multiple pollutants, including boron at the FGD ponds and calcium, chloride, sulfate and TDS at the landfill. As described above, the "upgradient" wells at the FGD ponds are neither upgradient nor appropriate background wells. They both show signs of coal ash contamination, which makes any statistical comparisons with other FGD pond wells meaningless. A valid comparison to truly upgradient wells would likely find SSIs for calcium, fluoride, sulfate, and TDS in addition to boron.

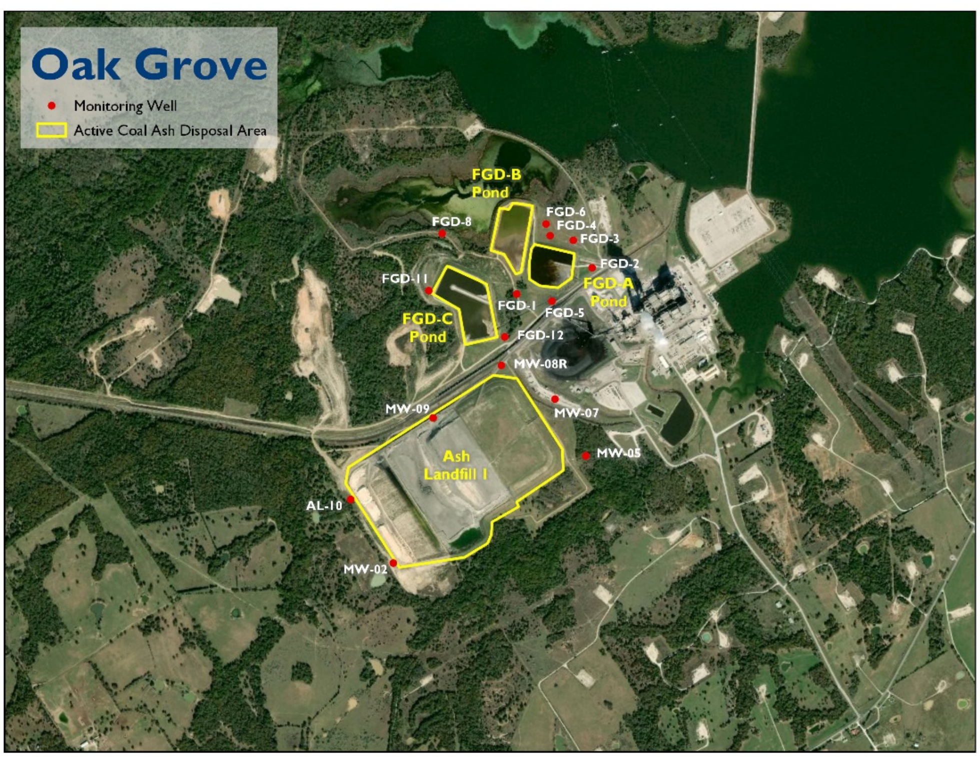
Luminant apparently agrees, at least with respect to the FGD ponds, because it has initiated assessment monitoring at these ponds.[58] But again, both coal ash units should be in assessment monitoring. Luminant has therefore violated the Coal Ash Rule in at least two ways at Oak Grove: First, by selecting inappropriate background wells, and second, by failing to initiate assessment monitoring at the landfill.

In assessment monitoring, the statistical problems described above (stemming from the use of inappropriate background wells) would undermine any statistical analysis. Yet even using Luminant's background wells, the data show likely SSIs for several pollutants:

Table 9.2: Wells with Likely Assessment Monitoring SSIs at Oak Grove

Downgradient well	Pollutants exceeding likely groundwater standard
Landfill	
MW-05	Arsenic
MW-08	Chromium and cobalt
FGD Ponds	
FGD-3	Cobalt and selenium

If Luminant were to perform valid assessment monitoring using appropriate background wells, it would find even more SSIs (statistically significant increases), including elevated cobalt, lithium, molybdenum, and radium in one or more wells at the FGD Ponds.



10. Pirkey

AEP's H.W. Pirkey Power Plant is located in Hallsville, on the shore of Brandy Branch Reservoir. There are several regulated coal ash units at the site, including East and West Bottom Ash Ponds, a landfill, and a "stackout pad" used to store fly ash and scrubber sludge before that material is moved to the landfill. The Bottom Ash Ponds are unlined.[59] AEP has acknowledged that the groundwater is contaminated, and all four units are now in assessment monitoring.[60]

The groundwater beneath each of the four monitored coal ash units has unsafe levels of multiple pollutants, most often including cobalt and lithium, but also including arsenic, beryllium, boron, cadmium, mercury, radium, and sulfate:

Table 10.1: Unsafe Groundwater at Pirkey

Well	Pollutant	Health threshold	Mean concentration	Maximum concentration
East Bottom Ash Pond				
AD-2	Cobalt (µg/L)	6	10.4	11.0
	Lithium (µg/L)	40	44.3	52.0
AD-4	Cobalt (µg/L)	6	6.9	9.0
AD-31	Arsenic (µg/L)	10	15.7	93.0
	Cobalt (µg/L)	6	15.9	50.0
	Lithium (µg/L)	40	92.5	97.0
AD-32	Beryllium (µg/L)	4	6.4	9.0
	Boron (mg/L)	3	3.5	5.8
	Cobalt (µg/L)	6	57.5	75.0
	Lithium (µg/L)	40	204.6	972.0
	Mercury (µg/L)	2	5.7	13.9
	Radium (pCi/L)	5	5.9	17.3
West Bottom Ash Pond				
AD-3*	Lithium (µg/L)	40	182.6	991.0
AD-17	Cobalt (µg/L)	6	10.6	14.0
AD-28	Cobalt (µg/L)	6	14.9	18.0
Landfill				
AD-27*	Beryllium (µg/L)	4	5.1	6.0
	Cobalt (µg/L)	6	20.4	22.0
	Lithium (µg/L)	40	94.1	104.0
AD-8*	Beryllium (µg/L)	4	5.0	7.0
	Cobalt (µg/L)	6	15.2	20.0
	Radium (pCi/L)	5	5.2	7.6
AD-23	Lithium (µg/L)	40	131.5	1,010
	Radium (pCi/L)	5	8.0	12.9
AD-34	Arsenic (µg/L)	10	10.1	25.0
	Cadmium (µg/L)	5	7.1	11.0
	Cobalt (µg/L)	6	296.1	306.0
	Lithium (µg/L)	40	166.8	183.0
	Radium (pCi/L)	5	9.1	13.2
	Sulfate (mg/L)	500	1,038	1,330

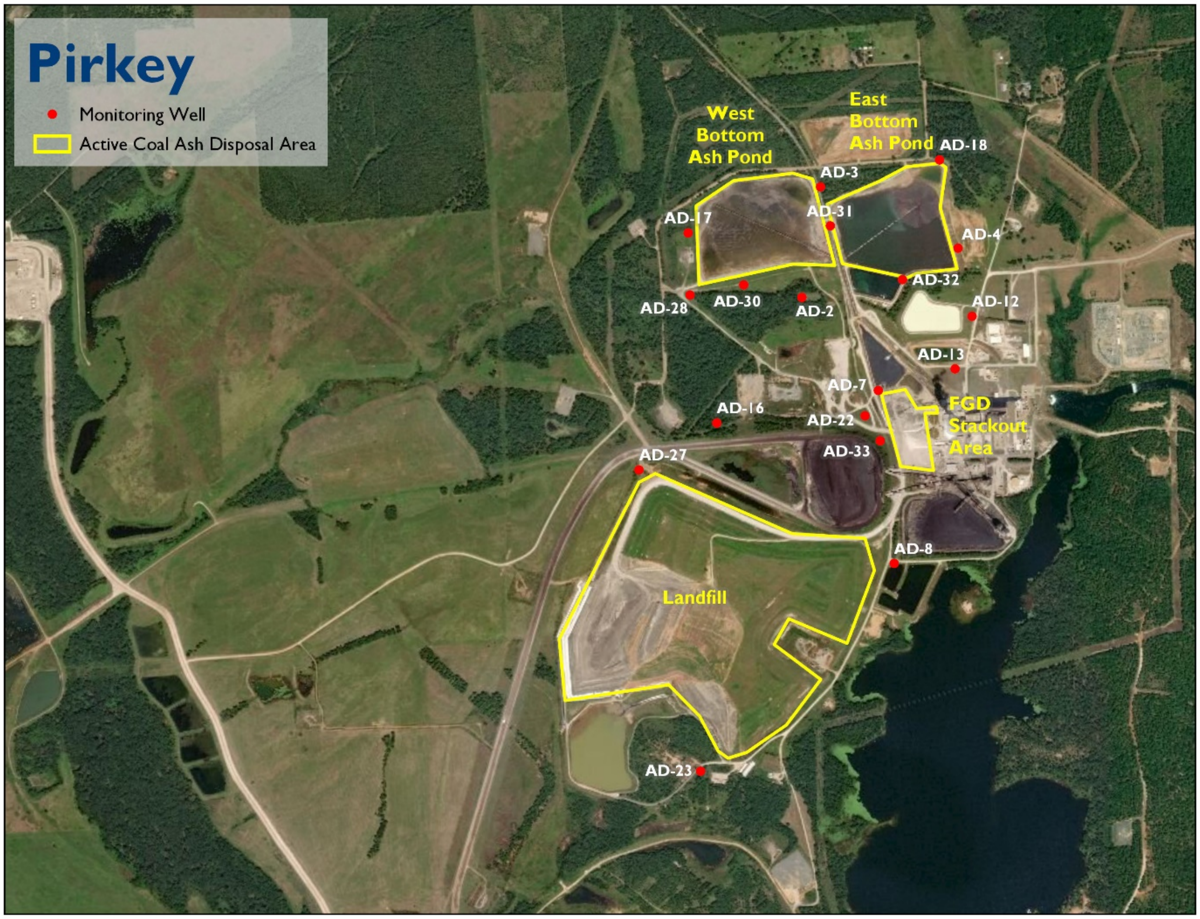
Well	Pollutant	Health threshold	Mean concentration	Maximum concentration
Stackout Pad				
AD-13*	Cobalt (µg/L)	6	42.9	56.0
	Lithium (µg/L)	40	137.3	158.0
AD-7	Beryllium (µg/L)	4	5.0	8.0
	Cobalt (µg/L)	6	32.1	52.0
	Lithium (µg/L)	40	94.4	111.0
AD-22	Arsenic (µg/L)	10	11.3	23.0
	Beryllium (µg/L)	4	6.5	13.0
	Cobalt (µg/L)	6	72.1	129.0
	Lithium (µg/L)	40	149.0	218.0
	Mercury (µg/L)	2	10.9	19.8
AD-33	Arsenic (µg/L)	10	10.1	67.0
	Cobalt (µg/L)	6	13.0	33.0

