MOBILE BAYKEEPER POLLUTION REPORT:
Coal Ash at Alabama Power's Plant Barry

Prepared By:

Mobile Baykeeper
Casi Callaway, Executive Director
Cade Kistler, Program Director
Laura Jackson, Program Coordinator

Waterkeeper Alliance
Pete Harrison, Staff Attorney

Southern Environmental Law Center
Keith Johnston, Managing Attorney
Christina Andreen, Staff Attorney

Mobile Baykeeper
450 C Government St
Mobile, Al
36602
www.MobileBaykeeper.org

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1. EXECUTIVE SUMMARY

Mobile Baykeeper's mission is to provide citizens the means to protect the beauty, health, and heritage of the Mobile Bay Watershed and our coastal communities. One of the ways we do this is by ensuring responsible growth - engaging early in policy and planning efforts and closely monitoring industrial projects affecting the Watershed. As a result of coal ash pond dam failures around the nation and new federal regulations, Mobile Baykeeper opened an investigation into Coastal Alabama's primary power plant, Alabama Power's Plant Barry in 2015. Findings from initial reviews provided a basis for concerns about the **ongoing pollution** and the risk of a **catastrophic collapse** of the coal ash pond dam. Mobile Baykeeper began working with Waterkeeper Alliance and the Southern Environmental Law Center (SELC) to rigorously sample, analyze, and investigate the pond. The investigation includes site visits, records review, aerial surveillance, and water and sediment sampling. This report outlines those findings and clearly illustrates how Alabama Power's coal ash pond at Plant Barry threatens the health, way of life, environment, and economy in coastal Alabama

Alabama Power stores more than 21 million tons of toxic coal ash at Plant Barry in a 597-acre pond adjacent to the Mobile River and in the heart of the Mobile-Tensaw Delta, one of the most biologically diverse ecosystems in the nation. The ash pond was built in 1965 – ten years after coal began being burned to generate power at Plant Barry. It is unlined, with no protective barrier to prevent groundwater contamination and is held back from the Mobile River by a dam built of dirt, clay, and even coal ash. Toxic chemicals are contaminating groundwater and seeping into the Mobile River. As seen from other dam failures across the country, these facilities have the potential to spill tons of coal ash into area waterways greatly impacting our local communities' ability to swim, fish, hunt, boat, and work.

This report presents the wealth of evidence that has been collected and, based on this evidence, makes a recommendation to close the pond at Plant Barry. In contrast to Alabama Power's preliminary decision to leave the coal ash by the river and "cap-in-place', we strongly recommend to dig up the toxic coal ash and move it to an upland, lined landfill away from area waterways.

The report finds three major issues with the ash pond:

1) ***Inappropriate Storage Location:*** There is strong evidence that the ash pond's location is unsuitable for waste storage and coal ash disposal.

   - The ash pond is located in a low-lying, swampy and often flooded area mere feet from the Mobile River within the Mobile-Tensaw Delta.
   - The ash pond was constructed on top of Sister's Creek, a creek that once naturally flowed through the site.
   - It is surrounded by environmentally sensitive wetlands that contain highly permeable soils.
   - The ash pond falls within the 100-year floodplain.
   - It sits above particularly shallow groundwater tables.
   - The ash pond is less than one mile away from the backup source of drinking water for more than 250,000 people as well as thousands of businesses in Mobile and the Eastern Shore of Baldwin County.

2) ***Ongoing Water Pollution:*** Field investigations conducted over a two-plus year period have demonstrated evidence of **ongoing** and **illegal** pollution leaking from the ash pond at Plant Barry.

