

# **Environmental Justice Concerns Associated with Potential Coal Ash Sites in North Carolina**

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ENEC 698

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December 13, 2016

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## Introduction

Coal ash is a byproduct of electricity generation at coal-fired power plants. Plants in North Carolina produce approximately 5.5 million tons of coal ash annually (Evans & Lisenby, 2012). Duke Energy owns 14 active and retired coal-fired power plants in the state of North Carolina. These 14 sites encompass 32 coal ash basins containing an estimated 108 million tons of coal ash (Jacobs & Birdwell 2014). The environmental and human health concerns with coal ash revolve around its toxicity – coal ash contains heavy metals such as hexavalent chromium, arsenic, lead, and mercury. Scientific studies have found that these carcinogens can leach out of coal ash basins and contaminate drinking water in surrounding areas.

On February 2, 2014, a drainage pipe broke and leaked 82,000 tons of coal ash from the Dan River Steam Station's coal ash pond into the Dan River in Eden, North Carolina (Rodriguez, 2016). This spill prompted the passage of the Coal Ash Management Act of 2014, which addressed the environmental risk posed by coal ash by requiring Duke Energy to clean up their coal ash basins. Looking for a cheap way to essentially re-dispose of the coal ash, Duke Energy contracted out two clay mines to dump coal ash into as a 'beneficial re-use' project. These two mines are Brickhaven Mine in Chatham County and Colon Mill Mine in Lee County. Combined, they have a capacity for around 20 million tons of coal ash (Downey, 2015). Duke Energy has been considering using other clay mines around the state to dispose of more coal ash. This study examines the demographics of people living around those other 93 clay mines to see if any minorities, low socio-economic status individuals, or otherwise disadvantaged groups of people would be disproportionately impacted by the re-location of coal ash. In other words, what are the environmental justice implications regarding race and socioeconomic status from the potential coal ash sites in North Carolina? Are there cumulative effects or impacts from other TRI sites?

## Literature Review

### *Environmental Justice*

A review of the relevant literature begins by looking at the concept of environmental justice itself. The idea that some model of justice applies to human interaction with the environment is a relatively new and developing area of study, first proposed in the 1980's following events that occurred in Warren County, North Carolina. The location of a toxic waste dump for Polychlorinated biphenyl (PCB) was forced upon the tiny community of Alton in Warren County. This community was 84% black at the time, had high rates of poverty, and was largely politically powerless to resist the landfill (Bullard and Wright, 2008). Residents of this community were sentenced to this toxic prison for over two decades until the hazardous material was finally removed in 2002. This environmental mistreatment of a largely minority community triggered the environmental justice movement across the US. Within academic literature, the premier scholar is Robert Bullard. His work focuses on environmental justice mostly through the lens of legacies of racism and classism that restrict the ability for African-American and low-income people to "have a seat at the table" when decisions are made that are likely to impact them. He identifies the principles of environmental justice to be an equitable distribution of environmental decision-making power that serves the interests of *all* people, in order to ensure equal protection under environmental laws and policies that evenly distribute consequences (Bullard, 2007).

The EPA provides a similarly broad definition of EJ that calls for "fair treatment and meaningful involvement" of all racial and socioeconomic groups in environmental decision-making. Although these definitions of environmental justice inform the moral requirement for equitable treatment and distribution, putting this principle into practice can prove to be challenging. The ambiguous nature of principles such as "fairness" makes it difficult to determine when an action can be classified as "unfair", especially within the scope of scientific research. The availability of clear parameters defining what constitutes populaces that are vulnerable to such unfair environmental action is limited. One of the only regulatory agencies with such criteria is the Massachusetts Office of Energy and Environment Affairs,

which defines an EJ community as a block group with annual median income equal or less than 65% of the state median, or 25% or more residents identifying as minority, or 25% or more households classified as limited English proficiency. We used these criteria in the methodology of our study since no such standards are defined by the EPA or the state government of North Carolina.