* *upgradient well*

As mentioned above, AEP has acknowledged that these four units are contaminating the groundwater and has initiated assessment monitoring. In assessment monitoring, AEP is likely to find SSIs for the following pollutants:

Table 10.2: Wells with Likely Assessment Monitoring SSIs at Pirkey

Downgradient well	Pollutants exceeding likely groundwater standard
East Bottom Ash Pond	
AD-2	Cobalt and lithium
AD-4	Cobalt and lithium
AD-31	Arsenic, beryllium, chromium, cobalt, lead, lithium, radium
AD-32	Arsenic, beryllium, cobalt, lithium, mercury, radium
West Bottom Ash Pond	
AD-17	Cobalt and radium
AD-28	Cobalt
Landfill	
AD-23	Lead, lithium, radium
AD-34	Arsenic, cadmium, cobalt, lead, lithium, radium
AD-35	Arsenic
Stackout Pad	
AD-7	Beryllium
AD-22	Arsenic, beryllium, cobalt, mercury, radium
AD-33	Arsenic, chromium, radium



11. San Miguel

The San Miguel Electric Plant south of San Antonio is the most contaminated coal ash site in Texas. The site is owned and operated by the San Miguel Electric Cooperative, Inc. For purposes of compliance with the Coal Ash Rule, the owner monitors the groundwater around three coal ash units: the "Ash Ponds" (Ash Ponds A and B), an "Equalization Pond," and a landfill known as the "Ash Pile."[61] Ash Pond A has a clay liner;[62]however, according to a recent decision from the U.S. Court of Appeals for the D.C. Circuit, this pond must be considered "unlined" because clay liners do not meet federal standards.[63] owner has not posted liner design certifications for the other ponds, which means that they are also "unlined."

The groundwater at San Miguel is grossly contaminated, with hazardous levels of many coal ash constituents (see Table 11.1). Among other things:

- Arsenic exceeds its Maximum Contaminant Level (MCL) in 14 wells, by up to 12 times.
- Beryllium exceeds its MCL in 17 wells, by up to 190 times.

- Boron is unsafe in 25 wells.
- Cadmium exceeds its MCL in 15 wells, by up to 130 times.
- Cobalt exceeds its health-based standard in 16 wells, frequently by two orders of magnitude (100-fold). Cobalt concentrations in well SP-34 are more than 1,000 times higher than the cobalt standard.
- Lithium and sulfate exceed health-based standards in every single onsite well; lithium concentrations are consistently at least 10 times higher than the lithium standard.

The "background" wells at San Miguel are often as contaminated as the downgradient wells, which suggests that they are being impacted by coal ash, and are not reliable background wells.

In short, there is no question that coal ash at San Miguel has created a serious groundwater hazard. The owner has initiated assessment monitoring at the site. In assessment monitoring, even though the owner has selected inappropriate "background" wells, it is likely to find SSIs (statistically significant increases) for several pollutants at each site where the downgradient pollution is even worse than the upgradient pollution (see Table 11.2).

Table 11.1a: Unsafe Groundwater at San Miguel Ash Ponds and Equalization Pond

Well	Pollutant	Health Threshold	Mean Concentration	Maximum Concentration
Ash Ponds				
PZ-2*	Boron (mg/L)	3	5.6	6.9
	Lithium (μg/L)	40	1,699	2,380
	Sulfate (mg/L)	500	2,854	3,120
PZ-3*	Arsenic (μg/L)	10	46	68
	Beryllium (μg/L)	4	321	463
	Boron (mg/L)	3	10.4	13.5
	Cadmium (μg/L)	5	350	382
	Cobalt (μg/L)	6	1,715	1,940
	Fluoride (mg/L)	4	4.3	8.3
	Lithium (μg/L)	40	2,769	3,680
	Selenium (μg/L)	50	245	453
	Sulfate (mg/L)	500	4,761	5,630
	Thallium (μg/L)	2	7	29
AP-31	Beryllium (μg/L)	4	9	11
	Boron (mg/L)	3	41.5	45.1
	Cobalt (μg/L)	6	230	253
	Lithium (μg/L)	40	791	908
	Sulfate (mg/L)	500	3,359	3,730
AP-32	Arsenic (μg/L)	10	30	64
	Beryllium (μg/L)	4	54	68
	Boron (mg/L)	3	15.8	19.8
	Cadmium (μg/L)	5	74	80

Well	Pollutant	Health Threshold	Mean Concentration	Maximum Concentration
	Cobalt (µg/L)	6	532	620
	Lithium (µg/L)	40	1,590	1,870
	Radium (pCi/L)	5	9.0	10.0
	Selenium (µg/L)	50	145	282
	Sulfate (mg/L)	500	3,395	3,790
	Thallium (µg/L)	2	4	5
AP-33	Arsenic (µg/L)	10	55	120
	Beryllium (µg/L)	4	302	372
	Boron (mg/L)	3	63.5	71.4
	Cadmium (µg/L)	5	122	129
	Cobalt (µg/L)	6	1,085	1,350
	Lithium (µg/L)	40	1,213	1,390
	Mercury (µg/L)	2	4.4	7.8
	Radium (pCi/L)	5	8.1	12.4
	Selenium (µg/L)	50	268	552
	Sulfate (mg/L)	500	3,393	4,150
	Thallium (µg/L)	2	11	49
AP-34	Arsenic (µg/L)	10	29	62
	Beryllium (µg/L)	4	210	288
	Boron (mg/L)	3	28.8	32.4
	Cadmium (µg/L)	5	44	55
	Cobalt (µg/L)	6	883	1,135
	Lithium (µg/L)	40	1,227	1,400
	Radium (pCi/L)	5	5.0	18.1
	Selenium (µg/L)	50	129	277
	Sulfate (mg/L)	500	3,477	4,520
	Thallium (µg/L)	2	2	5
AP-35	Beryllium (µg/L)	4	61	68
	Boron (mg/L)	3	42.9	48.2
	Cadmium (µg/L)	5	19	21
	Cobalt (µg/L)	6	141	157
	Lithium (µg/L)	40	968	1,050
	Mercury (µg/L)	2	5.7	6.9
	Radium (pCi/L)	5	28.8	32.6
	Sulfate (mg/L)	500	2,763	3,590
	Thallium (µg/L)	2	7	8
AP-36	Arsenic (µg/L)	10	19	90
	Beryllium (µg/L)	4	19	22
	Cobalt (µg/L)	6	68	72
	Lithium (µg/L)	40	975	1,070
	Sulfate (mg/L)	500	2,524	2,770
MW-3	Arsenic (µg/L)	10	16	32
	Beryllium (µg/L)	4	26	34
	Boron (mg/L)	3	15.4	17.8
	Cadmium (µg/L)	5	57	63
	Cobalt (µg/L)	6	337	386
	Lithium (µg/L)	40	1,798	2,130

Well	Pollutant	Health Threshold	Mean Concentration	Maximum Concentration
	Selenium (µg/L)	50	74	133
	Sulfate (mg/L)	500	4,241	4,650
PZ-5	Arsenic (µg/L)	10	25	52
	Beryllium (µg/L)	4	237	321
	Boron (mg/L)	3	46.6	51.2
	Cadmium (µg/L)	5	40	51
	Cobalt (µg/L)	6	636	766
	Lithium (µg/L)	40	701	830
	Selenium (µg/L)	50	129	260
	Sulfate (mg/L)	500	2,965	3,720
	Thallium (µg/L)	2	3	3
PZ-6	Boron (mg/L)	3	4.0	5.9
	Lithium (µg/L)	40	877	961
	Sulfate (mg/L)	500	3,061	3,230
Equalization Pond				
EP-31*	Arsenic (µg/L)	10	12	16
	Beryllium (µg/L)	4	76	128
	Boron (mg/L)	3	4.2	4.5
	Cadmium (µg/L)	5	17	29
	Cobalt (µg/L)	6	114	146
	Lithium (µg/L)	40	606	950
	Sulfate (mg/L)	500	3,278	3,660
EP-32	Boron (mg/L)	3	29.4	31.8
	Lithium (µg/L)	40	910	958
	Sulfate (mg/L)	500	4,258	4,640
EP-33	Boron (mg/L)	3	68.9	78.3
	Lithium (µg/L)	40	577	800
	Sulfate (mg/L)	500	3,154	3,610
EP-34	Boron (mg/L)	3	56.8	74.6
	Lithium (µg/L)	40	831	983
	Sulfate (mg/L)	500	3,141	3,500
EP-35	Boron (mg/L)	3	32.0	36.7
	Lithium (µg/L)	40	1,034	1,160
	Sulfate (mg/L)	500	3,154	3,450
EP-36	Boron (mg/L)	3	21.9	25.9
	Lithium (µg/L)	40	1,205	1,340
	Sulfate (mg/L)	500	2,549	2,700
EP-37	Boron (mg/L)	3	7.5	9.5
	Lithium (µg/L)	40	1,359	1,640
	Sulfate (mg/L)	500	2,919	3,130
EP-38	Lithium (µg/L)	40	628	683
	Sulfate (mg/L)	500	2,036	2,240
MW-4	Boron (mg/L)	3	10.6	11.7
	Lithium (µg/L)	40	736	832
	Sulfate (mg/L)	500	2,428	2,650