   - Alabama Power's own federally required groundwater monitoring and testing have repeatedly found significant levels of arsenic, selenium, lead, and other heavy metals leaking out of the pond since at least 2016.
   - Mobile Baykeeper's sampling analyzed by an independent lab on four separate occasions revealed that harmful pollutants (lead, selenium, vanadium, barium, cadmium, cobalt, manganese, and arsenic) were present above levels set by the Environmental Protection Agency (EPA) to protect human health and the environment.
   - Coal ash has also been found floating in around the ash pond site. Mobile Baykeeper collected two samples that were sent to an independent lab for laboratory analysis. Both samples taken in 2016 and 2018 were confirmed to have as much 55 - 80% fly ash.

- Many of these pollutants have *known* toxic effects on humans. For example, **arsenic** is a known carcinogen that causes multiple forms of cancer in humans and **lead** is a potent neurotoxin, highly damaging to the human brain and nervous system.

3) ***Potential for Dam Failure:*** Coal ash ponds throughout the nation have had failures. Each failure has cost upward of $1 billion for cleanup, and had significant negative impacts to the health of local communities, nearby property values, and the local environment. Mobile Baykeeper contracted a dam safety expert to study the earthen dam at Plant Barry. Quotes from the Burgess Dam Safety Report included herein express multiple areas of concern with Plant Barry's dam closure decision to cap-in-place:

   - Flooding - "The flood risk assessment…concluded that the resulting water level within the Barry ash pond would rise to less than half an inch of the top of the dike. This is a razor-thin margin of error."

   - Groundwater - "Groundwater seepage through the ash pond and into Mobile River will continue even if the ash pond is capped and closed in place."

   - Erosion – "The Mobile River will eventually meander through the Barry ash pond unless significant erosion protection measures are implemented to prevent this from occurring…It will be very difficult to ensure that these measures are implemented and effective over such a long time frame."

Ash Pond Closure Recommendation:

The evidence contained in this report clearly demonstrates that capping the ash pond in place, as recommended by Alabama Power, is not a viable solution. Capping in place will allow groundwater to continue to leak from the ash pond and present a risk of catastrophic spillage of 21 million tons of toxic coal ash into Mobile River. These issues endanger health across Alabama's coastal communities – their ability to swim, fish, work, and play – now and for future generations. Capping the ash pond in place will also have significant negative economic impacts and harm the Delta and Mobile Bay. Based on this evidence, the only responsible choice for the community and environment of Coastal Alabama is to dig up the coal ash and move it away from the Mobile River to an upland, lined landfill.

2. INTRODUCTION


Figure 1. Aerial of the Mobile-Tensaw Delta.

Deep in southern Alabama, the Mobile and Alabama Rivers intermingle to form the Mobile-Tensaw Delta, a 40-mile-long braid of rivers and bayous that spreads across 400 square miles of cypress swamps and bottomland forests before finally converging to form Mobile Bay. Known as North [America's Amazon] for its unrivaled biodiversity[1], the Delta is one of Alabama's most ecologically important resources in the nation. The rivers, delta, and Bay also drive the region's economy, directly supporting tens of billions of dollars of economic activity every year.[2, 3]


Figure 2. Coal ash pond located at Alabama Power's Plant Barry site directly adjacent to Mobile River

Yet, in the Delta, just 20 miles upstream from the City of Mobile, a threat looms. At Alabama Power Company's James M. Barry Electric Generating Plant (commonly known as Plant Barry), more than 21 million tons of toxic coal ash and contaminated water[4] (the equivalent of 4.28 billion gallons, 20 times more than the Deepwater Horizon BP Oil catastrophe, by volume) sits in an unlined 597-acre coal ash pond (hereinafter referred to as the "ash pond"). Built more than 50 years ago on a creek in the flood zone of the Mobile River, the pond holds enough toxic water to fill nearly 6,500 Olympic sized

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1 University of Alabama, 2013. *Southern Wonder Alabama's Surprising Biodiversity*. Book published by the University of Alabama and the Nature Conservancy, which was funded in part by the World Wildlife Federation. 2013.

