

NO ONE LIKES AN ASH HOLE: ADVOCATING FOR A  
MANAGEMENT SCHEME THAT PRIORITIZES BENEFICIAL  
UTILIZATION OF COAL ASH IN THE UNITED STATES AND  
GEORGIA THROUGH DOMESTIC AND INTERNATIONAL  
COMPARISONS

*Ethan Keith Morris*\*

TABLE OF CONTENTS

I. INTRODUCTION ..... 790

II. BACKGROUND..... 791  
A. *History of Regulation in the United States*..... 791

III. STATEMENT OF LAW..... 795  
A. *Kingston, TN & Eden, NC Spills: Prompting the Need for Federal Action* ..... 795  
B. *Georgia’s Proposed Rule*..... 798  
C. *The Indian Response* ..... 799

IV. ANALYSIS ..... 800  
A. *Insufficiency of the “Minimum Standards” Approach Taken by the EPA*..... 801  
B. *Greater than the Minimum, but How Much Greater?* ..... 803  
C. *The Indian Example: Leading the Way to Optimal Utilization* ..... 804  
D. *Problems with the Indian Plan*..... 805  
E. *Why the United States Must Adapt and What We Can Learn from India* ..... 806

V. CONCLUSION ..... 807

---

\* J.D. Candidate, University of Georgia School of Law, 2018. B.S. in Biology, B.A. in Political Science, and Minor in Chemistry, Georgia Southern University, 2014.

## I. INTRODUCTION

Coal Combustion Residuals (CCRs), also known as coal ash, are by-products generated from burning coal to produce electricity.<sup>1</sup> CCRs contain harmful substances such as mercury, cadmium, and arsenic and if not managed properly can cause pollution of waterways and air.<sup>2</sup> In 2015, the United States generated approximately 33% of its power from coal-fired power plants.<sup>3</sup> This high level of coal fired power utilization produces a substantial amount of coal ash, with approximately 120 million tons of CCRs being generated in the United States each year.<sup>4</sup> While coal-derived energy output has decreased over the years,<sup>5</sup> coal's status as an abundant, cheap, and reliable energy source makes it unlikely to be completely replaced by a viable alternative in the foreseeable future. With this in mind, the United States and countries around the world are faced with a difficult question—what should be done with all the ash?

This Note will examine the CCR management issue by evaluating the efficacy of three regulatory schemes: (1) the Environmental Protection Agency (EPA) minimum standards approach, (2) the Georgia greater than the minimum approach, and (3) the Indian beneficial utilization approach. After examining each of these approaches, this Note will analyze the benefits and drawbacks of each approach so the United States and Georgia can ensure that CCRs are managed in a way that prioritizes the protection of citizens and preservation of valuable natural resources while optimizing the beneficial use of coal ash.

---

<sup>1</sup> *Coal Ash (Coal Combustion Residuals, or CCR)*, U.S. ENVTL. PROT. AGENCY, <https://www.epa.gov/coalash> (last visited Nov. 13, 2016) [hereinafter *Coal Ash*].

<sup>2</sup> *Coal Ash Basics*, U.S. ENVTL. PROT. AGENCY, <https://www.epa.gov/coalash/coal-ash-basics> (last visited Nov. 13, 2016).

<sup>3</sup> *2016 Coal Combustion Residuals*, S. CO. (May 2016) <http://www.southerncompany.com/content/dam/southern-company/pdf/reports/CoalCombustionResiduals2016.pdf> [hereinafter *Coal Combustion Residuals*].

<sup>4</sup> *ACAA 2014 Production and Use Chart*, AMERICAN COAL ASH ASS., <https://www.acaa-usa.org/Portals/9/Files/PDFs/2014CCPPProdandUseCharts.pdf> (last visited Apr. 3, 2018).

<sup>5</sup> See *Monthly Energy Review September 2016—Table 6.1 Coal Overview*, U.S. ENERGY INFO. ADMIN., [https://www.eia.gov/totalenergy/data/monthly/pdf/sec6\\_3.pdf](https://www.eia.gov/totalenergy/data/monthly/pdf/sec6_3.pdf) (last updated Mar. 2018).

## II. BACKGROUND

### A. *History of Regulation in the United States*

In 1965, Congress passed the Solid Waste Disposal Act (SWDA) as a response to industrial pollution and widespread trash burning.<sup>6</sup> Since its passage, the SWDA has been amended numerous times to address gaps in regulation.<sup>7</sup> On October 21, 1976, Congress passed its first significant amendment to the SWDA—the Resource Conservation and Recovery Act (RCRA).<sup>8</sup> The RCRA set national goals for “protecting human health and the environment from the potential hazards of waste disposal; conserving energy and natural resources; reducing the amount of waste generated; ensuring that wastes are managed in an environmentally-sound manner.”<sup>9</sup>

RCRA also gave the EPA the power to regulate solid and hazardous wastes according to management standards developed using EPA research.<sup>10</sup> Under subtitle D of the RCRA, the EPA set criteria for solid waste landfills, barred the open dumping of solid waste, and prompted states to develop and submit comprehensive management plans for solid waste.<sup>11</sup> Under RCRA Subtitle C, the EPA set strict standards for the regulation of hazardous waste generators, transporters, owners, and operators as well as treatment, storage, and disposal facilities (TSDFs).<sup>12</sup> Because subtitle C of the RCRA regulates hazardous wastes from generation to disposal, it is known as a “cradle-to-grave” management scheme.<sup>13</sup> On December 18, 1978, when the EPA released its regulations for hazardous waste under RCRA Subtitle C, it decided to withhold judgment for six categories of wastes that it deemed

---

<sup>6</sup> *What is the Solid Waste Disposal Act of 1965?*, U.S. ENVTL. PROT. AGENCY, <https://waste.zendes.com/hc/en-us/articles/211677218-What-is-the-Solid-Waste-Disposal-Act-of-1965-> (last visited Apr. 3, 2018).

<sup>7</sup> *See EPA History: Resource Conservation and Recovery Act*, U.S. ENVTL. PROT. AGENCY, <https://www.epa.gov/history/epa-history-resource-conservation-and-recovery-act> (last visited Apr. 3, 2018) [hereinafter *History*].