Table 11.1b: Unsafe Groundwater at San Miguel Ash Pile

Well	Pollutant	Health threshold	Mean concentration	Maximum concentration
SP-34*	Arsenic (µg/L)	10	23	34
	Beryllium (µg/L)	4	146	164
	Boron (mg/L)	3	13.2	21.0
	Cadmium (µg/L)	5	180	203
	Cobalt (µg/L)	6	1,336	6,490
	Lithium (µg/L)	40	1,165	1,290
	Radium (pCi/L)	5	8.1	13.4
	Selenium (µg/L)	50	180	216
	Sulfate (mg/L)	500	2,935	3,900
	Thallium (µg/L)	2	18	20
SP-1	Arsenic (µg/L)	10	69	98
	Beryllium (µg/L)	4	550	760
	Boron (mg/L)	3	8.7	11.3
	Cadmium (µg/L)	5	621	665
	Cobalt (µg/L)	6	3,130	3,510
	Fluoride (mg/L)	4	10.7	22.0
	Lithium (µg/L)	40	3,256	4,090
	Radium (pCi/L)	5	13.5	17.8
	Selenium (µg/L)	50	399	659
	Sulfate (mg/L)	500	7,458	8,530
	Thallium (µg/L)	2	19	21
SP-2	Beryllium (µg/L)	4	9	17
	Boron (mg/L)	3	9.5	11.7
	Cadmium (µg/L)	5	16	18
	Lithium (µg/L)	40	704	1,610
	Selenium (µg/L)	50	102	113
	Sulfate (mg/L)	500	1,741	2,580
	Thallium (µg/L)	2	3	4
SP-3	Arsenic (µg/L)	10	11	54
	Beryllium (µg/L)	4	39	54
	Boron (mg/L)	3	7.0	8.5
	Cadmium (µg/L)	5	49	59
	Cobalt (µg/L)	6	156	172
	Lithium (µg/L)	40	1,494	1,940
	Radium (pCi/L)	5	8.4	9.6
	Selenium (µg/L)	50	142	843
	Sulfate (mg/L)	500	2,716	3,665
	Thallium (µg/L)	2	6	7
SP-31[64]	Arsenic (µg/L)	10	17	
	Beryllium (µg/L)	4	377	
	Boron (mg/L)	3	8.0	
	Cadmium (µg/L)	5	150	
	Cobalt (µg/L)	6	723	
	Fluoride (mg/L)	4	9.9	
	Lithium (µg/L)	40	3,170	

Well	Pollutant	Health threshold	Mean concentration	Maximum concentration
	Sulfate (mg/L)	500	4,840	
SP-32	Arsenic (µg/L)	10	74	102
	Beryllium (µg/L)	4	428	563
	Boron (mg/L)	3	9.1	11.1
	Cadmium (µg/L)	5	408	462
	Cobalt (µg/L)	6	3,002	3,620
	Fluoride (mg/L)	4	7.8	17.5
	Lithium (µg/L)	40	3,703	4,680
	Selenium (µg/L)	50	411	753
	Sulfate (mg/L)	500	10,042	11,800
	Thallium (µg/L)	2	15	17

* *upgradient well*

Table 11.2: Wells with Likely Assessment Monitoring SSIs at San Miguel

Downgradient well	Pollutants exceeding likely groundwater standard
Ash Ponds	
AP-31	Antimony
AP-32	Mercury, radium
AP-33	Mercury, radium
AP-35	Mercury, radium
PZ-5	Antimony
Equalization Pond	
EP-35	Lithium
EP-36	Lithium
EP-37	Lithium
Ash Pile	
SP-1	Arsenic, beryllium, cadmium, fluoride, lithium, radium, selenium
SP-3	Lithium
SP-31	Beryllium, fluoride, lithium,
SP-32	Arsenic, beryllium, cadmium, fluoride, lithium, selenium

12. Sandow

The Sandow Steam Electric Station in Rockdale, owned by Luminant, closed in 2018 after more than 60 years of operation. The only regulated coal ash disposal unit at the site is a relatively new, lined, 169-acre landfill known as the "AX Landfill."[65] Identifying contamination from the landfill is complicated by the fact that the landfill is located within the former Sandow lignite coal mine.

The groundwater around the Sandow landfill is unsafe, particularly in the upgradient wells.

Table 12.1: Unsafe Groundwater at Sandow

Well	Pollutant	Health threshold	Mean concentration	Maximum concentration
AX-23*	Thallium (µg/L)	2	51.5	410.5
AX-29*	Cobalt (µg/L)	6	100.6	124.0
	Lead (µg/L)	15	29.1	227.0
	Mercury (µg/L)	2	5.9	46.9
	Sulfate (mg/L)	500	1,179	1,300
AXMW-1*	Arsenic (µg/L)	10	15.4	19.9
	Cobalt (µg/L)	6	352.3	419.5
	Sulfate (mg/L)	500	2,140	2,440

Well	Pollutant	Health threshold	Mean concentration	Maximum concentration
AXMW-2*	Arsenic (µg/L)	10	22.4	48.0
	Cobalt (µg/L)	6	37.2	49.3
	Lithium (µg/L)	40	89.5	100.0
	Sulfate (mg/L)	500	1,804	2,200
AX-24	Cobalt (µg/L)	6	11.4	26.9
	Lithium (µg/L)	40	73.7	84.1
	Sulfate (mg/L)	500	780	1,010
AX-25	Cobalt (µg/L)	6	22.4	34.2
	Sulfate (mg/L)	500	544	783
AX-26	Cobalt (µg/L)	6	50.0	205.0
	Lithium (µg/L)	40	502.9	625.0
	Sulfate (mg/L)	500	865	1,050
AX-27	Cobalt (µg/L)	6	46.2	230.0
	Lithium (µg/L)	40	79.8	103.0
AX-28	Chromium (µg/L)	100	183.5	1,240.0
	Cobalt (µg/L)	6	25.3	32.2
	Lithium (µg/L)	40	218.7	271.0
	Sulfate (mg/L)	500	1,382	1,950
AX-22R	Lithium (µg/L)	40	52.1	55.3
	Thallium (µg/L)	2	51.5	410.5

The upgradient wells at Sandow are contaminated. The contamination may be coming from other, unregulated coal ash disposal areas. Although the plant has been burning coal since the 1950s, the AX Landfill was only built between 2013 and 2016; coal ash generated before that time was presumably disposed of elsewhere at the site, and may be affecting onsite groundwater. It is also possible that some or all of the contamination is related to the mine on which the AX Landfill is built. And it is also possible that the 'upgradient' wells are impacted by the AZ Landfill itself, as they are located very close to the landfill. Regardless of the cause, the upgradient contamination means that statistical comparisons between up- and downgradient wells are unlikely to show any significant differences.

With that said, chloride concentrations in wells AX-26, 27 and 28 do appear to be significantly greater than chloride concentrations in upgradient wells, which should trigger assessment monitoring. Luminant does not appear to have initiated assessment monitoring, but if it did, it would likely find SSIs for lithium in wells AX-26 and 28, and chromium in well AX-28.

13. Sandy Creek

The Sandy Creek Energy Station is located in Riesel, southeast of Waco. It has a single, large (940 MW) coal unit that has only been operational since 2013. The only regulated coal ash disposal area at Sandy Creek is a 65-acre landfill, around which the owner has placed four monitoring wells. The owners of Sandy Creek have in many ways failed to comply with the Coal Ash Rule. To begin with, the site's compliance website is missing much of the documentation required by the rule.[66] In addition, the purportedly upgradient monitoring well, BW-1, is located on the edge of the landfill and shows high concentrations of coal ash indicators such as boron and sulfate. Since this well appears to be impacted by coal ash, it is not a reliable background well, and the monitoring network at Sandy Creek therefore violates the Coal Ash Rule.