2 Martin, J. C. (2007, December 5). *The Local And Regional Economic Impacts Of The Port Of Mobile* (Rep.). Retrieved March 16, 2018, from Alabama State Port Authority website: http://www.asdd.com/aspa_feis/Appendix_C_MobileImpact.pdf

3 Economic Impact 2016(Rep.). (2016). Retrieved March 16, 2018, from Alabama Tourism Department website: http://tourism.alabama.gov/content/uploads/FullFY16AnnualReport4_17.pdf

4 Alabama Power Co., *Report of Annual CCR Surface Impoundment Inspection for Plant Barry* (2017) (reporting 15,961,255 yd^3 coal ash and 240,000 yd^3 water; 1 yd^3 = 201.974 gal.).

swimming pools. The Plant Barry ash pond was built on top of a swamp[5], and has no liner[6] to prevent contaminants from leaking into groundwater and, through its earthen dam (made of dirt, sand, coal ash, and clay)[7], into the river. Data presented in this report and federally required groundwater monitoring conducted by Alabama Power irrefutably shows the ash pond is illegally leaking large amounts of dangerous contaminants (including known carcinogens[8]), into the Mobile River and groundwater every day. Equally concerning is the risk of catastrophic failure: the dam could break and release a toxic payload into the river, impacting all that lies downstream[9] including the ability of local citizens and future generations to swim, fish, play, and work.

This report summarizes the issues at the Plant Barry ash pond and the evidence collected to date including historical information about the pond, independent water samples revealing leakage from the pond, and the likelihood of and risks associated with a dam failure. The evidence presented herein demonstrates that "cap-in-place" is an inappropriate and unsafe decision for long-term storage of coal ash at Plant Barry – and ultimately, removing the coal ash away from the river and vulnerable communities - is the only way to preserve and protect the Mobile River, Delta, and Bay.

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[5] Final Report, Screening Site Inspection, Phase II, Alabama Power Company – Barry Steam Plant, Bucks, Mobile County, Alabama, EPA ID #: ALD0821148800, Prepared for TDD No. F4-9001-181, Contract No. 68-01-7346, Revision 0, for the Waste Management Division, U.S. Environmental Protection Agency (Apr. 3, 1991) [hereinafter SSI 1991]

[6] U.S. EPA (2010). *Dam Safety Assessment of CCW Impoundments James M. Barry Electric Generating Plant.* https://archive.epa.gov/epawaste/nonhaz/industrial/special/fossil/web/pdf/apc_barry_cbi_final.pdf [hereinafter EPA 2010 CCW Assessment; Alabama Department of Environmental Management (ADEM) (1994). *Hydrogeological Evaluation of Barry Steam Plant Inert Landfill.* Permit No. 49-18R, Mobile County, Alabama (May 17, 1994) [hereinafter ADEM Hydrogeological 1994; SSI 1991

[7] EPA 2010 CCW Assessment; ADEM Hydrogeological 1994

[8] Alabama Department of Environmental Management (ADEM) (2018). Enforcement in the amount of $250,000 issued by ADEM to Alabama Power Company regarding groundwater pollution emanating from the Plant Barry ash pond.

[9] Alabama Power Co. (2017). *CCR Surface Impoundment Emergency Action Plan.* Revision 0.(Apr. 17, 2017) http://www.alabamapower.com/content/dam/alabamapower/Our%20Company/The%20Environment/CCR%20Rule%20Compliance%20Data%20and%20Information/Plant%20Barry/DESIGN_CRITERIA/Emergency%20Action%20Plan%20-%20Ash%20Pond.pdf

3. BACKGROUND

3.1. Economic Impacts

The Mobile River and Mobile Bay are vital to the region's economic success. The Port of Mobile is the 9th largest port in the nation by tonnage, moving more than 64 million tons[10] of cargo every year and contributing an estimated $22 billion to the economy[11]. There are numerous services in the maritime industry and industrial facilities that operate and support the economy. Along the Port of Mobile, there are four different shipbuilding or repair facilities including Austal USA, C&G Boatworks, Signal Ship Repair, and Horizon Shipbuilding. Closer to Plant Barry, there are several chemical and manufacturing facilities that rely on the Mobile River including: AM/NS Calvert, Olin Corporation, BASF, and AMVAC Chemical, among others.