<sup>8</sup> Linda Luther, *Background on and Implementation of the Bevill and Bentsen Exclusions in the Resource Conservation and Recovery Act: EPA Authorities to Regulate “Special Wastes,”* CONG. RES. SERV. (Aug. 6, 2013), <http://nationalaglawcenter.org/wp-content/uploads/assets/crs/R43149.pdf>.

<sup>9</sup> *History*, *supra* note 7.

<sup>10</sup> Luther, *supra* note 8, at 1.

<sup>11</sup> *History*, *supra* note 7.

<sup>12</sup> Luther, *supra* note 8, at 3.

<sup>13</sup> *Id.*

“special wastes,” until further study could be completed; among these wastes was what is now known as coal ash.<sup>14</sup>

Until the “Disposal of Coal Combustion Residuals from Electric Utilities” final rule was signed by the EPA Administrator on December 19, 2014, the United States had no minimum standards for the management of CCRs.<sup>15</sup> Since the 1980s, the EPA considered treating coal ash as hazardous waste under Subtitle C of the RCRA,<sup>16</sup> but after the EPA deferred judgment in December of 1978, Congress took action and passed the Bevill Amendment to the RCRA on October 8, 1980, which exempted CCRs from classification as hazardous waste under Subtitle C of the RCRA.<sup>17</sup> The passage of the Bevill Amendment ensured that coal utilities would be free from strict federal regulations and costs associated with management of hazardous substances under Subtitle C of the RCRA.<sup>18</sup> Congress’s primary motive for enacting the Bevill Amendment was that certain wastes, namely “solid waste[s] from the extraction, beneficiation, and processing of ores and minerals,” were generated in extremely large volumes compared to other substances regulated under Subtitle C.<sup>19</sup> Congress believed that prematurely imposing stricter Subtitle C standards upon these substances would give rise to astronomical management costs, so the legislature held off on regulation until more research could be presented as to the effects of coal ash.<sup>20</sup>

While Congress decided to exempt coal ash from Subtitle C regulation in the interim, it required the EPA to study coal ash extensively to determine

---

<sup>14</sup> *Special Wastes*, U.S. ENVTL. PROT. AGENCY, <https://www.epa.gov/hw/special-wastes> (last visited Apr. 3, 2018).

<sup>15</sup> *Final Rule: Disposal of Coal Combustion Residuals from Electric Utilities*, U.S. ENVTL. PROT. AGENCY, <https://www.epa.gov/coalash/coal-ash-rule> (last visited Apr. 3, 2018) [hereinafter *Final Rule*].

<sup>16</sup> Kristen Lombardi, *The Hidden History*, THE CTR. FOR PUB. INTEGRITY (Jan. 7, 2009), <https://www.publicintegrity.org/2009/01/07/2980/hidden-history>.

<sup>17</sup> The Bevill Amendment exempted special wastes such as fossil fuel combustion waste, waste from extraction, beneficiation, and processing of ores and minerals, and cement kiln dust. The EPA was also required to study the exempted substances and submit a formal report to Congress on its findings so that a final regulatory determination could be made in regards to whether the Bevill exempted wastes should be regulated under Subtitle C of RCRA. See *Special Wastes*, *supra* note 14.

<sup>18</sup> Charles T. Wehland & G. Graham Holden, *EPA Proposes Sweeping Regulation for Coal Ash Disposal*, JONES DAY COMMENTARY (June 2010), [http://www.jonesday.com/epa\\_proposes\\_sweeping\\_regulation/](http://www.jonesday.com/epa_proposes_sweeping_regulation/) (listing requirements for hazardous waste management under Subtitle C of RCRA).

<sup>19</sup> Luther, *supra* note 8, at Summary, 4.

<sup>20</sup> Rena Steinzor & Michael Patoka, COMMENTS: HAZARDOUS AND SOLID WASTE MANAGEMENT SYSTEM: IDENTIFICATION AND LISTING OF SPECIAL WASTES; DISPOSAL OF COAL COMBUSTION RESIDUALS FROM ELECTRIC UTILITIES, CENTER FOR PROGRESSIVE REFORM (Nov. 19, 2010), [http://www.progressivereform.org/articles/Coal\\_Ash\\_Comments\\_Steinzor\\_111910.pdf](http://www.progressivereform.org/articles/Coal_Ash_Comments_Steinzor_111910.pdf).

whether the substance was truly dangerous enough to be declared hazardous.<sup>21</sup> In 1988, the EPA completed initial studies and published its findings in a report to Congress, although the agency failed to complete the regulatory determination mandated by Congress.<sup>22</sup> Three years later, as part of a consent decree to complete said regulatory determination, the EPA divided CCRs into two categories—one category containing “fly ash, bottom ash, boiler slag, and flue gas emission control waste from the combustion of coal by electric utilities and independent commercial power producers,”<sup>23</sup> and the other category containing “all remaining wastes subject to the Bevill exemption.”<sup>24</sup> While this determination provided insight as to the varying categories of CCRs, the EPA still gave no explanation as to how CCRs should be regulated under the RCRA. In August of 1993, the EPA again decided not to subject either category of CCRs to Subtitle C regulation.<sup>25</sup>

In 1999, the EPA submitted a second report to Congress that again addressed whether the Bevill Amendment should continue to apply to CCRs.<sup>26</sup> The report concluded that Bevill Amendment wastes would continue to be exempted from Subtitle C and that CCRs disposed in landfills and surface impoundments would be subject to national minimum standards under Subtitle D of the RCRA.<sup>27</sup> Although the EPA decided to regulate CCRs disposed in landfills and impoundments under Subtitle D, the proposed minimum standards were never issued, and Congress took no action in light of the EPA recommendations.<sup>28</sup> While environmental groups were disappointed by this outcome, the EPA promised to revisit its decision

---

<sup>21</sup> Wehland & Holden, *supra* note 18, at 7.

<sup>22</sup> *Id.*

<sup>23</sup> Fly Ash is “a very fine, powdery material composed mostly of silica made from the burning of finely ground coal in a boiler.” Bottom Ash is “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.” Boiler Slag is “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 Material is “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 powered material that is a mixture of sulfites and sulfates.” See *Coal Ash*, *supra* note 1.

<sup>24</sup> Wastes subject to the Bevill exemption include large volume coal combustion wastes generated at electric utility and independent power-producing facilities that are co-managed with other coal combustion wastes. See Wehland & Holden, *supra* note 18, at 3.