### ***The Dangers of Coal Ash***

The placement of storage facilities for coal ash provides the potential for environmental justice concerns due to its associated health effects. An independent report from the advocacy group Physicians for Social Responsibility demonstrates the dangers of coal ash to human health when inhaled or ingested. It contains toxicants such as Arsenic, Boron, Chromium, Lead, Mercury, and Selenium, which have neurotoxic and carcinogenic effects on humans. Case studies included in the report found that levels of these toxicants near coal ash sites were anywhere from 73 to 1800 times higher than Federal drinking water standards (Gottlieb, Gilbert and Evans, 2010). This threat to human health is identified by the EPA as justification for greater regulation on effluents from electric power plants (EPA 2013), as well as the North Carolina Department of Environmental Quality in their recent mandates for groundwater testing near coal ash sites (NC SB729, 2014).

These regulations come as a result of evidence showing that the toxic metals present in coal ash are able to leach into groundwater near holding ponds. A study by Vengosh, Harkness, and Sulkin demonstrates the process by which coal ash toxicants leak from the 32 existing sites into nearby surface and shallow groundwater (2016). They find limited evidence proving that toxicants leach into drinking wells which typically extend into deep groundwater, but claim that the potential for human harm still exists. This places communities located nearby coal ash holding sites at considerable risk for ingestion of harmful toxic metals and risk of serious health impacts. When mandated to test drinking wells located within 1000 feet of their existing pits, the NC Department of Water Resources classified 95% of the 304 wells tested as “Do Not Drink” due to levels of contaminants higher than the Federal or North Carolina drinking water standards (NCDEQ, 2015). Although much of the focus on the environmental and health impacts of coal ash pits comes from the threat of catastrophic spill, these findings imply a significant passive threat to nearby residents and ecosystems. The assumption that coal ash storage under current management strategies threatens nearby communities is vital for our inspection of proposed relocation plans.

Applying an environmental justice perspective to these impacted communities is necessary to ensure that inequitable distribution of coal ash-related hazards is not occurring. There exists scarce academic research on the makeup of communities located nearby existing sites in North Carolina. The only empirical study existing on this topic is a non-peer-reviewed analysis conducted by Libbie Weimer of the 32 existing sites and 2 proposed mine reclamation sites. She finds that 5 of the existing sites, and 1 proposed site, trigger environmental justice concerns for disproportionate effect on minorities (Weimer, 2016). Weimer’s study serves as the foundation for the methodology for our own analysis. We followed many of her recommendations such as expanding the sample to include other potential mine reclamation sites, including a closer 0.5 mile buffer, as well as inspecting cumulative impacts from TRI sites.

### ***CAMA and Site Closure***

Following the Dan River spill disaster in 2013, the government of North Carolina took action to mitigate future damage through the enactment of the Coal Ash Management Act (CAMA). Among other purposes, the CAMA prohibits the construction or expansion of “coal combustion residual surface impoundments”, and mandates the closure of all existing impoundments by as soon as 2019 for “high-risk” sites and no later than 2029 for intermediate and low-risk sites. Although controversial for its loopholes and lack of strict enforcement especially for low-risk sites, this act represents the first step

towards rectifying decades of mismanagement by ensuring greater groundwater monitoring and closure of coal ash ponds (Goemann, 2015). As designated in the act, closure of coal ash ponds must occur according to one of two methods. The first option is disposal in a traditional landfill with a composite liner and cap system, either onsite or relocated to an existing landfill. The second option is for relocation of the coal ash to a structural fill project, or for some other “beneficial reuse”. As discussed later, structural fill and beneficial reuse projects have differing permitting and regulatory requirements that can influence their selection. Clay mine reclamation projects like those we inspect in this study are classified as beneficial reuse, although the proposed plans for these projects closely mirror the standards set for landfill or structural fill projects.

### ***Beneficial Reuse Regulations and Definitions***

As the focus of our project is centered around analyzing coal ash relocation sites that have been slated as beneficial reuse mine reclamation, it is important to delve deeper into what exactly that phrasing entails. The North Carolina Coal Ash Management Commission compiled a report describing what exactly is meant by beneficial reuse, and its applications in practice. As the 32 current coal ash disposal ponds are being subjected to closer scrutiny following the Dan River incident, and the 2104 Coal Ash Management Act, alternative forms of disposal and storage are being tested. The Coal Ash Commission treats coal ash as a material for reuse as opposed to a waste product for disposal. Beneficial reuse is classified as being used for projects that “promote public health and environmental protection.” In 2000 the EPA determined that coal ash does not qualify as a hazardous waste, which opens up the opportunity for it to be used in various projects instead of simply being disposed of, specifically it is classified as a Subtitle D solid/non-hazardous waste.