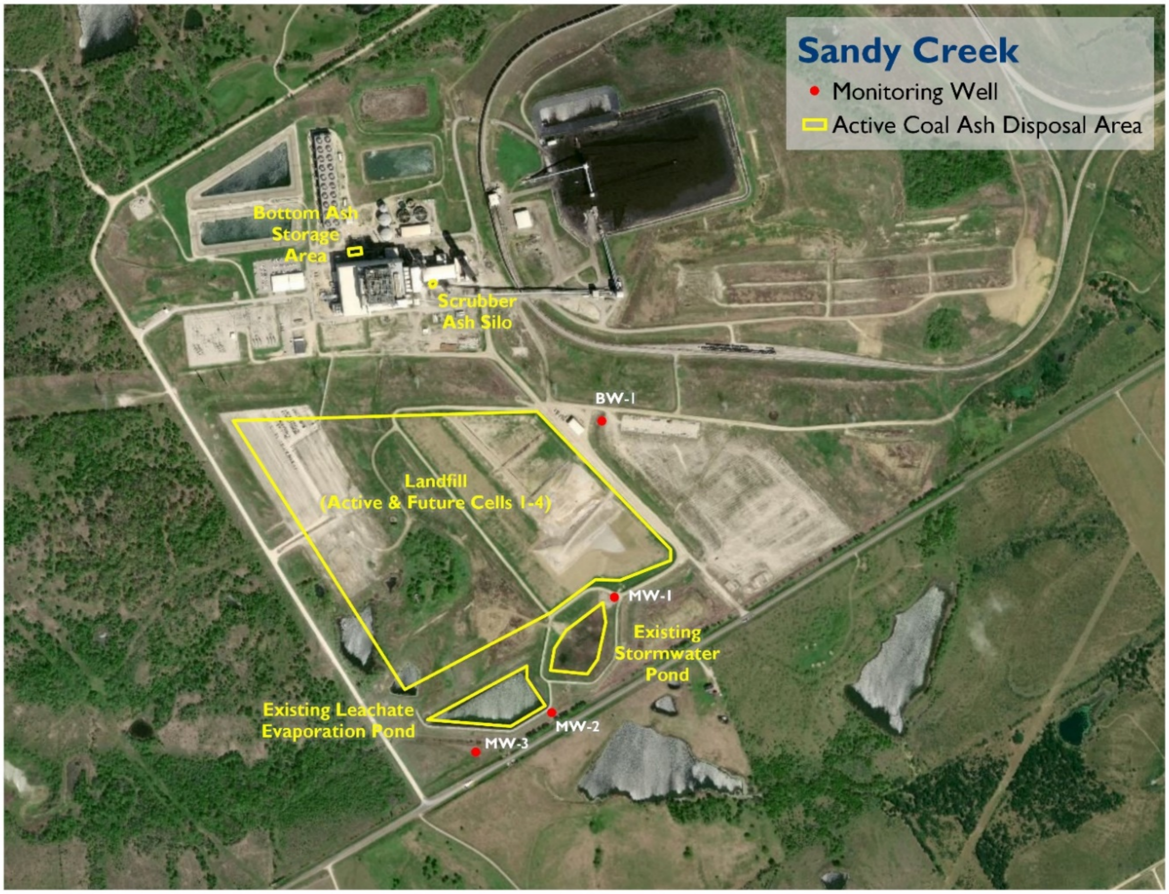
The groundwater at Sandy Creek has unsafe levels of several coal ash pollutants in all four monitoring wells, as shown in Table 13.1. Arsenic, cobalt, lead, and lithium have all exceeded safe levels by at least 10-fold in one or more wells. Lithium is 10-20 times higher than the safe level in all four wells.

Table 13.1: Unsafe Groundwater at Sandy Creek

Well	Pollutant	Health threshold	Mean concentration	Maximum concentration
BW-1*	Boron (mg/L)	3	3.3	4.0
	Lithium (µg/L)	40	745.3	790.0
	Sulfate (mg/L)	500	2,579	2,870
MW-1	Arsenic (µg/L)	10	18.4	120.0
	Cobalt (µg/L)	6	12.7	87.0
	Lead (µg/L)	15	28.7	210.0
	Lithium (µg/L)	40	439.4	780.0
	Selenium (µg/L)	50	139.0	200.0
	Sulfate (mg/L)	500	2,290	2,620
MW-2	Cobalt (µg/L)	6	7.6	11.0
	Lithium (µg/L)	40	775.4	870.0
	Sulfate (mg/L)	500	3,050	3,710
MW-3	Cobalt (µg/L)	6	7.1	10.0
	Lithium (µg/L)	40	748.9	1,030.0
	Sulfate (mg/L)	500	2,188	2,950

* *upgradient well*

The owners of Sandy Creek claim that the groundwater contamination is not due to the landfill, but they are almost certainly wrong. Not only do the data show clearly elevated levels of coal ash indicator pollutants, but any credible statistical analysis – even assuming that the purportedly upgradient well is a reliable indicator of background – would show statistically elevated levels of many coal ash pollutants. In detection monitoring, the owners of Sandy Creek should have found statistically significant increases (SSIs) for chloride, sulfate, and total dissolved solids in well MW-2 (see summary data in Attachment A). The site should therefore be in assessment monitoring. In assessment monitoring, the owners would find SSIs for multiple toxic pollutants, including arsenic, chromium, cobalt, lead, and selenium in well MW-1 (see summary data in Attachment B). If the owners were using a truly "background" well for statistical analysis, they would undoubtedly find even more evidence of contamination.



14. Twin Oaks

The Twin Oaks Power Station in Bremond, southeast of Waco, is currently owned and operated by Major Oak Power, LLC. The single regulated coal ash disposal unit at the site is a landfill ("Utility Landfill" or "CCR Landfill") holding roughly 10 million cubic yards of coal ash.[67] Major Oak Power monitors the landfill with eight wells, four upgradient and four downgradient, all located along the edge of the landfill. Well MW-7 is notable for having the highest onsite concentrations of boron, sulfate, cobalt, lithium, and pH. Although Major Oak Power calls this an "upgradient" well, it is located very close to the landfill and appears to be impacted by coal ash. Well MW-7 is probably not a reliable upgradient well.

The groundwater at Twin Oaks has unsafe levels of arsenic, cobalt and radium, mainly in upgradient wells.

Table 14.1: Unsafe Groundwater at Twin Oaks

Well	Pollutant	Health threshold	Mean concentration	Maximum concentration
MW-7*	Cobalt (µg/L)	6	6.9	11.6
MW-16*	Arsenic (µg/L)	10	12.7	23.2
	Cobalt (µg/L)	6	6.7	11.6
	Radium (pCi/L)	5	5.7	9.9
MW-17	Radium (pCi/L)	5	5.3	10.5

** upgradient well*

Groundwater quality in up- and downgradient wells at Twin Oaks is not appreciably different, and it is unlikely that statistical comparisons would find SSIs during either detection monitoring or assessment monitoring. That said, downgradient wells do show chloride concentrations that appear to be significantly greater than background, and that should be enough to trigger assessment monitoring. In assessment monitoring, based on the available data and in light of the contaminated upgradient wells, Major Oak Power would probably not find any SSIs.

15. W.A. Parish

The W.A. Parish Electric Generating Station in Thompsons, southwest of Houston, is owned and operated by NRG Texas Power, LLC (NRG). The site has six regulated units. Four of these units are contiguous landfill cells on the northeast side of Smithers Lake, known as cells 1C, 2A, 2B, and 3. The other two units are small impoundments close to the power plant itself, on the southeast side of Smithers Lake. These are known as the Air Preheater Pond and the FGD Emergency Pond. The ponds are lined with clay, which means that they are, for purposes of the Coal Ash Rule, unlined.

NRG has failed to post any groundwater monitoring data for the pollutants listed in Appendix IV of the Coal Ash Rule, including arsenic, cobalt, lithium, and so on. This is a clear violation of the rule, and it means that we do not yet know the full extent of the contamination around the landfill or the two ash ponds. The limited available data do show unsafe levels of sulfate at all six units (See Table 14.1), and as discussed in more detail below, show elevated levels of many coal ash indicators downgradient of all six units. All six coal ash units therefore appear to be leaking. If NRG were to disclose the full set of groundwater monitoring data, the data would presumably show unsafe levels of many toxic pollutants.

The site also has a closed, 80-acre coal ash landfill known as "Cell 2" located between the actively regulated landfills and Smithers Lake. Cell 2 was closed before the Coal Ash Rule was finalized, and is therefore not subject to the rule. However, NRG has monitored the groundwater around Cell 2 pursuant to state law, and the results are available on EIP's Ashtracker website. The data for Cell 2 show clear evidence of coal ash contamination, with unsafe levels of multiple pollutants in many wells (see Table 14.1).

The data posted by NRG show that detection monitoring should have shown SSIs (statistically significant increases) for multiple constituents at each of the six units. For example, at landfill cell 1C, mean concentrations of boron, calcium, chloride, pH, and sulfate in one or more downgradient wells exceeded maximum upgradient concentrations. The same was true for the ash ponds. At landfill cell 2A, boron and pH appear to be significantly elevate din downgradient wells. At cell 2B, boron, calcium, pH, and sulfate all appear elevated. At cell 3, the elevated pollutants include boron, calcium, chloride, and pH.

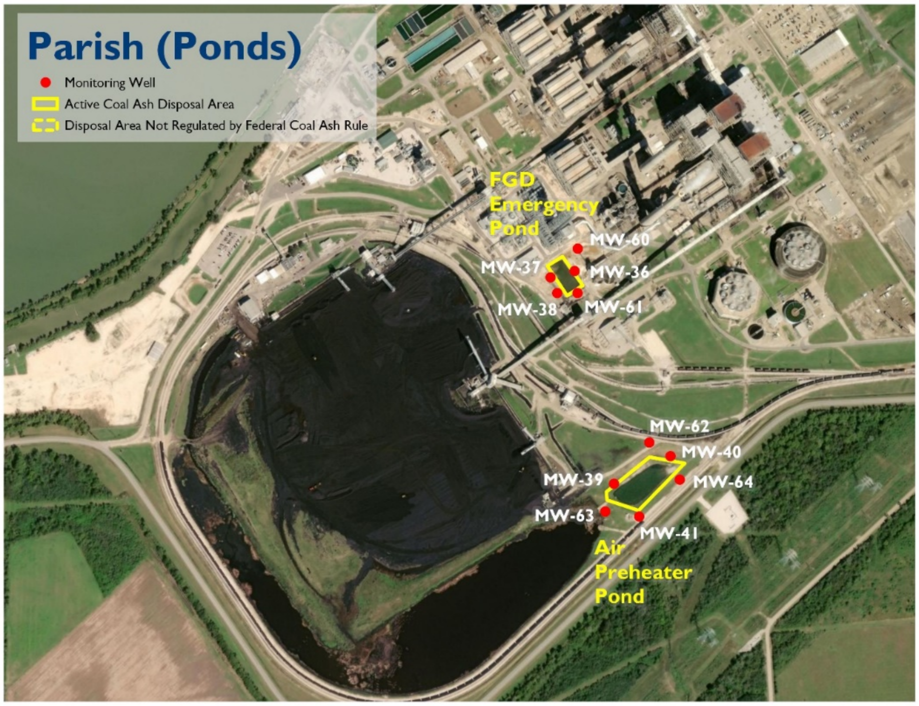
In short, all six units should be in assessment monitoring. Yet NRG does not appear to have initiated assessment monitoring at any of the units. This is another violation of the Coal Ash Rule. Since NRG has not posted any data for the assessment monitoring constituents, we do not know exactly what NRG would find, but it is fair to assume that they would find SSIs for multiple pollutants.