<sup>25</sup> *Id.*

<sup>26</sup> *Id.*

<sup>27</sup> *Id.*; see also Wehland & Holden, *supra* note 18, at 5 (listing requirements for hazardous waste management under Subtitle D of RCRA).

<sup>28</sup> Wehland & Holden, *supra* note 18, at 5.

not to regulate CCRs under Subtitle C of the RCRA after completing further studies on the substances.<sup>29</sup>

Following the 1999 EPA decision to regulate CCRs under Subtitle D, environmental stakeholders continued to urge the EPA to reclassify coal ash as a Subtitle C hazardous substance due to its potential to leach from impoundments into water stores.<sup>30</sup> The EPA evaluated these claims and appeared to take note of stakeholder concerns when it proposed a draft determination to the White House Office of Management and Budget (OMB) that stated:

Public comments and other analyses . . . have convinced [the] EPA that these wastes can, and do, pose significant risks to human health and the environment when not properly managed, and there is sufficient evidence that adequate controls may not be in place for a significant number of facilities. This, in our view, justifies the development of tailored regulations under [the hazardous] Subtitle C of RCRA.<sup>31</sup>

EPA Administrator Carol Browner proposed a draft rule to the OMB containing the above determination, but this is as far as the rulemaking process would go.<sup>32</sup> Once the OMB received the EPA draft rule, utility lobbies learned of the EPA's intention to reclassify coal ash as a hazardous substance and immediately mounted fierce opposition to the proposal.<sup>33</sup> After analyzing scientific studies and comments from interested parties, the OMB performed what amounted to a cost-benefit analysis, concluding that the cost of management to utilities, estimated at a minimum of \$1 billion per year and a maximum \$13 billion per year, outweighed the benefit of regulating CCRs as hazardous waste.<sup>34</sup> After OMB revisions, the original EPA proposal to regulate coal ash as a hazardous waste was abandoned in favor of less stringent standards for CCR management, although the agency did not address the proposed less stringent regulations again for eight years.<sup>35</sup>

---

<sup>29</sup> *Id.*

<sup>30</sup> Environmental stakeholders pushed the agency to take note of sixty water sources that had been contaminated by coal ash. *See Lombardi, supra* note 16.

<sup>31</sup> *Id.*

<sup>32</sup> *Id.*

<sup>33</sup> *Id.*

<sup>34</sup> *Id.*

<sup>35</sup> *Id.*

## III. STATEMENT OF LAW

A. *Kingston, TN & Eden, NC Spills: Prompting the Need for Federal Action*

On December 22, 2008, in Kingston, Tennessee, a dike used to contain coal ash held in a surface impoundment was compromised, resulting in the release of 5.4 million cubic yards of coal ash into the Emory River channel.<sup>36</sup> The subsequent cleanup lasted over six years and ran up costs in excess of \$1.1 billion.<sup>37</sup> The spill made headlines due to its size, which exceeded one billion gallons and released more sludge than the Deepwater Horizon spill in the Gulf of Mexico.<sup>38</sup> While efforts to regulate coal ash had largely stalled up until this point, the disaster in Kingston brought to light the devastation that could result from the mismanagement of CCRs.<sup>39</sup> In the wake of the Kingston spill, Lisa Jackson, newly appointed director of the EPA, announced that the agency would finally publish a comprehensive rule regulating coal ash.<sup>40</sup>

While Jackson's announcement appeared to answer the prayers of environmental groups, the rulemaking process has taken many years to generate results. On October 16, 2009, after completing a first draft of the proposed rule, the EPA submitted a copy to the OMB's Office of Information and Regulatory Affairs (OIRA).<sup>41</sup> Over the course of seven months, a White House team led by "regulatory czar" Cass Sunstein proceeded to rewrite the EPA's Proposed Rule,<sup>42</sup> and on June 21, 2010, the EPA published the revised rule in the Federal Register for comment.<sup>43</sup> Upon publishing, environmental stakeholders were miffed by the revised rule and argued that EPA efforts to enact an effective rule were again undermined by industry lobbying efforts, which made the new rule "barely recognizable."<sup>44</sup> Stakeholder concerns were warranted because prior to submission for OIRA review, the EPA's original proposal only contemplated regulating CCRs as hazardous wastes under Subtitle C of RCRA.<sup>45</sup> When the rule emerged from

---

<sup>36</sup> *U.S. Environmental Protection Agency and Tennessee Valley Authority Kingston Coal Ash Release Site Project Completion Fact Sheet*, U.S. ENVTL. PROT. AGENCY (Dec. 2014), [https://www.epa.gov/sites/production/files/2016-02/documents/projectcloseout\\_dec2014\\_factsheet.pdf](https://www.epa.gov/sites/production/files/2016-02/documents/projectcloseout_dec2014_factsheet.pdf).

<sup>37</sup> *Id.*

<sup>38</sup> Steinzor & Patoka, *supra* note 20.

<sup>39</sup> See Lombardi, *supra* note 16.

<sup>40</sup> Wehland & Holden, *supra* note 18, at 3.

<sup>41</sup> *Coal Ash Waste Disposal Standards: What's at Stake?*, CTR. FOR PROGRESSIVE REFORM (Sept. 30, 2016), <http://www.progressivereform.org/13RulesCoalAsh.cfm>.

<sup>42</sup> *Id.*

<sup>43</sup> *Final Rule*, *supra* note 15.

<sup>44</sup> Steinzor & Patoka, *supra* note 20, at 3.

<sup>45</sup> *Id.*

OIRA review, the revision offered nothing close to the strong approach provided by Subtitle C of the RCRA.<sup>46</sup> The revised rule essentially proposed two options in regards to regulation of CCRs.<sup>47</sup>

The first option proposed to regulate CCRs as *special* waste under Subtitle C of the RCRA when they are marked for disposal in landfills or surface impoundments.<sup>48</sup> This option reflected the OIRA's view that regulating coal ash as *hazardous* waste would stigmatize the substance and discourage beneficial use efforts.<sup>49</sup> Labeling CCRs as special waste would also continue the Bevill exemption for coal ash until a final regulatory determination could be made as to whether these substances are indeed hazardous.<sup>50</sup> The second option proposed to regulate CCRs under Subtitle D of the RCRA by establishing national minimum criteria.<sup>51</sup> This option would place the onus of regulating coal ash on legislators and state governments, which would promote disparate approaches to the issue from state to state.

