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by Kennedy Maize

Coal

The Convoluted Tale of U.S. Coal Ash Management

Sometime around midnight on Dec. 22, 2008, a dike at the coal ash dewatering pond for the [Tennessee Valley Authority's \(TVA's\) 1,400-MW Kingston power plant in Roane County, Tennessee](#), failed. That led to what has been reported as the [largest industrial spill in U.S. history](#).

TVA and the U.S. Environmental Protection Agency (EPA) initially estimated that the event released 1.7 million cubic yards of gray sludge. [The EPA later upped the estimate](#) to 5.4 million cubic yards. While there were no injuries, the spill damaged a score of private dwellings. The plume reached the Clinch River miles away (Figure 1). The event eventually cost TVA about \$1 billion and took seven years to clean up.



1. Sometime around midnight on Dec. 22, 2008, a dike at the coal ash dewatering pond for the TVA's 1,400-MW Kingston power plant failed. It led to what has been called the largest industrial spill in U.S. history. Source: TVA

The Kingston coal ash spill also brought public attention to a problem that has long faced the coal and power industries: how to deal with what is left after coal and water have turned into steam and power. Despite increased regulatory scrutiny after the TVA event, spills of coal combustion residuals (CCRs) have continued.

Ironically, about 10 years after the Kingston spill, on Sept. 2, 2018, floodwaters from Hurricane Florence caused a breach at the legacy coal ash disposal ponds at Duke Energy's [L.V. Sutton](#) power station near Wilmington, North Carolina. The 575-MW coal-fired plant was retired and demolished in 2013, replaced by a 625-MW gas combined cycle plant, but the ash remained.

The Sutton spill, small and quickly contained, came on top of a much [larger coal ash release in February 2014](#) at Duke Energy's 276-MW, 1949 vintage coal-fired Dan River plant, where the legacy coal pond suffered a 48-inch pipe failure, releasing some 50,000 to 82,000 tons of coal ash slurry into the Dan River. The plant had been shut in 2012.

[Peter Alvey, PE](#), who works for [Roux](#), an environmental regulatory consulting firm that frequently assists companies that provide insurance to utility operations, was on the scene at both the Kingston and Dan River spills. He told *POWER* that the two big ash accidents kicked off the modern age of concern about managing coal combustion products (see sidebar). "TVA was the first," he said. "Before that, ash ponds were just being used without much publicity. The Dan River released kicked off the environmental concerns about handling coal ash."

Just What Is Coal Ash?

Coal ash is shorthand for a complex mix of material that remains when coal is burned to generate power. A more precise, but less catchy term, is “coal combustion residuals,” with a predictable acronym, CCRs. The industry prefers “coal combustion products,” with the CCP acronym, reflecting that coal combustion residues can be used commercially. In fact, a third of CCRs are recycled—and a majority of fly ash is utilized—which the industry refers to as “beneficial uses.”

The [EPA defines CCRs](#) as consisting mostly of four basic components:

- Fly ash, “a very fine, powdery material composed mostly of silica made from the burning of finely ground coal in a boiler.” Fly ash is widely used and important in making cement.
- Bottom ash, “a coarse, angular ash particle that is too large to be carried up into the smoke stacks so it forms in the bottom of the coal furnace.” Bottom ash is used in roofing shingles.
- Boiler slag, “molten bottom ash from slag tap and cyclone type furnaces that turns into pellets that have a smooth glassy appearance after it is cooled with water.”
- Flue gas desulfurization residues, “a material leftover from the process of reducing sulfur dioxide emissions from a coal-fired boiler that can be a wet sludge consisting of calcium sulfite or calcium sulfate or a dry powdered material that is a mixture of sulfites and sulfates.” Scrubber sludge is used to make gypsum wallboard.

The combination of the Kingston and Dan River spills led [Duke Energy in January 2020 to announce](#) it would be “closing all ash basins across our system.” The giant investor-owned utility’s timetable calls for all the ash ponds to be closed by the end of 2038. Alvey speculated that may cost Duke \$5 billion to \$7 billion. (Alvey publishes the “Ash Pond Newsletter.”)

Coal ash is one of the largest industrial wastes generated in the U.S. According to an American Coal Ash Association (ACAA) report, some 130 million tons of coal ash were generated in 2014, the latest published assessment of production.

Utilities deal with coal ash in a variety of ways, including recycling into valuable products. What isn't recycled is stored in both lined or unlined ponds, or often goes to landfills. [According to the ACAA](#), in 2019, "The volume of fly ash used in concrete increased 1 percent over the previous year, but most other uses saw significant declines, leading to an overall decrease in recycling activity of 31 percent."