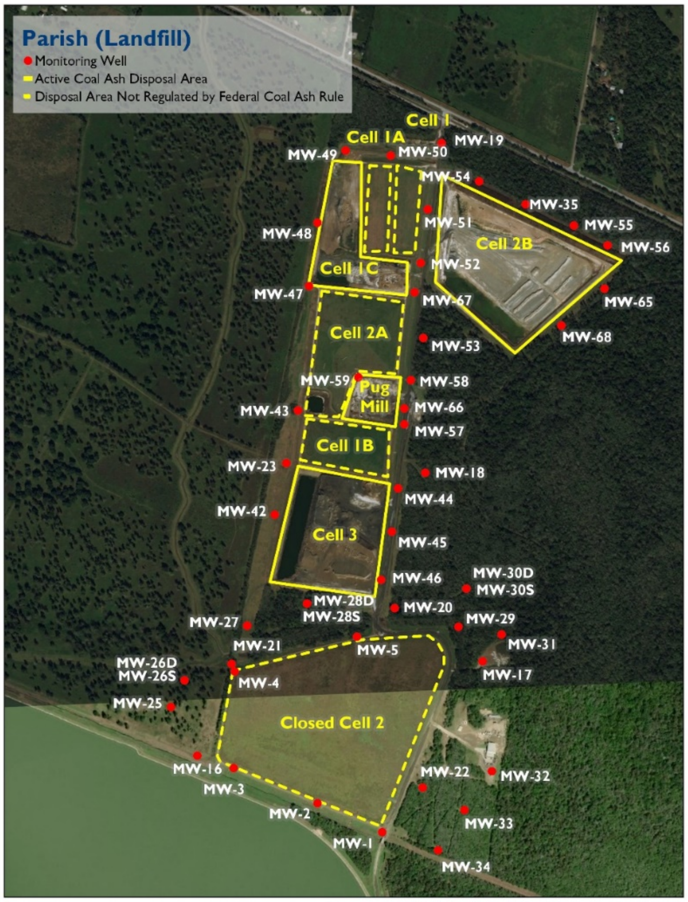
Table 15.1: Unsafe Groundwater at W.A. Parish

Well	Pollutant	Health threshold	Mean concentration	Maximum concentration
Landfill cell 1C				
MW-19	Sulfate (mg/L)	500	606	1,960
MW-52	Sulfate (mg/L)	500	576	745
Landfill cell 2A				
MW-58	Sulfate (mg/L)	500	587	3,900
Landfill cell 2B				
MW-65	Sulfate (mg/L)	500	529	700
Landfill cell 3				
MW-42*	Sulfate (mg/L)	500	1,049	1,220
MW-45	Sulfate (mg/L)	500	883	2,760
Landfill cell 2 (Ashtracker data from 2010-2014)[68]				
MW-1	Manganese (µg/L)	300	768	1,850
	Strontium (mg/L)	4	5.9	10.7
	Sulfate (mg/L)	500	1,273	2,530
MW-2	Manganese (µg/L)	300	916	2,220
	Strontium (mg/L)	4	6.3	8.8
	Sulfate (mg/L)	500	2,244	3,100
MW-3	Manganese (µg/L)	300	2,720	5,020
	Strontium (mg/L)	4	7.4	9.8
	Sulfate (mg/L)	500	1,828	2,230
MW-4	Boron (mg/L)	3	5.3	8.1
	Manganese (µg/L)	300	1,500	4,120
	Molybdenum (µg/L)	40	573	730
	Sulfate (mg/L)	500	3,215	4,400
MW-5	Boron (mg/L)	3	6.8	10.6
	Manganese (µg/L)	300	322	586
	Molybdenum (µg/L)	40	394	1,170
	Sulfate (mg/L)	500	955	1,580
MW-20	Boron (mg/L)	3	13.1	62.6
	Manganese (µg/L)	300	780	1,820
	Strontium (mg/L)	4	4.5	5.2
	Sulfate (mg/L)	500	1,961	2,400
MW-21	Boron (mg/L)	3	3.2	5.5
	Manganese (µg/L)	300	1,400	3,900
	Molybdenum (µg/L)	40	150	284
	Sulfate (mg/L)	500	2,825	3,390
MW-22	Arsenic (µg/L)	10	57.0	101.0
	Manganese (µg/L)	300	2,100	3,910
	Sulfate (mg/L)	500	610	2,620
MW-24	Arsenic (µg/L)	10	12.0	22.0
	Manganese (µg/L)	300	531	1,050
MW-25	Arsenic (µg/L)	10	15.0	66.0
	Manganese (µg/L)	300	1,700	4,520
	Strontium (mg/L)	4	7.3	12.0
	Sulfate (mg/L)	500	971	2,670

Well	Pollutant	Health threshold	Mean concentration	Maximum concentration
MW-26D	Arsenic (µg/L)	10	29.0	103.0
	Manganese (µg/L)	300	347	496
MW-26S	Arsenic (µg/L)	10	28.0	140.0
	Manganese (µg/L)	300	1,630	3,340
	Sulfate (mg/L)	500	1,171	2,780
MW-27	Manganese (µg/L)	300	1,720	2,410
	Molybdenum (µg/L)	40	49	215
	Strontium (mg/L)	4	6.1	7.6
	Sulfate (mg/L)	500	2,863	3,280
MW-28S	Sulfate (mg/L)	500	562	1,010
MW-29	Manganese (µg/L)	300	986	1,540
	Sulfate (mg/L)	500	1,019	1,860
MW-30D	Arsenic (µg/L)	10	59.0	125.0
	Manganese (µg/L)	300	605	1,010
MW-30S	Manganese (µg/L)	300	306	520
MW-31	Manganese (µg/L)	300	379	1,150
	Sulfate (mg/L)	500	590	2,170
MW-32	Arsenic (µg/L)	10	13.0	24.0
	Manganese (µg/L)	300	360	800
MW-33	Arsenic (µg/L)	10	10.0	18.0
MW-34	Manganese (µg/L)	300	3,700	4,580
	Strontium (mg/L)	4	6.9	8.5
	Sulfate (mg/L)	500	2,350	3,050
MW-35	Chromium (µg/L)	100	119.0	278.0
FGD Emergency pond				
MW-36*	Sulfate (mg/L)	500	542	876
MW-37	Sulfate (mg/L)	500	742	971
MW-38	Fluoride (mg/L)	4	4.2	21.8
	Sulfate (mg/L)	500	1,596	3,300
MW-61	Sulfate (mg/L)	500	1,621	2,160
Air Preheater Pond				
MW-63	Sulfate (mg/L)	500	518	766

* *upgradient well*


Parish (Ponds)
Monitoring Well
Active Coal Ash Disposal Area
Disposal Area Not Regulated by Federal Coal Ash Rule
FGD Emergency Pond
MW-60
MW-37
MW-36
MW-38
MW-61
MW-62
MW-40
MW-39
MW-64
MW-63
MW-41
Air Preheater Pond


Parish (Landfill)
Monitoring Well
Active Coal Ash Disposal Area
Disposal Area Not Regulated by Federal Coal Ash Rule
Cell 1
Cell 1A
MW-19
MW-49
MW-50
MW-54
MW-35
MW-48
MW-51
MW-55
Cell 2B
MW-56
Cell 1C
MW-52
MW-47
MW-67
MW-65
Cell 2A
MW-53
MW-68
MW-59
MW-58
Pug Mill
MW-43
MW-66
MW-57
Cell 1B
MW-23
MW-18
MW-44
MW-42
Cell 3
MW-45
MW-46
MW-30D
MW-30S
MW-28D
MW-28S
MW-20
MW-29
MW-27
MW-21
MW-5
MW-31
MW-26D
MW-26S
MW-4
MW-17
MW-25
Closed Cell 2
MW-16
MW-3
MW-22
MW-32
MW-2
MW-33
MW-1
MW-34

16. Welsh

The J. Robert Welsh Power Plant near Cason, east of Dallas in Titus County, is owned and operated by Southwestern Electric Power Company (SWEPCO), a subsidiary of American Electric Power (AEP). AEP monitors the groundwater around three adjacent coal ash units, including a Primary Bottom Ash Pond (unlined), a Landfill, and a Bottom Ash Storage Pond (unlined).

The groundwater at Welsh is contaminated with unsafe levels of multiple coal ash pollutants.