The coal ash commission suggests that coal ash can be used in an environmentally sound manner, and provide benefits such as a reduction in greenhouse gas emissions, reduced need for landfills, and reduced use of resources. In addition, the economic benefits can include reduced disposal costs, job creation and reduce in materials needed for disposal. Coal ash in mine reclamation is described by the commission as being useful as an agricultural supplement that creates artificial soil. They argue it promotes vegetation growth, improves quality of nearby lakes and streams, and aids in the re-establishment of wildlife populations to these sites. Coal ash is used in these sites as a fill material that seals the mine to prevent surface water contamination. However, they also point out that there is the potential for groundwater contamination, but say that can be mitigated by applying the ash above the water table. According the commission, application of coal ash into active or abandoned coal mines is not covered by the Final EPA Rule, and reclamation projects other than coal mines are treated as a structural fill.

Structural fill means using coal ash as a replacement for other materials as a mixer with soil/earthen materials. It also involves ash used in concrete that is then used for construction projects, such as the Asheville Airport runway. Coal ash is cheaper than other materials that can be used for these projects, in this case Duke provided it at no charge for the airport. A protective liner is required for coal ash use in embankments, and proper upkeep must happen to ensure that there is no erosion and leakage of coal ash into the surrounding environment (CAMA, 2015).

Despite the broad claims made by the Coal Ash Commission, there is little scientific evidence in the literature they provide to backup their claims that coal ash can help rehabilitate these sites. The important takeaways are that, due to the EPA ruling that coal ash is non-hazardous, disposal in non-landfill structures is legal. The EPA’s Office of Resource Conservation and Recovery, which is responsible for laying out the step by step process for permitting both landfills and beneficial reuse sites. The process for landfill permitting can take up to two years, while the process for sites such as mine reclamation can be as short as 4 months. In addition, there is no federal regulation for beneficial reuse sites, instead it is up to the

states to determine how rigorous they want their regulations to be (EPA, 2015). This raises obvious concerns, as state environmental regulations are notoriously less stringent than federal ones.

### ***Concern with Relocation***

The Blue Ridge Environmental Defense League (BREDL) released an extensive report detailing the potential concerns over the coal ash relocation sites. First and foremost, they reject the idea that the projects are actually mine reclamations at all. 70% of the land slated for these reclamation sites had never previously been mined, which would undermine the claims by the Coal Ash Commission of the rehabilitation aspects of mine reclamation. If there was no mine to begin with, there is nothing to rehabilitate. BREDL also found no positive environmental, or public health benefits that would come from the relocation, and argue that use of these areas would incur worse environmental damage, as there has been a natural takeover by various wildlife and vegetation. The placement of coal ash would result in destruction of these environments and surrounding water sources

The proposed relocation sites would be protected with a single liner system. These liners have a warranty of five years, meaning that the likelihood of degradation after that time would increase, and there would be very little means to fix it after the coal ash is already in place. Although coal ash is listed as a non-hazardous waste, BREDL argues that the heavy metals contained within it will create serious concern for groundwater and soil contamination.

They also argue that there will be a disproportionate burden of these potential health and environmental impacts placed on the surrounding communities, especially schools and daycare facilities that are located near the sites. There is also concern for environmental justice issues with these sites, as the Colon and Brickhaven areas in North Carolina that are to receive coal ash have higher percentages people of color than the counties they are located in (BREDL, 2015). BREDL also provided previous examples of environmental justice issues surrounding coal ash relocation. In 2008, a coal ash spill in Kingston, Tennessee produced four million cubic yards of ash that were relocated to a solid waste landfill in Alabama. The area where the spill occurred was 94% white, and the relocation site in Alabama was 68% African American. The existence of precedent cases such as this are important to consider, as they provide justification for concern over the potential environmental justice triggers of relocation sites (BREDL, 2014).

### ***Gaps in the Literature***

As we move forward into our research, the gaps in the available literature on coal ash and coal ash relocation will help provide a roadmap of how to proceed. First and foremost, there is no research available on the proposed coal ash relocation sites and potential environmental concerns. No demographic data has been compiled to determine whether there would be an issue with relocation. Additionally, there is little research on coal ash in North Carolina at all, outside of the Weimer study. The precedence of her research gives us the parameters we are to use in our own study, with the use of .5, 1 mile and 2 mile buffers when gathering demographic information. Finally, there is an absence of standardized guidelines on what exactly qualifies as an environmental trigger. There are no EPA or NC standards for what percentages of low income or minority populations would qualify as triggering environmental justice concerns, so for the sake of our own research we use what standards are available in previous state studies, in this case Massachusetts.