Figure 3. Aerial of the port of Mobile.

The Mobile Bay area is a popular location for recreational activities such as hunting, fishing, boating, kayaking, and more. Outdoor recreation in Alabama contributes more than $7.5 billion to the state's economy through direct consumer spending, supports 86,000 direct jobs and adds $494 million to state and local tax revenues.[12]

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10 U.S. Army Corps of Engineers, *Waterborne Commerce of the United States, Part 5, National Summaries* (New Orleans, LA: Annual Issues), tables 1-1, and 5-2, available at http://www.navigationdatacenter.us/wcsc/wcsc.htm(link is external) as of May 11, 2016.

11 Martin, J. C. (2007, December 5). *The Local And Regional Economic Impacts Of The Port Of Mobile* (Rep.). Retrieved March 16, 2018, from Alabama State Port Authority website: http://www.asdd.com/aspa_feis/Appendix_C_MobileImpact.pdf

12 Allen, Tom, and Rob Southwick. *The Outdoor Recreation Economy: Technical Report on Methods and Findings*. Outdoor Industry Association/Southwick Associates, 2012, *The Outdoor Recreation Economy: Technical Report on Methods and Findings*, www.outdoorindustry.org/pdf/OIA-RecreationEconomyReport2012-TechnicalReport.pdf.

Mobile Bay and surrounding coastal areas are vital to Alabama's seafood industry supporting fisherman, seafood processing plants, and local restaurants. The tourism industry is a major contributor to the economic vitality of the area. More than eight million people visit Mobile and Baldwin Counties and spend nearly $4.5 billion combined to visit scenic beaches, bays, and adventure on the Delta.

Figure 4. Commercial fishing vessel in Mobile Bay.

Additionally, the Mobile River is the backup drinking water supply for Mobile and Baldwin Counties (250,000 people and thousands of businesses) and the drinking water intake sits **less than one mile** upsteam of the coal ash pond at Plant Barry. Clearly, the Mobile River is the backbone of the local economy and quality of life.

3.2. The Coal Ash Problem

Coal ash is the toxic material leftover when coal is burned. It is made up of heavy metals and chemicals such as arsenic, mercury, and selenium that do not combust and go out of the stack. More than 500 coal-fired power plants in the nation collectively produce more than one billion tons of coal ash *every year*. All of this ash has been stored for decades in on-site landfills or on-site wet storage ash ponds (also referred to as coal ash pits, lagoons, or impoundments) – many of which are located alongside the nation's waterways. Because they were built in the 1950's, a time when there was little knowledge about the implications of coal ash, the ponds are often unlined, allowing these pollutants to leak into nearby groundwater. Ash ponds are held back from local waterways by earthen dams or dikes often made of mud and clay formed from the soil surrounding the site. Those earthen dams lack adequate safeguards against breaches – potentially spilling toxin-laden material. Catastrophic spills are not uncommon. There have been four massive spills and at least 14

Figure 5. Coal ash pulled from the bottom of Dan River in North Carolina near a Duke Energy coal ash spill. (Photo credit: Dan River Basin Association)

total spills across the nation (*See* Kingston Coal Ash Spill[13], and Dan River Coal Ash Spill[14]). In 2008, the largest spill to date occurred in Tennessee where a dam failed at the Kingston Plant, spilling more than one billion gallons of toxic coal ash[15] into the Emory and Clinch Rivers.