Table 16.1: Unsafe Groundwater at Welsh

Well	Pollutant	Health threshold	Mean concentration	Maximum concentration
AD-5*	Cobalt (µg/L)	6	12.7	15.0
	Lithium (µg/L)	40	183.1	239.0
AD-8	Cobalt (µg/L)	6	6.6	9.0
	Lithium (µg/L)	40	107.1	135.0
AD-9	Cobalt (µg/L)	6	23.9	42.0
	Lithium (µg/L)	40	1,210.5	1,440.0
	Sulfate (mg/L)	500	1,105	1,770
AD-11	Beryllium (µg/L)	4	4.1	5.0
	Cobalt (µg/L)	6	25.7	30.0
	Lithium (µg/L)	40	41.4	47.0
	Sulfate (mg/L)	500	606	760
AD-14	Cobalt (µg/L)	6	7.4	10.0
AD-15	Arsenic (µg/L)	10	26.6	131.0
	Cobalt (µg/L)	6	26.9	134.0
	Lead (µg/L)	15	27.4	161.0
AD-16R	Cobalt (µg/L)	6	41.0	45.3
	Radium (pCi/L)	5	9.9	25.2
AD-17	Cobalt (µg/L)	6	67.2	74.80
	Lithium (µg/L)	40	352.0	394.0
	Sulfate (mg/L)	500	1,134	1,450
AD-18	Beryllium (µg/L)	4	12.4	26.0
	Cobalt (µg/L)	6	795.3	961.0
	Lithium (µg/L)	40	1,948.8	2,150.0
	Radium (pCi/L)	5	12.9	22.5
	Sulfate (mg/L)	500	5,189	5,920

* *upgradient well*

There are a number of problems with how AEP analyzes its data. First, there are four wells at the site that AEP has at times described as "upgradient," but they are not all upgradient, and AEP does not use them consistently in its statistical analysis. Wells AD-17 and AD-18 are west of the coal ash units, but groundwater flow maps show that they are downgradient, not upgradient, of the units.[69] AEP contractors have more or less acknowledged that AD-17 is downgradient of the landfill,[70] and have described AD-18 as "sidegradient" of the landfill.[71] Perhaps for this reason, AEP's contractors have decided that only AD-1 and AD-5 should be used as upgradient wells for the Landfill and the Bottom Ash Storage Pond.[72] AEP's statistical analysis of data from the Primary Bottom Ash Pond used AD-1, AD-5, and also AD-17 as upgradient/background wells.[73]

An additional problem with AEP's statistical methods is that its contractors frequently use "intrawell" statistical comparisons, which means that they compare each downgradient well to itself, rather than comparing it to a background well. An intrawell test will identify changes over time in an individual well, but says nothing about differences between wells. To make matters more confusing, AEP uses intrawell comparisons for some pollutants, but not others, and the mix is different for each coal ash unit.[74] In any case, the use of intrawell comparisons, and the failure to analyze all data on an "interwell" basis, violates the Coal Ash Rule, which appropriately requires statistical comparisons between downgradient wells and background wells.

Despite the fact that its statistical approach was partially invalid, AEP did find SSIs during detection monitoring at all three units.[75] A proper analysis using only interwell comparisons would also have found multiple SSIs at each unit. AEP has initiated assessment monitoring at the Landfill and the Primary Bottom Ash Pond, but not at the Bottom Ash Storage Pond. All three units should be in assessment monitoring.

In assessment monitoring, if AEP were to use the appropriate interwell statistical approach and compare downgradient wells to upgradient wells AD-1 and AD-5, it would likely find multiple SSIs at each unit. These should include SSIs in wells AD-17 and AD-18, which are downgradient of the Landfill and the Primary Bottom Ash Pond:

Table 16.2: Wells with Likely Assessment Monitoring SSIs at Welsh

Downgradient well	Pollutants exceeding likely groundwater standard
AD-9	Cobalt, lithium
AD-11	Beryllium, cobalt
AD-15	Arsenic, beryllium, cadmium, chromium, cobalt, lead
AD-16R	Cobalt, radium
AD-17	Cadmium, cobalt, lithium
AD-18	Beryllium, cobalt, fluoride, lithium, radium, thallium

The Primary Bottom Ash Pond at Welsh is sitting in groundwater,[76] which greatly facilitates the leaching of pollutants. AEP is planning to close this pond in place. This is a bad idea – regardless of any cap placed over the ash, contamination will continue indefinitely as groundwater saturates the ash. The only way for AEP to restore local groundwater quality is to remove the ash from this ash pond.

D. Conclusions and Recommendations

Coal ash clearly poses a threat to people and ecosystems across Texas. Every coal plant in the state (with monitoring data) has contaminated local groundwater with unsafe levels of three or more toxic pollutants. A history of weak regulatory oversight has led to this problem, and only a stronger regulatory framework can fix it. Unfortunately, neither the federal Coal Ash Rule nor Texas's proposed coal ash program rise to that challenge.

Among other critical weaknesses, the federal rules and the proposed state program only cover some of the coal ash at each site. The 80-acre coal ash landfill at the W.A. Parish site known as "Cell 2" is an obvious example of unregulated coal ash dumps, but most sites are likely to have one or more old, abandoned, and unregulated coal ash units. These units are just as likely to contaminate groundwater as the newer units, and the failure to account for them makes the regulatory framework both needlessly complicated and ultimately unsuccessful.

Many coal plant owners are misinterpreting the federal rule's requirements as to background wells. According to the Coal Ash Rule, background wells cannot be "affected by leakage from a CCR [coal ash] unit."[77] Yet many background wells are plainly contaminated by coal ash. Some wells are apparently affected by the unit they are supposed to be background for (see, e.g., well BAP-57 at Big Brown, or well JKS-45 at Calaveras). Other wells appear to be affected by unregulated coal ash units (see, e.g., the "upgradient" wells at Monticello). In some cases, owners have simply failed to identify any background wells (see, e.g., Permanent Disposal Pond 5 at Luminant). EPA has been silent about the widespread failure to select appropriate background wells.

The federal Coal Ash Rule requires that all existing ash ponds and new ash ponds and landfills be built at least five feet above the "upper limit of the uppermost aquifer,"[78] and for good reason: Coal ash that is constantly or periodically saturated with groundwater will inevitably contaminate groundwater. Yet this consideration is largely absent from federal and state closure requirements. The Coal Ash Rule allows "closure in place," requiring little more than a cap over the ash, regardless of how much of the ash is saturated. The proposed state program mirrors the federal rules in this regard. Although the rules technically require owners closing ash dumps in place to "control, minimize or eliminate" the leaching of pollutants "to the maximum extent feasible," many owners are ignoring this requirement, or interpreting the word "feasible" to their own advantage, by ignoring the effect of groundwater saturation on post-closure leaching.[79] This is a critical flaw in both regulatory programs. If coal ash is exposed to groundwater, then placing a cap over it will do nothing at all to reduce contamination. Most sites in Texas (and other states) are taking advantage of the option of closing their coal ash units where they are (see Table 4.3), presumably because it is the cheaper option. If these sites are in contact with groundwater, as they are at the Monticello and Welsh plants, then they will continue to leach toxic metals into groundwater for generations.

Many coal plant owners are not making available to the public all groundwater monitoring data required by the Coal Ash Rule. For example, NRG has not posted any of the sampling data for Appendix IV constituents (arsenic, cobalt, lithium, etc.) at its Limestone and W.A. Parish plants. The San Miguel Electric Cooperative initially failed to post eight rounds of monitoring data for their San Miguel Electric Plant, as required by the rule, and only posted one round of sampling for wells around the onsite ash ponds (this was eventually corrected). For many coal ash dumps, it is not clear whether the owner has initiated assessment monitoring, or whether assessment monitoring has revealed any statistically significant increases, because owners have not made that information available. EPA has made this situation worse by approving an incorrect interpretation of the coal ash rule, effectively giving owners six extra months to initiate and report on assessment monitoring.[80]

EPA and/or the Texas Commission on Environmental Quality could fix these problems in the following ways:

- Require coal-fired power plants to remediate coal ash contamination from any onsite ash dumps, regardless of whether these dumps are active or inactive.
- Explicitly prohibit the closure of coal ash units in place unless all coal ash is permanently dry (above groundwater). Specifically, the Texas CEQ should require all coal plant owners to show whether any onsite coal ash is buried beneath the water table, and prohibit the closure of coal ash units in place unless all ash is at least five feet above the seasonal high water table. Ash ponds at the Monticello and Welsh

plants are in contact with groundwater, and the owners of these plants are planning to close the ponds in place. Leaving ash in these ponds will result in ongoing, long-term contamination of groundwater.

- Enforce the Coal Ash Rule, require owners to post all groundwater monitoring data as soon as the data are collected, and require owners to follow the assessment monitoring schedule laid out in the Coal Ash Rule, not the creative interpretation suggested by industry groups and sanctioned by the Trump EPA. Assessment monitoring should begin no later than 90 days after finding SSIs (statistically significant increases) in detection monitoring, and the assessment monitoring data should be analyzed for SSIs within 90 days of initiating assessment monitoring.
- Require owners to select background monitoring wells that are unaffected by coal ash from any coal ash unit, regulated or unregulated. This is what the federal Coal Ash Rule requires, and EPA and Texas should strictly enforce this provision of the rule.
- Create meaningful opportunities for public participation in permitting decisions including the siting, closure, expansion, and cleanup of coal ash dumps.
- Require testing of any residential or municipal drinking water wells within one-half mile of coal ash ponds and landfills.
- Consider environmental justice and avoid disproportionate impacts of coal ash disposal on low-income communities and communities of color.
- Increase the frequency of groundwater monitoring to quarterly in order to capture any seasonal fluctuations.
- Add boron to the list of pollutants that trigger corrective action to ensure timely and effective groundwater remediation. The U.S. EPA has already proposed doing this, recognizing that boron is one of the leading "risk drivers" associated with coal ash, but has not yet acted on its proposal.