After completing an extensive study of the issue and examining comments from all interested parties, the EPA again elected to regulate CCRs under Subtitle D of the RCRA.<sup>52</sup> As previously stated, this option appeared to favor electric utilities because utilities were permitted to eschew burdensome management costs.<sup>53</sup> Further, "disposal landfills and surface impoundments [could] continue to function for the remainder of their useful [lives]."<sup>54</sup> While the EPA chose not to pursue a plan that required closure and remediation of landfills and impoundments, it created a mechanism for reviewing and approving state management of CCR landfills and surface impoundments.<sup>55</sup> As part of the EPA's early development of its waste management infrastructure under the RCRA, the agency created a process that allowed states to submit Solid Waste Management Plans (SWMP) for exactly how they intend to manage certain solid wastes.<sup>56</sup> In light of the new CCR regulations, the EPA recommended that states update their SWMPs to

---

<sup>46</sup> Wehland & Holden, *supra* note 18, at 5 (stating that Subtitle C would have required state and EPA monitoring, state permitting, and minimum storage qualifications in addition to measures required by Subtitle D).

<sup>47</sup> *Id.* at 3–4.

<sup>48</sup> *Final Rule*, *supra* note 15.

<sup>49</sup> Steinzor & Patoka, *supra* note 20, at 7.

<sup>50</sup> Luther, *supra* note 8.

<sup>51</sup> *Final Rule*, *supra* note 15.

<sup>52</sup> *Id.*

<sup>53</sup> Steinzor & Patoka, *supra* note 20, at 54–55.

<sup>54</sup> *Id.* at 4.

<sup>55</sup> *Final Rule*, *supra* note 15.

<sup>56</sup> *Id.*

reflect how they planned to regulate landfills and impoundments and submit the plan to the EPA for approval.<sup>57</sup>

Although the decision to regulate CCRs under Subtitle D was made and the rule-making process appeared to be complete, the EPA did not issue a final rule until December of 2014.<sup>58</sup> Most notably, the agency only issued the rule after being compelled by a consent decree resulting from the settlement of a lawsuit filed by a number of national and local environmental groups.<sup>59</sup> This resolution was most likely reached due to another catastrophic event that occurred in Eden, North Carolina, on February 2, 2014, when 39,000 tons of coal ash spilled from a Duke Energy facility into the Dan River.<sup>60</sup> As part of an Administrative Order of Consent between Duke Energy and the EPA, Duke removed 4,000 cubic yards of coal ash that accumulated as a result of the spill.<sup>61</sup> The removal action was completed in July 2014, and the utility was required to monitor the site through July 2015, at which time the EPA would decide whether additional sampling was necessary.<sup>62</sup>

After the second coal ash disaster in six years, the EPA finally decided enough was enough. On December 19, 2014, Gina McCarthy, the administrator of the EPA, signed the Disposal of Coal Combustion Residuals from Electric Utilities Final Rule.<sup>63</sup> A few months later on April 17, 2015 the rule was published in the Federal Register.<sup>64</sup> Over a year later, on July 26, 2016, the EPA Administrator signed a direct final rule and a companion proposal to extend compliance deadlines for certain inactive CCR surface impoundments.<sup>65</sup> The comment period for the direct final rule ended on

---

<sup>57</sup> *Id.* (explaining “[t]here are several ways in which a state can submit a SWMP for approval. If a regulatory agency wants to have their SWMP approved of before state CCR regulations have been adopted, they can submit the plan based on the expectation of the regulations being put in place. These SWMPs can receive approval conditioned on adoption of those state CCR regulations. A state can also initially submit a plan dealing only with compliance schedules. This would be considered a partial approval and can be granted provided the state agrees to submit an entire plan in a timely fashion.”).

<sup>58</sup> *Id.*

<sup>59</sup> *Appalachian Voices v. McCarthy*, 989 F. Supp. 2d 30, 56 (D.D.C. 2013) (concluding that the EPA is required to provide updated information to the Court “regarding the status of its review and revision to properly fashion a schedule for the EPA’s compliance with its obligation to review and revise if necessary its Subtitle D regulations concerning coal ash”).

<sup>60</sup> *Duke Energy Coal Ash Spill in Eden, NC: History and Response Timeline*, U.S. ENVTL. PROT. AGENCY (2016), <https://www.epa.gov/dukeenergy-coalash/history-and-response-timeline>.

<sup>61</sup> *Id.*

<sup>62</sup> *Id.*

<sup>63</sup> *Final Rule*, *supra* note 15.

<sup>64</sup> *Id.*

<sup>65</sup> *Id.*

August 22, 2016, and because no adverse comments were received, the rule went into effect on October 4, 2016.<sup>66</sup>

### *B. Georgia's Proposed Rule*

Until 2016, the State of Georgia refrained from addressing the coal ash issue with its own comprehensive regulations. Prompted by the issuance of EPA regulations, Georgia initiated its own rulemaking process to devise an effective CCR management scheme at the state level. The process began in May 2016 when the Environmental Protection Division (EPD) of the Georgia Department of Natural Resources (DNR) held a hearing to allow various stakeholders the opportunity to provide input for a draft rule.<sup>67</sup> On July 7, 2016, the EPD proposed amendments to the state's rules pertaining to solid waste management.<sup>68</sup> In choosing to deal with the coal ash issue by amending solid waste rules instead of hazardous waste rules, Georgia adopted the EPA determination that coal ash is not a hazardous waste. Georgia's Proposed Rule also adopted the majority of the regulations contained in the EPA's CCR rule and "include[d] additional regulations to address the exemptions and gaps in the federal CCR rule."<sup>69</sup> These "additional regulations" included the following requirements: (1) Municipal Solid Waste Landfills (MSWL) must be included in the regulatory scheme if they accept CCRs, requiring additional monitoring costs and formation of a CCR Management Plan for these facilities; (2) Financial Assurance for all CCR Units at Electric Facilities, meaning that the permittee is liable for all costs associated with the site and must provide proof that it can handle this obligation; (3) regulation of inactive ground units at all Electrical Utilities, including the monitoring of groundwater at said units; and (4) all CCR units at Electric Utilities must have a permit.<sup>70</sup> Like the EPA rule, the amendments allowed for the continued use of landfills and surface

---

<sup>66</sup> *Id.*

<sup>67</sup> *Id.*

<sup>68</sup> Dan Chapman, *Georgia to Hold Hearing to Develop Own Coal Ash Rules*, ATL.-J. CONST. (May 11, 2016), <http://politics.myajc.com/news/state--regional-govt--politics/georgia-consider-own-rules-for-handling-toxic-coal-ash/KsnPVKGocKMO3e1Q03z9YL/>; see Synopsis of Proposed Amendments to the Rules of the Department of Natural Resources Environmental Protection Division Relating to Solid Waste Management, ENVTL. PROT. DIV. § 391-3-4 (proposed July 7, 2016), [https://epd.georgia.gov/sites/epd.georgia.gov/files/11092017\\_Synopsisand%20StatementofRationale\\_SolidWasteManagement.pdf](https://epd.georgia.gov/sites/epd.georgia.gov/files/11092017_Synopsisand%20StatementofRationale_SolidWasteManagement.pdf) [hereinafter *Synopsis*].