## **Methods**

The potential coal ash relocation sites were found from the North Carolina Environmental Quality's (NCDEQ) Division of Energy, Mineral and Land Resources (2012). NCDEQ provided useful information for each potential site, including the latitude and longitude location, permit number, location name, county, mine status, and total acreage for each site. Ninety-three relocation sites were further

analyzed using an online research tool called the Environmental Justice Screen (2016), which provided information about the population and environment surrounding each site. The EJ screen (2016) is an online mapping tool created by the Environmental Protection Agency (EPA) and provides data regarding demographic and environmental variables. The demographic variables considered include percent minority, low income, in linguistic isolation, with less than a high school education, under the age of 5, and over the age of 64. The environmental variables considered include particulate matter in air, ozone in air, diesel particulate matter level in air, cancer risk from inhalation of air toxics, NATA respiratory hazard, traffic proximity and volume, lead paint, proximity to superfund sites, risk management plan facilities, hazardous waste management facilities, and proximity to major discharges to water. The EJ screen tool was used by searching the latitude and longitude of all 93 relocation sites.

A 0.5-mile, 1-mile, and 2-mile buffer was applied to each site and the data provided were recorded. The decision to observe the sites at three buffer zones was by recommendation from the Weimer study (2016). Having multiple buffer zones provided a better representation of the population and environment surrounding each of the 93 sites. After the data collection, the data was analyzed using different thresholds. For most of the demographic and environmental variables, the state averages for each were used as the thresholds, which was also provided on the EJ screen. In addition to state averages, the Massachusetts Standards (2002) were also used for variables like minority and low income. The Massachusetts study defined minority populations as those having above 25% minority out of the total population, and defined low income as a population with a median income less than 65% of the state median income (2002). These thresholds, 25% minority and median low income less than 65% of the state median income, were used for observing environmental justice triggers for the 93 sites. Because the EJ screen did not include data for median income, further research had to be done to collect this information.

To spatially analyze the data ArcGIS was used. Demographic data, incomes and minority populations were collected from the 2014 American Community Survey (ACS). Transportation data, major roads and railways, were downloaded from the North Carolina Department of Transportation (NC DOT). Major waterways of North Carolina were downloaded from the North Carolina Flood Risk Information System (NC FRIS). Latitude and longitudes of potential coal ash relocation sites from NCDEQ were uploaded to ArcMap on top of a basemap of North Carolina from the Census. A buffer analysis was performed where the two-mile buffers were color coded to show areas where environmental justice triggers were found. These sites were mapped with the major waterways and transportation hubs to show environmentally sensitive areas and population hubs respectively.

The toxic release inventory (TRI) is an EPA regulated data set that includes the toxic chemicals released into land, waterways, or recycled on site by industrial and federal facilities. These data were used to show cumulative environmental impacts on the triggered communities at the recommendation of Wiemer. All TRI sites in North Carolina were mapped with the potential coal ash sites.

## **Results**

### ***Demographic and Economics***

Of the 93 proposed sites, 81 of those sites met either the low income or high minority population thresholds, and 31 of those sites met the low income and high minority population thresholds. Observing either threshold, 87% of the sites are in potential environmental justice areas, and observing both accounts for a third of the total sites.

Also, out of the 93 proposed sites, 11 of the sites met both the low income and high minority population thresholds as well as showed an increase in the percentage of the population that were white as the distance from the site increased. This indicates a greater likelihood of disproportionate impacts for the minority populations. These 11 sites, located in Alamance (2), Anson (1), Harnett (3), Lee (2), Montgomery

(1), Rowan (1), and Wake County (1), are considered the sites with the highest potential for being environmental justice concerns.