We encourage the Texas Commission on Environmental Quality and EPA to consider these recommendations as the minimum set of additional safeguards that can effectively protect public health and prevent ongoing environmental contamination.

[1] U.S. Energy Information Administration, "Texas State Energy Profile," accessed December 19, 2018. Link: https://www.eia.gov/state/print.php?sid=TX
[2] Ibid.
[3] Jamie Satterfield, "180 New Cases of Dead or Dying Coal Ash Spill Workers, Lawsuit Says," USA Today/Knox News, March 28, 2018. Link: https://www.knoxnews.com/story/news/crime/2018/03/28/tva-coal-ash-spill-cleanup-roane-county-lawsuits-dead-dying-workers/458342002/
[4] The rule is also known as the CCR rule, with CCR is an acronym for coal combustion residuals, another way of saying coal ash.
[5] Environmental Integrity Project, "America's Top Power Plant Toxic Air Polluters," 2011. Link: http://www.environmentalintegrity.org/documents/Report-TopUSPowerPlantToxicAirPolluters.pdf
[6] Coal plant south of San Antonio off chopping block - for now. 08/07/2017. https://www.expressnews.com/business/eagle-ford-energy/article/Coal-plant-south-of-San-Antonio-off-chopping-11735440.php
[7] 40 C.F.R. Part 257.
[8] "CCR unit" is defined in the rule as "any CCR landfill, CCR surface impoundment, or lateral expansion of a CCR unit, or a combination of more than one of these units… ." 40 C.F.R. § 257.53. The definition is therefore not limited to regulated units, and instead covers all CCR units.
[9] The exception would be for a site that can demonstrate that something other than the regulated coal ash unit caused the SSI. 40 C.F.R. § 257.94(e)(2).
[10] The CCR rule initially waived groundwater monitoring and other requirements for ponds that closed early (before April 17, 2018). EPA vacated this loophole on August 5, 2016, and gave the affected owners until April 17, 2019 to meet the initial groundwater monitoring requirements. 40 C.F.R. § 257.100(e)(5)(i).
[11] The 2015 rule originally set the standards for these four chemicals at background. On July 17, 2018, EPA changed the standards. The new standards for cobalt, lithium and molybdenum (6, 40 and 100 micrograms per liter, respectively) are based on EPA Regional Screening Levels, which are health-based standards used in the superfund program. For lead, EPA set the standard at the national drinking water standard for lead, 15 micrograms per liter.
[12] *Utility Solid Waste Activities Group, et al., v. EPA*, No. 15-1219, 2018 WL 4000476, D.C. Cir. Ct., *slip op.* at *27 (Aug. 21, 2018) ("[W] e vacate the Rule insofar as it treats "clay-lined" units as if they were lined. *See* 40 C.F.R. § 257.71(a)(1)(i)").
[13] Id.
[14] 40 C.F.R. § 257.102(d).
[15] *See* 42 U.S.C. § 6945(d),
[16] Texas Commission on Environmental Quality, Chapter 352 – Coal Combustion Residuals Management Rule, Project No. 2017-037-352-WS (hereinafter "Proposed Texas Rule").
[17] State programs are supposed to be "at least as protective as" the federal coal ash rule. Id. at § 6945(d)(1)(B). The federal regulations changed while Texas was considering its initial state program, so Texas presumably went back to the drawing board to make sure that their state program would conform to the new federal rule.
[18] Proposed 30 Tex. Admin. Code § 352.101, 352.111.
[19] *Id*. at § 352.121.
[20] *See* Proposed Texas Rule at Page 3 ("TRRP is an established and successful risk-based corrective action program adopted by the TCEQ in 1999 that would provide for a more efficient regulatory process for addressing corrective action releases from CCR units").
[21] *See* TCEQ, TRRP protective concentration levels, available at https://www.tceq.texas.gov/remediation/trrp/trrppcls.html; 40 C.F.R. § 257.95(h).
[22] *See* Proposed § 352.461(b).
[23] *See* Proposed Texas Rule at Page 42.
[24] *See* Proposed § 352.1021(e)(1).
[25] 40 C.F.R. § 257.90(g)(2).
[26] UTIL. SOLID WASTE ACTIVITIES GRP. V. ENVTL. PROT. AGENCY, 901 F.3D 414 (D.C. CIR. 2018).
[27] EPA proposed adding boron to Appendix IV (assessment monitoring), recognizing that boron is one of the leading risk drivers associated with coal ash contamination, but has not yet acted on that proposal. 83 Fed. Reg. 11584 (Mar. 15, 2018).
[28] U.S. EPA, 2018 Edition of the Drinking Water Standards and Health advisories Tables. https://www.epa.gov/sites/production/files/2018-03/documents/dwtable2018.pdf
[29] EIP's Ashtracker website uses a different approach, and considers groundwater to be unsafe if it exceeds a health-based threshold at least once. We are using mean values in order to emphasize the pollutants that are most likely to present long-term health threats.
[30] The groundwater standard for each pollutant is either this presumptive standard or the site-specific background value, whichever is greater.
[31] 40 µg/L is the EPA Lifetime Health Advisory for molybdenum .
[32] There are a handful of coal plants in Texas that are either unregulated or do not monitor groundwater, including the Harrington, Oklaunion and Tolk plants. We do not know whether these plants are legitimately exempt from the Coal Ash Rule, and we do not know whether the groundwater at these plants is contaminated.
[33] The pollutants identified are here are those for which the mean concentrations in one or more downgradient wells exceed likely groundwater protection standards, which are the higher of either (1) the presumptive groundwater standard for a pollutant, or (2) the highest upgradient reading for that pollutant.
[34] Luminant plans to remove the coal ash from one pond (the Southwest Pond), and place it within the footprint of the two other ponds (the Northeast Pond and the West Pond), which are both being closed in place.
[35] According to Luminant, the two bottom ash ponds, which are side-by-side, "are considered one CCR surface impoundment" due to their proximity to each other. Pastor, Behling & Wheeler, LLC, Certification of Lined Construction Big Brown Steam Electric Station North and South Bottom Ash Ponds Freestone County, Texas (Oct. 2016), https://www.luminant.com/ccr/#.
[36] *Id.*; *Utility Solid Waste Activities Group, et al., v. EPA*, No. 15-1219, 2018 WL 4000476, D.C. Cir. Ct., *slip op.* at *27 (Aug. 21, 2018) ("[W] e vacate the Rule insofar as it treats "clay-lined" units as if they were lined. *See* 40 C.F.R. § 257.71(a)(1)(i)").
[37] Luminant, Notification for the Establishment of an Assessment Monitoring Program, Big Brown Steam Electric Station (Aug. 16, 2018), https://www.luminant.com/ccr/#big-brown.
[38] CPS Energy, Compilation of Construction History (Oct. 17, 2016), https://www.cpsenergy.com/content/dam/corporate/en/Documents/Environmental/A8338%20Calaveras%20Construction%20History.pdf