<sup>69</sup> *Id.*

<sup>70</sup> *Id.*

impoundments for the storage of CCRs.<sup>71</sup> Just as the EPA rule was criticized for being too lenient, the Georgia rule has faced similar criticisms, especially from stakeholders involved with the Broadhurst landfill in Jesup, Georgia.<sup>72</sup> Fortunately for Georgia, it appears that its primary electric utility, Georgia Power, plans to do even more than the proposed rule requires.<sup>73</sup>

After proposing the rule on July 7, 2016, public hearings were held on July 27, 2016, in Atlanta, Georgia and August 4, 2016, in Brunswick, Georgia.<sup>74</sup> The public comment period ended August 10, 2016, and a total of 1,012 comments were received from interested parties throughout Georgia.<sup>75</sup> Despite the large volume of stakeholder comments, no changes were recommended to the proposed rules based on the comments received, and the Amendments to Georgia's Rules Pertaining to Solid Waste Management were approved for publication on October 26, 2016.<sup>76</sup>

### C. *The Indian Response*

While CCR regulations are a relatively new phenomenon in the United States, other countries have been setting standards for the management of coal ash for some time. At the forefront of this movement is India, a country that produces upwards of 180 million tons of fly ash per year.<sup>77</sup> Indian coal

---

<sup>71</sup> Proposed Amendments to the Rules of the Department of Natural Resources Environmental Protection Division Relating to Solid Waste Management, ENVTL. PROT. DIV. § 391-3-4 (proposed July 7, 2016) [hereinafter *Amendments*].

<sup>72</sup> Janisse Ray, *From Ashes Such as These, What Can Rise?*, BITTER SOUTHERNER (Apr. 2016), [http://bittersoutherner.com/coal-ash/#.V\\_ZjgqIrLZu](http://bittersoutherner.com/coal-ash/#.V_ZjgqIrLZu) (Republic Services recently applied for a permit to build a railway alongside its rural Georgia Broadhurst landfill with hopes of increasing the amount of coal ash it can move to its facility. Citizens of Jesup largely oppose the issuance of the permit and believe that Republic Services has not been transparent about many of the risks associated with coal ash disposal). Terry Dickson, *Republic Services Scuttles Plans to Bury Coal Ash at its Wayne County Landfill*, FLORIDA TIMES-UNION, (Apr. 5, 2017) (after a hard fought campaign led by local publisher Dink NeSmith, Republic Services scrapped its plan to pursue a permit to dispose of coal ash in its Broadhurst landfill).

<sup>73</sup> On March 29, 2016, Southern Company announced that all of Georgia's twenty-nine ash ponds will be closed within fifteen years with twelve of those ponds being closed within two years. Furthermore, Southern Company reports that approximately 40% to 50% of its coal ash is sold for beneficial use purposes. See *Coal Combustion Residuals*, *supra* note 3.

<sup>74</sup> Memorandum from Jeff Cown, Chief of the Land Protection Division, to Richard E. Dunn, Director of the Environmental Protection Division (Oct. 6, 2016), <https://epd.georgia.gov/sites/epd.georgia.gov/files/CCRResponsetoComments.pdf>.

<sup>75</sup> *Id.*

<sup>76</sup> *Id.*

<sup>77</sup> Report on Fly Ash Generation at Coal/Lignite Based Thermal Power Stations and its Utilization in the Country for the Year 2014–2015, CENT. ELEC. AUTH. (Oct. 2015) [hereinafter *Central Electricity*]. See Table-I Summary of Fly Ash Generation and Utilization During the Year 2014–2015.

is known for its high ash content, with levels typically ranging from “20–30 percent but sometimes more than 40 percent by weight” compared to 10%–15% in the United States.<sup>78</sup> This means that Indian coal leaves behind a much greater amount of CCRs compared to coal from other countries, making the coal ash problem even more dire in India.

In response to its coal ash predicament, India’s Ministry of the Environment, Forest, and Climate Change (MoEFCC) issued its first policy notification in 1999 to promote the beneficial utilization of fly ash.<sup>79</sup> Until this point, India had managed fly ash in the traditional way by utilizing surface impoundments and landfills to store large amounts of ash.<sup>80</sup> Citing the need to “protect the environment, conserve top soil and prevent the dumping and disposal of fly ash discharged from coal or lignite based thermal power plants on land,” MoEFCC changed the course of coal ash management from a scheme that focused on simply storing CCRs in designated areas to a scheme that promoted beneficial utilization of coal ash.<sup>81</sup> This notification marked the beginning of India’s gradual transition to 100% coal ash utilization, and the original notification set a target of five years for the goal to be reached.<sup>82</sup>

#### IV. ANALYSIS

There is no dispute that Coal Combustion Residuals present a daunting problem for Georgia, the United States, and the world at large. With most of the world’s power being generated by coal, the end of CCRs does not appear to be in sight.<sup>83</sup> If coal ash is here to stay, stakeholders must work toward a plan for sensible management that places a premium on minimizing pollution and maximizing beneficial use. The regulations currently in place do not adequately accomplish this goal. After examination of each of the

---

<sup>78</sup> S. Jayanti, K. Maheswaran & V. Saravanan, *Assessment of the Effect of High Ash Content in Pulverized Coal Combustion*, 31 APPLIED MATHEMATICAL MODELLING 934, 935 (2007).