The unrecycled CCRs, including those currently on utility sites, are stored, often for decades, in ponds and landfills or discharged into waterways with federal Clean Water Act discharge permits. While generators will face declining amounts of new coal residues, they still must work to prevent spills or discharges from existing ponds and landfills, as well as deal with the new quantities.

Twisted Regulatory Environment

The growing concern over the problems of coal ash take place in a confused, on-again, off-again regulatory environment. Coal residues can contain a variety of toxins, including arsenic, lead, and mercury, so both the potential damage caused to waterways by spills and toxic waste issues must be considered.

A paper from Harvard's Environmental & Energy Law Program—["The Coal Ash Rule Trilogy Spanning Obama, Trump, and the D.C. Circuit"](#)—lays out the tortuous course of federal regulation of coal ash. The story begins in 1976, with the passage of the Resource Conservation and Recovery Act (RCRA). The law authorized the EPA to regulate many

solid and hazardous wastes, including coal ash. The Harvard Law paper notes, “Although the statutory authority to regulate has existed for four decades, federal regulation of coal ash is relatively new to the books.”

That started to change after the 2008 TVA spill. The EPA declared the Kingston event subject to the Superfund program, with TVA as the “[lead federal agency to implement the cleanup actions required.](#)”

Congressional hearings and lawsuits followed. Little changed until the Dan River incident. The EPA in 2015 produced the first federal coal ash regulations, defining CCRs as non-hazardous. The Harvard paper says, “The 2015 Rule required leaking, unlined coal ash impoundments to initiate closure and stop receiving waste. The rule allowed unlined coal ash impoundments without leaks to continue operating. Environmentalists and industry both challenged the final rule.”

In 2018, Trump’s EPA adopted rules suspending the Obama regulations. Since then, the U.S. Court of Appeals for the D.C. Circuit has remanded both the Obama and Trump rules back to the EPA.

The Biden administration is pondering what to do. It is unclear what direction it will take. Thomas Adams, executive director of the ACAA, said in an interview that he worries new rules may regulate coal ash as hazardous. “They can’t do that without devastating the beneficial use industry,” he said. Building codes would have to be rewritten if coal ash is deemed hazardous. “That would cause a lot of people to stop using coal combustion products.”

Regulation, said Alvey, is only a part of the coal ash management issue. It’s driven by economics and politics. “More important,” he said, “is the cost of generation and pollution, and the politics behind climate change.”

A Research Agenda

The Electric Power Research Institute (EPRI) has long focused on coal ash management. A 2009 EPRI paper—“[Coal Ash: Characteristics, Management and Environmental Issues](#)”—laid out the basic issues in managing coal ash. A [2017 EPRI Journal article](#) highlighted the research institute’s interest in beneficial uses, particularly fly ash recycling. The article says, “Collaborative research by EPRI, the University of Kentucky Center for Applied Research, and Golder Associates helped inform Duke Energy’s efforts to ramp up ash recycling.” The research, mandated by the North Carolina Coal Ash Management Act of 2014, examined three areas:

- The drivers and dynamics of established markets for coal ash in North Carolina and surrounding states, including concrete and cement manufacturing.
- The state of the technologies for processing ash to make it suitable for use in these markets.
- Innovative coal ash uses and products still in the research stage, or with little or no market in the U.S.

Last August, [EPRI and Southern Company’s Georgia Power, a major coal user, announced](#) the opening of an Ash Beneficial Use Center at a Georgia Power four-unit, 3,500-MW coal-fired station. EPRI said, “The center will work with technology developers to provide third-party evaluations and cost profiles of emerging technologies. Repurposing coal ash stored in landfills and ash ponds presents the potential for long-term economic and environmental benefits.”

EPRI’s Ben Gallagher, who runs the beneficial use program, told *POWER* that EPRI is looking at “harvesting” coal residues from existing ponds “When utilities build they have long life in mind and understand

ponds. “When utilities build, they have long life in mind, and understand those sorts of costs,” he said. “The solid materials are there (in the legacy coal ponds and landfills) and there is an opportunity to harvest them, that’s what we are working on now.”

Where Is Ash Management Headed?

[Mike McLaughlin](#), a licensed professional engineer and lawyer at the environmental consulting firm [SCS Engineers](#), told *POWER* that as coal plants shut down, the companies are going to have to close the legacy ponds, landfills, and plants, as well as figure out what to do with the land afterward. “Our electric utility clients are approaching on all different fronts. Many clients want to install solar on those sites—there are opportunities there. A lot of our clients are solid waste disposal companies who are reclaiming some surface mines, and considering reclaimed ponds and landfills for siting renewables,” he said.

—*Kennedy Maize is a veteran energy journalist and long-time contributor to POWER magazine.*