[39] CPS Energy, Liner Design Criteria for Existing CCR Surface Impoundments, https://www.cpsenergy.com/content/dam/corporate/en/Documents/Environmental/Liner%20Design%20Exist%20CCR%20impoundments.pdf
[40] pH is unlike other constituents in that contamination can be indicated by both higher and lower values, as compared to background. At Calaveras, pH at the Evaporation pond appears to be significantly higher than background, while pH at the Fly Ash Landfill and the Sludge Recycle Holding Ponds appears to be significantly lower than background.
[41] Environmental Resources Management, Written Demonstration – Responses to Potential Statistically Significant Increases at Calaveras Power Station (Apr. 4, 2018), https://www.cpsenergy.com/content/dam/corporate/en/Documents/Environmental/Calaveras_Written%20Demonstration_Final%202018.pdf.
[42] Letter from Dan Bullock, Bullock, Bennett & Associates, LLC, to Robert Stevens, Coleto Creek Power Plant Manager, Re: Coleto Creek Power – Certification of Ash Ponds Liner System in Accordance with 40 CFR Part 257.71(4)(b) (Oct. 13, 2016), available at https://www.dynegy.com/sites/default/files/ccr/Texas/Coleto-Creek/Doc_636219707633402039.pdf?ts=636637980126220303.
[43] Environmental Resources Management, CCR Surface Impoundment Liner Design Criteria, Ash Ponds and Scrubber Sludge Pond, TMPA Gibbons Creek Steam Electric Station (Oct. 12, 2016), available at http://www.texasmpa.org/envReports/ashPonds/ccr%20surface%20impoundment%20liner%20design%20criteria.pdf
[44] This table does not show data for lithium and sulfate, which are present at unsafe levels in all onsite wells, but without clear upgradient/downgradient patterns. See text for more details.
[45] Sargent & Lundy, Liner Documentation for Existing CCR Surface Impoundments, NRG Texas Power LLC Limestone Generating Station Units 1 & 2 (Oct. 7, 2016), available at https://www.nrg.com/legal/coal-combustion-residuals.html (under "Limestone" and "Liner Design Documentation").
[46] *Utility Solid Waste Activities Group, et al., v. EPA*, No. 15-1219, 2018 WL 4000476, D.C. Cir. Ct., *slip op.* at *27 (Aug. 21, 2018) ("[W] e vacate the Rule insofar as it treats "clay-lined" units as if they were lined. *See* 40 C.F.R. § 257.71(a)(1)(i)").
[47] *Utility Solid Waste Activities Group, et al., v. EPA*, No. 15-1219, 2018 WL 4000476, D.C. Cir. Ct., *slip op.* at *27 (Aug. 21, 2018) ("[W] e vacate the Rule insofar as it treats "clay-lined" units as if they were lined. *See* 40 C.F.R. § 257.71(a)(1)(i)").
[48] Luminant, Notification for the Establishment of an Assessment Monitoring Program, Martin Lake Steam Electric Station (Aug. 16, 2018), https://www.luminant.com/ccr/#big-brown.
[49] In the annual groundwater monitoring report for PDP 5, Luminant's contractor stated that "]g]roundwater is mounded at PDP, with an inferred groundwater flow direction radially outward from the unit. Based on the inferred direction of groundwater flow, there are no upgradient areas in the immediate vicinity of PDP 5. All of the CCR monitoring wells, which are positioned radially around PDP 5, are downgradient wells." Pastor, Behling & Wheeler, LLC, Coal Combustion Residual Rule 2017 Annual Gorundwater Monitoring Report, Martin Lake Steam Electric Station, PDP 5 (Jan. 31, 2018), available at https://www.luminant.com/ccr/.
[50] *See, e.g.*, U.S. EPA, Aquatic Life Ambient Water Quality Criterion for Selenium in Freshwater, 2016 Fact Sheet, https://www.epa.gov/sites/production/files/2016-06/documents/se_2016_fact_sheet_final.pdf.
[51] Wells H-29 and H-31 show maximum concentrations of 68 and 116 micrograms per liter, respectively, as shown in Attachment B to this report. Well H-21B, which is not monitored pursuant to the Coal Ash Rule, shows a maximum concentration of 327 micrograms per liter. Data for well H-21B can be found at the Environmental Integrity Project's Ashtracker website: https://ashtracker.org/facility/236/martin-lake-steam-electric-station.
[52] *Utility Solid Waste Activities Group, et al., v. EPA*, No. 15-1219, 2018 WL 4000476, D.C. Cir. Ct., *slip op.* at *27 (Aug. 21, 2018) ("[W] e vacate the Rule insofar as it treats "clay-lined" units as if they were lined. *See* 40 C.F.R. § 257.71(a)(1)(i)").
[53] Golder, Luminant Generation Company LLC, CCR Rule Location Restriction Demonstration, Monticello Steam Electric Station, at 4 (Oct. 10, 2018) ("The upper limit of the uppermost aquifer in the vicinity of the Ash Ponds was measured to be approximately Elev. 365 to 367 feet MSL and the base of the pond liner is located at approximately Elev. 358 ft MSL. Based on these measurements, the upper limit of the uppermost ground-water bearing unit can exceed the base of the liner in the ponds due to normal fluctuations in groundwater elevations").
[54] Golder Associates, Certification of Lined Construction, CCR Surface Impoundments, Oak Grove SES (Oct. 2016), available at https://www.luminant.com/ccr/.
[55] *Utility Solid Waste Activities Group, et al., v. EPA*, No. 15-1219, 2018 WL 4000476, D.C. Cir. Ct., *slip op.* at *27 (Aug. 21, 2018) ("[W] e vacate the Rule insofar as it treats "clay-lined" units as if they were lined. *See* 40 C.F.R. § 257.71(a)(1)(i)").
[56] Pastor, Behling & Wheeler, LLC, Coal Combustion Residual Rule, 2017 Annual Groundwater Monitoring Report, Oak Grove Steam Electric Station FGD Pond Area at Figure 3 (Jan. 31, 2018), available at https://www.luminant.com/ccr/.
[57] Id.
[58] Luminant, Notification for the Establishment of an Assessment Monitoring Program, Oak Grove Steam Electirc Station FGD Ponds (Aug. 16, 2018), https://www.luminant.com/ccr/#oak-grove.
[59] See AEP, Coal Combustion Residuals Monitoring & Reporting, Pirkey Plant, https://www.aep.com/about/codeofconduct/CCRRule/Pirkey.aspx ("Liner Design Certification" documents can be found under the names of the East and West Bottom Ash Ponds).
[60] *Id*. (an "Assessment Monitoring Notice" can be found under the name of each coal ash unit).
[61] San Miguel Electric Cooperative, Inc., CCR Rule Compliance Data and Information, http://www.smeci.net/CCR.html
[62] Environmental Resources Management, Existing CCR Surface Impoundment Liner Design Criteria, San Miguel Electric Cooperative, Inc. (Oct. 17, 2016), available at http://www.smeci.net/CCR/SILinerDesignCriteriaAshPondA.pdf
[63] *Utility Solid Waste Activities Group, et al., v. EPA*, No. 15-1219, 2018 WL 4000476, D.C. Cir. Ct., *slip op.* at *27 (Aug. 21, 2018) ("[W] e vacate the Rule insofar as it treats "clay-lined" units as if they were lined. *See* 40 C.F.R. § 257.71(a)(1)(i)").
[64] Based on a single sample
[65] Pastor, Behling & Wheeler, Coal Combustion Residual Rule, 2017 Annual Groundwater Monitoring Report, Sandow Steam Electric Station, AX Landfill, Rockdale, Texas (Jan. 31, 2018), available at https://www.luminant.com/ccr/ .
[66] http://www.sandycreekpower.net/reports/plans/
[67] Twin Oaks Power Station Coal Combustion Residual (CCR) Landfill 2017 Annual Inspection, available at http://www.twinoaksccr.com/uploaded/pdfs/1515429406_2017%20Annual%20CCR%20Landfill%20Inspection_FIN.pdf
[68] See https://ashtracker.org/facility/100/wa-parish-electric-generating-station.
[69] See, e.g., SWEPCO, Annual Groundwater Monitoring Report, J. Robert Welsh Power Plant, at Figure 8 (Jan. 2018), available at https://www.aep.com/about/codeofconduct/CCRRule/docs/2018/CCR-Mar2/WH-LF-AnnGWMonRept-013118.pdf.

[70] "Shallow groundwater flow directly west of the landfill in the area of monitoring well AD-17 is westerly toward a topographically low-lying area west of monitoring well AD-17." Arcadis, Landfill – CCR Groundwater Monitoring Well Network Evaluation, J. Robert Welsh Power Plant (May 2, 2016), available at https://www.aep.com/about/codeofconduct/CCRRule/docs/2017/Groundwater/WH-LF-GWMW-030917.pdf.
[71] Arcadis, Landfill – CCR Groundwater Monitoring Network Evaluation, J. Robert Welsh Power Plant, at 8 (Feb. 5, 2018), available at https://www.aep.com/about/codeofconduct/CCRRule/docs/2018/WH-LF-GWMN-031418.pdf.
[72] *Id.*; Arcadis, Bottom Ash Storage Pond - CCR Groundwater Monitoring Network Evaluation, J. Robert Welsh Power Plant, at 9 (Feb. 5, 2018), available at https://www.aep.com/about/codeofconduct/CCRRule/docs/2018/WH-BASP-GWMN-031418.pdf
[73] Geosyntec, Statistical Analysis Summary, Primary Bottom Ash Pond, J. Robert Welsh Power Plant (Jan. 15, 2018), available at https://www.aep.com/about/codeofconduct/CCRRule/docs/2018/CCR-Mar2/WH-PBAP-AnnGWMonStatRpt-011518.pdf.
[74] See, e.g., id. (using interwell comparisons for boron and pH, and intrawell comparisons for everything else); see also Geosyntec, Statistical Analysis Summary, Landfill, J. Robert Welsh Power Plant (Jan. 15, 2018), available at https://www.aep.com/about/codeofconduct/CCRRule/docs/2018/CCR-Mar2/WH-LF-AnnGWMonStatRpt-011518.pdf (using interwell comparisons for boron, fluoride, TDS, and sulfate, and intrawell comparisons for everything else); Geosyntec, Statistical Analysis Summary, Bottom Ash Storage Pond, J. Robert Welsh Power Plant (Jan. 15, 2018), available at https://www.aep.com/about/codeofconduct/CCRRule/docs/2018/CCR-Mar2/WH-BASP-AnnGWMonStatRpt-011518.pdf (using interwell comparisons for pH, and intrawell comparisons for everything else).
[75] See AEP's CCR Rule compliance page, where a "Groundwater Monitoring Statistical Evaluation Report" can be found under the heading of each coal ash unit at Welsh, https://www.aep.com/about/codeofconduct/CCRRule/Welsh.aspx
[76] Arcadis, American Electric Power Service Corporation, Primary Bottom Ash Pond – CCR Location Restriction Evaluation, J. Robert Welsh Power Plant at 8 (Oct. 3, 2018), https://www.luminant.com/ccr/#oak-grove ("[T]he base of the Primary Bottom Ash Pond is in contact with this aquifer [the aquifer underlying the pond]").
[77] "CCR unit" is defined in the rule as "any CCR landfill, CCR surface impoundment, or lateral expansion of a CCR unit, or a combination of more than one of these units… ." 40 C.F.R. § 257.53. The definition is therefore not limited to regulated units, and instead covers all CCR units.
[78] 40 C.F.R. § 257.60.
[79] 40 C.F.R. § 257.102(d).
[80] Letter from Barnes Johnson, U.S. EPA, to James Roewer, Edison Electric Institute, et al., re: Coal Combustion Residuals Rule Groundwater Monitoring Requirements (Jan. 26, 2018) (extending the date by which owners have to initiate assessment monitoring by 90 days); Letter from Barnes Johnson, U.S. EPA, to James Roewer, Edison Electric Institute, et al., re: Coal Combustion Residuals Rule Groundwater Monitoring Requirements (Apr. 30, 2018) (extending the date by which owners have to make statistical determinations in assessment monitoring by 90 days).