<sup>79</sup> This notification provided, among other things, that no person within 100 kilometers could manufacture clay bricks or tiles without mixing at least 25% coal ash, and all construction activities within the same boundary shall use only fly ash based products for construction. Table-II set forth a gradual scheme for achieving 100% utilization by the year 2004. See MOEFCC Utilisation of Flyash from Coal or Lignite Based Thermal Power Plants Notification S.O. 763(E), 1999, Gazette of India, pt. II sec. 3(ii) (Sept. 14, 1999) [hereinafter Notification].

<sup>80</sup> Central Electricity, *supra* note 77.

<sup>81</sup> Notification, *supra* note 79, at 376.

<sup>82</sup> *Id.* at 382.

<sup>83</sup> *Breakdown of Electricity Generation by Source*, THE SHIFT PROJECT DATA PORTAL, <http://www.tsp-data-portal.org/Breakdown-of-Electricity-Generation-by-Energy-Source#tspQvChart> (last visited Nov. 6, 2016).

management schemes discussed above, a proposal will be made that advocates for implementation of a gradual plan toward optimal beneficial utilization of coal ash.

A. *Insufficiency of the “Minimum Standards” Approach Taken by the EPA*

Since its inception, the EPA’s coal ash rule has faced harsh criticism from environmental stakeholder groups.<sup>84</sup> The primary concern from many of these groups is that the regulation does too little to combat the coal ash problem. While the rule establishes requirements for landfills and surface impoundments, addresses risks of coal ash disposal, sets out recordkeeping and reporting requirements, and differentiates between beneficial use and disposal, it still allows storage of CCRs in landfills and surface impoundments.<sup>85</sup>

Another concern is that the rule is self-implementing, which means that there is no method of enforcing these regulations other than by way of citizen suits, which can only be brought by states or other citizens, many times after regulations have already been violated.<sup>86</sup> For humans and the environment to be truly protected, this reactive scheme must be eschewed in favor of a plan that takes greater preventative action.

Critics are further dismayed by the EPA’s failure to regulate coal ash as a “hazardous” waste even though it contains “hazardous” substances such as mercury, arsenic, and cadmium.<sup>87</sup> Stakeholders believe this is because electric utilities would rather pay to lobby legislators and bureaucrats instead of bearing the burden of increased management costs.<sup>88</sup> Until utility companies prioritize human and environmental health over the almighty dollar, the United States will continue to fall short in its regulation of CCRs.

Another area where the EPA rule undoubtedly comes up short is in its failure to mandate a minimum requirement for beneficial use of coal ash. The EPA has stated that it does not want to label CCRs as hazardous because this would discourage the reuse of coal ash, yet it does nothing to advance the beneficial use goals that it apparently views as worthy of protecting.<sup>89</sup>

---

<sup>84</sup> Steinzor & Patoka, *supra* note 20, at 8.

<sup>85</sup> *Synopsis*, *supra* note 68, at 4.

<sup>86</sup> *Frequent Questions on the Implementation of the Disposal of Coal Combustion Residuals (CCR) from Electric Utilities Final Rule*, U.S. ENVTL. PROT. AGENCY, [https://www.epa.gov/site/production/files/2015-08/documents/frequent\\_questions\\_on\\_the\\_implementation\\_of\\_the\\_ccr\\_final\\_rule\\_aug\\_11\\_2015\\_v5\\_.pdf](https://www.epa.gov/site/production/files/2015-08/documents/frequent_questions_on_the_implementation_of_the_ccr_final_rule_aug_11_2015_v5_.pdf) (last visited Apr. 3, 2018) [hereinafter *Frequent Questions*].

<sup>87</sup> See 40 C.F.R. §§ 261.33, 261.24 (2017) (listing mercury and arsenic as P and U wastes and cadmium as a characteristic waste).

<sup>88</sup> Steinzor & Patoka, *supra* note 20, at 5.

<sup>89</sup> *Id.* at 7.

The EPA argues that its rule is still the most sensible solution because it allows “states [to] devise programs to deal with state-specific conditions and needs” rather than imposing a scheme of top-down regulation that would be difficult to conform to.<sup>90</sup>

The real issue with the minimum standards established by the EPA is the fact that these standards are too *de minimis* to ensure human and environmental safety. This is not the first time the EPA has chosen to regulate by passing minimum regulations and leaving the rest to the states. The coal ash regulation scheme bears a striking resemblance to another regulatory scheme that has faced harsh criticism in light of recent events—water quality standards regulated under the Safe Drinking Water Act (SDWA). The SDWA regulates drinking water standards through a three-step process.<sup>91</sup> First, the EPA identifies contaminants that may pose a threat to public health and occur in drinking water at a sufficient frequency.<sup>92</sup> Second, the EPA sets a maximum contaminant level goal for these regulated contaminants, which is the level below which there is no risk to human health.<sup>93</sup> Third, the EPA specifies a maximum contaminant level, which is the maximum allowable level of a contaminant in drinking water delivered to consumers.<sup>94</sup> After the EPA sets these “minimum standards,” the water supplier is required to comply with and implement such standards.<sup>95</sup> While the EPA provides guidance, assistance, and public information, responsibility for oversight is largely left to the states, and as we have seen in Flint, Michigan, leaving regulation and oversight functions solely to state and local governments can have grave consequences.

Just as the SDWA system places the majority of the burden of compliance on suppliers, the EPA rule also places the entire burden of management on utilities, states, and localities, effectively ensuring a cost-benefit approach in lieu of a method that focuses on remediation of disposal sites and health and environmental safety. The SDWA scheme was the driver that led to the degradation of the water quality in Flint when the emergency manager decided to take water from the polluted Flint River instead of paying to obtain water from alternative sources.<sup>96</sup> While this is an extreme example of

---

<sup>90</sup> 80 Fed. Reg. 21310 (Apr. 15, 2015).

<sup>91</sup> *Understanding the Safe Water Drinking Act*, U.S. ENVTL PROT. AGENCY (2004), <https://www.epa.gov/sites/production/files/2015-04/documents/epa816f04030.pdf>.

<sup>92</sup> *Id.*

<sup>93</sup> *Id.*

<sup>94</sup> *Id.*

<sup>95</sup> *Id.*

<sup>96</sup> Merrit Kennedy, *2 Former Flint Emergency Managers, 2 Others Face Felony Charges Over Water Crisis*, NAT'L PUB. RADIO (Dec. 20, 2016), <https://www.npr.org/sections/thetwo-way>

what can happen when minimum standards regulatory schemes go awry, when human and environmental health is at stake every measure must be taken to ensure that this health is preserved.