### ***Railways and Waterways***

Many of the proposed coal ash relocation sites are also near railways to make transporting the coal ash more efficient in the least cost way, as well as near waterways. Of the 81 proposed sites that meet low income or minority population thresholds, 53 of those sites are within two miles of a railway. Of the 31 sites that meet low income and minority population thresholds, 22 of those sites are within 2 miles of a railway. Lastly, of the 11 sites with the highest potential for being environmental justice concern, 9 of those sites are within 2 miles of a railway. Of these 11 sites, 8 of them are also within a half mile up to just 100 feet of open water or areas with a high annual flood risk of 2%.

### ***Cumulative Impacts and Children***

Many of the areas surrounding the proposed coal ash relocation sites have cumulative impacts stemming from TRI facilities. Of the 11 sites with the highest potential for being environmental justice concerns, 5 sites, or roughly 45%, have at least one TRI site located within two miles. Of the 31 proposed sites that meet the low income and minority population thresholds, 17 of those sites, about 55%, have one or more TRI sites within two miles of the site. Finally, of the 81 proposed sites that meet the low income or minority population thresholds, 37 of those sites, about 45%, have one or more TRI sites within two miles of the site. So, regardless of how the threshold requirements are approached, 45-55% of proposed sites have areas around them which already face impacts from TRI sites being located nearby.

Additionally, many of the proposed coal ash relocation sites are in areas that have a disproportionately high amount of children compared to the state. We considered areas that had a percentage of children at or above the 80<sup>th</sup> percentile in the state, about 67% higher than the state average, to have a disproportionately high amount of children. Of the 11 sites with the highest potential for being environmental justice concerns, 3 sites, or roughly 27%, have a disproportionately high amount of children. These were sites, 1, 38, and 82 (Hanford Brick Company, Treadmont Inc., and Boral Bricks Inc.).

Of the 31 proposed sites that meet the low income and minority population thresholds, 9 of those sites, which are about 29%, have a disproportionately high amount of children. And finally, of the 81 proposed sites that meet the low income or minority population thresholds, 22 of those sites, which are about 27%, have a disproportionately high amount of children. A summary a little more than 25% percent of the sites have a disproportionate number of children living in the surrounding area, who also have a high likelihood of experiencing potential effects from TRI sites that are already located nearby.

### ***Limitations***

In the Massachusetts study childhood asthma rates and linguistically isolated populations were two pillars of the findings. We were unable to obtain data on childhood cancer and asthma rates; this data is imperative in determining the severity of the situation due to the danger heavy metals posed when consumed by children.

The EPA standard for linguistically isolated populations is extremely vague, it is defined as if anyone in a household over the age of 14 speaks English “pretty well” their entire household is considered not to be linguistically isolated (EJSCREEN). “Pretty well” is not a scientifically quantifiable measurement. There also exists a gap in linguistic data due to the undercounting of vulnerable communities of undocumented immigrants, making these populations unquantifiable. There were also 10 environmental variables from the EPA that we observed but none of them were significant to our findings do to.

The manner in which we measured for low income populations could have been done differently. We settled on the standard for the Massachusetts study which is <65% of the state median income and considered an area low income if any part of the .5 mile, 1 mile or 2 mile buffers intersected any part of the low-income block.

## **Conclusion and Recommendations**

From our research we have concluded that 87% of the 93 proposed sites are above our threshold for either being high minority (>25% minority population) or low income (<65% median North Carolina income) populations and 33% of the sites are above our threshold for both of these variables. Since this is a sufficient portion of the sites, if used, environmental justice issues will arise.

In the future we recommend expansion upon our limitations to include linguistic isolation, cancer, and childhood asthma rates as environmental justice triggers, as in the Massachusetts study (2002). A more efficient measure of linguistics should be developed. We also recommend that future research of the areas surrounding the proposed pits consider ecological issues beyond environmental justice that were beyond the scope of our study. A particularly imperative example would be taking into account the proximity of the pits to existing water sources. As shown in the Vengosh study, the dangers of coal ash contaminating groundwater generate health concerns. Since many of these sites are located in rural areas where well water is a pertinent drinking source, this is a crucial variable (Vengosh et al.). Our final recommendation is in regards to the recent agreement between the Yadkin Riverkeepers and Waterkeepers Alliance and Duke Energy, requiring that the coal ash be recycled into concrete onsite at the Buck facility located in Salisbury, North Carolina (Siobahn). With the current transition in North Carolina's political climate following the election of Roy Cooper as governor, this is may be a potentially feasible alternative to using the abandoned clay mine pits as storage sites.

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