Finally, there is an argument that the EPA rule, while minimal in its scope, may still be the most appropriate federal response to the issue. There have been instances where the EPA has attempted to regulate in a more specific fashion, as with the Clean Power Plan (CPP).<sup>97</sup> While the CPP approach may accomplish specific EPA goals, its success has been jeopardized by sovereignty arguments from the states, resulting in protracted litigation.<sup>98</sup> By leaving the responsibility of promulgating rules to the states, each party is required to adhere to the minimum regulations and may enact more stringent rules as they see fit. This will undoubtedly result in some states enacting more comprehensive rules than others. However, this poses an interesting question—should state sovereignty take precedence over protecting all U.S. citizens from the dangers of harmful substances such as coal ash? The EPA seems to believe that the preservation of the former is of greater importance, necessitating an examination of whether interests of Georgia residents can be adequately protected at the expense of advancing state sovereignty.

### *B. Greater than the Minimum, but How Much Greater?*

Georgia recently amended its rules for solid waste management in light of the EPA's coal ash final rule, and while it appears that Georgia's rule will do more than the EPA rule, there is still much that needs to be addressed to adequately combat the CCR problem. The primary concern with the amendments to the Georgia rule is that these amendments, like the rule enacted by the EPA, allow for the continued viability of CCR landfills and surface impoundments and do not require impoundments to be completely remediated when closed.<sup>99</sup> While Georgia Power has committed to closing all of its impoundments in the coming years, only seventeen of the twenty-

---

y/2016/12/20/506314203/2-former-flint-emergency-managers-face-felony-charges-over-water-crisis.

<sup>97</sup> *Fact Sheet: Overview of the Clean Power Plan*, U.S. ENVTL. PROT. AGENCY, <https://archive.epa.gov/epa/cleanpowerplan/fact-sheet-overview-clean-power-plan.html> (last visited Apr. 3, 2018) (stating that the EPA's Clean Power Plan has attempted to reduce CO<sub>2</sub> emissions in coal plants by creating a partnership between states and tribes, setting a goal, and allowing states and tribes to choose how they meet that goal).

<sup>98</sup> *State of West Virginia et al. v. EPA*, No. 15-1363 (D.C. Cir. Aug. 17, 2016) (order granting en banc oral argument).

<sup>99</sup> *Amendments*, *supra* note 71.

nine impoundments will see their coal ash completely removed.<sup>100</sup> Additionally, the ash from these sites will not truly be completely removed; it will be relocated to landfills or other impoundments with an undisclosed amount earmarked for beneficial reuse.<sup>101</sup> Georgia has attempted to hold utilities accountable by including provisions that mandate Financial Assurance for CCR units and require regulation and monitoring of groundwater at inactive units; however, this is still problematic because monitoring is only required for thirty years after closure.<sup>102</sup> Furthermore, Financial Assurance provisions only provide back-end protection in the event that a spill occurs and a cleanup is needed and do nothing to preempt the problems caused by coal ash disposal. Georgia's weak rules also allow utilities in states with more stringent regulations to transport ash for disposal in Georgia.<sup>103</sup>

While this scheme is a good starting point for combatting the coal ash issue, it shows that Georgia would rather kick the can down the road—placating the cost concerns of electric utilities—and move CCRs from one storage medium to another. It is illogical to think that the state of affairs can change overnight, but Georgia would be wise to gradually adapt to a beneficial use scheme to protect its citizens and environment.

### *C. The Indian Example: Leading the Way to Optimal Utilization*

Countries around the world are now realizing that management of CCRs poses a daunting challenge. India was among the first to recognize this problem and began the process of gradually transitioning to 100% beneficial use in 1999.<sup>104</sup> While it has not met the goals it set in 1999, India has continued to amend its 1999 notification to adapt to present circumstances.<sup>105</sup> Furthermore, India realizes the dangers posed by coal ash and its byproducts, resulting in a shift away from a scheme that focuses largely on minimizing costs to utility companies.<sup>106</sup> India's plan is sensible because it does not simply mandate beneficial use—it goes a step further by establishing a plan that CCR generators must follow in order to ensure that beneficial use is actually occurring.<sup>107</sup> For instance, the newest MoEFCC notification

---

<sup>100</sup> *Coal Combustion Residuals*, *supra* note 3.

<sup>101</sup> *Id.*

<sup>102</sup> *Synopsis*, *supra* note 68, at 4.

<sup>103</sup> Paul Rea, *Banks County Inherits North Carolina's Coal Ash*, NOW HABERSHAM (May 24, 2015), <http://www.nowhabersham.com/banks-county-inherits-north-carolinas-coal-ash/>.

<sup>104</sup> Notification, *supra* note 79.

<sup>105</sup> *Id.*

<sup>106</sup> Central Electricity, *supra* note 77.

<sup>107</sup> *Id.*

requires utilities to store CCRs in silos with a separate access road for ease of transportation.<sup>108</sup> Utilities are also required to bear the cost of transportation of coal ash to sites within 100 kilometers of the thermal power plants that are manufacturing coal ash products or using coal ash products for road construction or soil conditioning.<sup>109</sup> Because India's plan outlines specific measures utilities must take to ensure beneficial use, coal ash generators can easily understand what is expected of them and are not afforded leeway to escape regulations by pleading ignorance.

Although India failed to reach the lofty goal set by MoEFCC in 1999, the ministry has continued to amend the original notification to update the prescribed targets for its fly ash utilization plan.<sup>110</sup> India's current level of utilization of 55.69% is much higher than levels prior to the release of the notification, which amounted to less than 10% in 1996 and 1997.<sup>111</sup> Furthermore, India's most recent amendment puts the onus of ensuring beneficial use largely on utilities that burn coal for energy.<sup>112</sup> While India is making improvements, it still has many issues to address within its program, such as problems with enforcement of the notification as well as public concerns about safety of the substance.<sup>113</sup>

#### *D. Problems with the Indian Plan*

Although the Indian plan appears to be the ideal solution, there have been some hurdles in its implementation. First and foremost, if coal ash products become a viable alternative to other construction materials, many industries, namely clay brick makers, stand to suffer substantially. This appears to be a primary reason that India's plan has faced pushback from stakeholders.

Another area of concern comes with the mechanism of enforcement of the notification. As indicated from the 2014 complaint filed by the Nashik Fly Ash Bricks Association, many contractors have continued to use clay bricks for construction projects, even within the 100 km radius from thermal power

---

<sup>108</sup> Notification, *supra* note 78.

<sup>109</sup> Central Electricity, *supra* note 77.

<sup>110</sup> *Id.*

<sup>111</sup> *Id.*

<sup>112</sup> See Amendment to MOEFCC Utilisation of Flyash from Coal or Lignite Based Thermal Power Plants Notification S.O. 763(E), 2016, Gazette of India, pt. II sec. 3(ii) (Jan. 25, 2016).

<sup>113</sup> In March of 2014, the Nashik Fly Ash Bricks Association filed a complaint against MoEF alleging that they have not implemented notifications relating to the utilization of fly ash and that widespread manufacturing and use of red clay bricks continues to persist, even in the mandatory use zones near thermal power plants. See *Nashik Fly Ash Bricks Association v. MoEF et al.*, (J) Appln. No.16 of 2013 (WZ).

plants mandated for use of coal ash bricks only.<sup>114</sup> The most recent coal ash amendment states, “[i]t shall be the responsibility of all State Authorities approving various construction projects to ensure that Memorandum of Understanding or any other arrangement for using fly ash or fly ash-based products is made between the thermal power plants and the construction agency or contractors.”<sup>115</sup> For India’s plan to succeed, State Authorities can no longer turn a blind eye to blatant violations of the notification.

While some of the blame should be placed on monetary interests and lack of enforcement, there is also difficulty in overcoming the stigma that comes with coal ash products.<sup>116</sup> Since people know that coal ash itself is a harmful substance, many believe that products derived from coal ash pose the same threat.<sup>117</sup> The reality of coal ash products is quite the opposite, as EPA studies have shown that the amount of harmful substances that leach from concrete made with fly ash is actually less than the amount leached from concrete made without fly ash.<sup>118</sup> If India’s target of 100% beneficial utilization is to be attained, this notion must be adequately communicated to stakeholders and citizens so that unfounded fears may be dispelled.

#### *E. Why the United States Must Adapt and What We Can Learn from India*

The United States must follow India’s example not only for the purposes of protecting its citizens and the natural environment against the dangers of CCRs, but also to assist in the industry shift from coal to natural gas. While natural gas does have some drawbacks, it has still proven to be a cleaner and cheaper energy source than coal.<sup>119</sup> Furthermore, facilitating a shift to natural gas would assist the United States in honoring the carbon reduction commitments made at the United Nations Framework Convention on

<sup>114</sup> *Id.*

<sup>115</sup> See Amendment to MOEFCC Utilisation of Flyash from Coal or Lignite Based Thermal Power Plants Notification, *supra* note 112.

<sup>116</sup> Ed Dodge, *Can Coal Fly Ash Waste Be Put to Good Use?*, BREAKING ENERGY, <http://breakingenergy.com/2014/02/18/can-coal-fly-ash-waste-be-put-to-good-use/>.

<sup>117</sup> *Id.*

<sup>118</sup> See Barbara Horwitz-Bennet, *The Truth About Fly Ash*, GREEN BUILDER MEDIA (Feb. 6, 2015), <http://www.greenbuildermedia.com/buildingscience/the-truth-about-fly-ash>. See also U.S. ENVTL. PROT. AGENCY, EPA-600/R-09/151, CHARACTERIZATION OF COAL COMBUSTION RESIDUES FROM ELECTRIC UTILITIES LEACHING AND CHARACTERIZATION DATA (2009).

<sup>119</sup> Compared to the average new coal plant, natural gas emits 50% to 60% less carbon dioxide when combusted in a new, efficient natural gas power plant. See *Cost and Performance Baseline for Fossil Energy Plants Volume 1a: Bituminous Coal (PC) and Natural Gas to Electricity Revision 3*, U.S. DEP’T OF ENERGY: NAT’L ENERGY TECH. LAB., OFF. OF FOSSIL ENERGY (2015), [https://www.netl.doe.gov/File %20Library/Research/Energy %20Analysis/Publications/Rev3Vol1aPC\\_NGCC\\_final.pdf](https://www.netl.doe.gov/File%20Library/Research/Energy%20Analysis/Publications/Rev3Vol1aPC_NGCC_final.pdf).

Climate Change.<sup>120</sup> The nation missed an opportunity to invest in clean and cheap renewable energy at the height of the 2008 recession, and the United States must now use its natural gas stores as a bridge to renewable energy.<sup>121</sup>

One area of Indian policy that the United States could certainly emulate is the requirement that coal ash producers make CCRs available free of charge. Currently, utilities in the United States sell the ash to companies that specialize in production of materials such as Portland cement, synthetic gypsum, and concrete, but why should utilities make a profit off of substances that are otherwise bound for landfills and impoundments?<sup>122</sup> Allowing such a practice only raises the price of coal ash products, which further impedes beneficial use. By switching to a scheme that places an emphasis on beneficial use, the United States can kill two birds with one stone by blazing a path toward renewable energy and ridding the country of the harmful coal ash problem it currently lives with.

## V. CONCLUSION

Regardless of whether the suggested changes are the most ideal solution to the United States and Georgia's coal ash problem, there is no disputing that a management scheme emphasizing beneficial use is the most ideal way to protect both humans and the environment. Traditionally, U.S. governmental bodies have eschewed regulation because CCRs are produced in significant quantities and would be very expensive to manage under Subtitle C of the RCRA. The recent changes at the federal and state levels are a good start, but if future generations are to be protected, change must continue. As evidenced by India, pivoting from a management scheme that prioritizes minimizing costs to a scheme that places a primary focus on beneficial use is not easy, but nothing worthwhile is ever simple.

---

<sup>120</sup> See Paris Agreement, art. 2.1, Dec. 12, 2015, [http://unfccc.int/files/essential\\_background/convention/application/pdf/english\\_paris\\_agreement.pdf](http://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf).

<sup>121</sup> Nobel laureate economist Joseph Stiglitz stated that the United States missed its opportunity to invest in clean energy infrastructure when the housing market crashed in 2008. Stiglitz believes this would have had a two-fold effect of reducing income inequality while also stimulating the global economy. See David Biello, *Zero Carbon or Bust*, SCI. AM. (July 13, 2015), <https://www.scientificamerican.com/article/zero-carbon-or-bust/>.

<sup>122</sup> *Coal Combustion Residuals*, *supra* note 3.