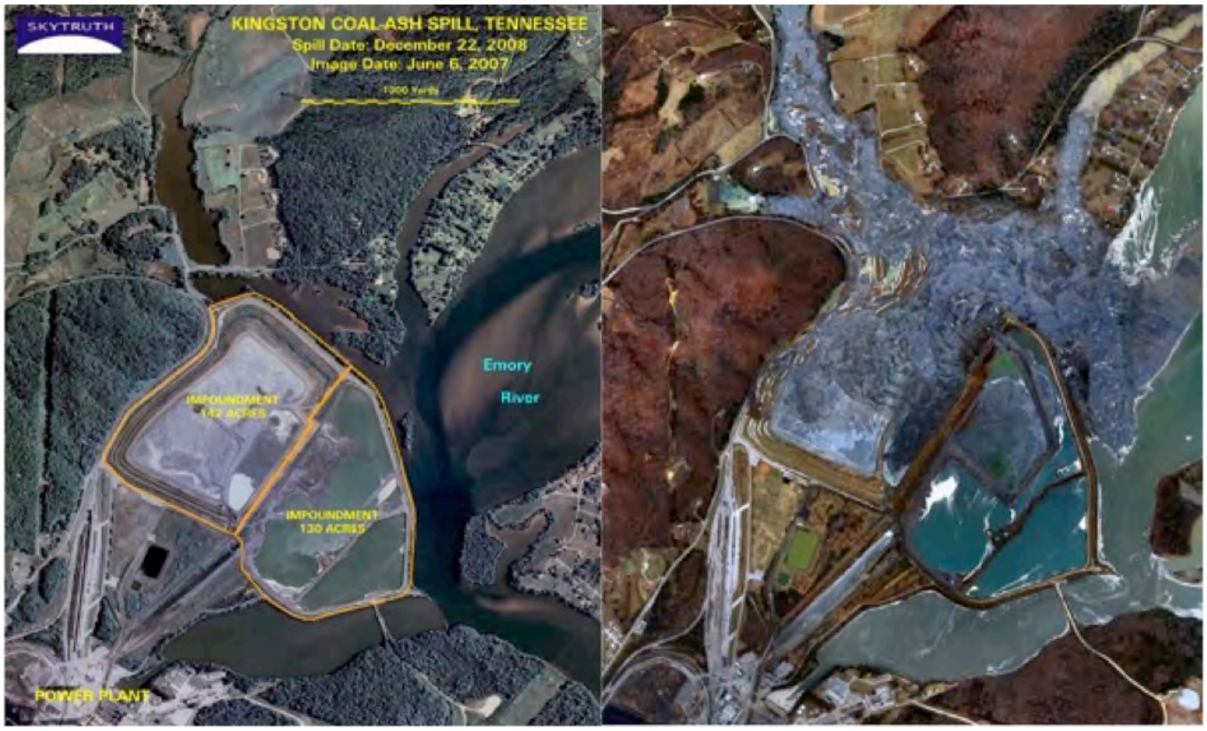

Figure 6."Tennessee sludge spills over homes, water (December 24, 2008)"-CNN. Retrieved from http://www.cnn.com/2008/US/12/23/tennessee.sludge.spill/

The spill destroyed homes and exposed people and wildlife to this toxic pollution for years. The cleanup for the Kingston spill alone has cost more than $1.2 billion and has taken almost a decade to address.

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13 Tennessee sludge spill runs over homes, water. (2008, December 24). CNN. Retrieved from http://www.cnn.com/2008/US/12/23/tennessee.sludge.spill/

14 Dan River Coal Ash Disaster: Environmental impact could take years to determine. (2015, February 14). Greensboro News & Record. Retrieved from http://www.greensboro.com/news/dan_river/dan-river-coal-ash-disaster-environmental-impact-could-take-years/article_fed5e6e8-0150-528d-a35e-c4355ba8aa88.html

15 A First-Hand Account of the TVA Coal Ash Disaster in Kingston, TN. (2008, December 28; Updated 2017, December 06). Huffington Post. Retrieved from https://www.huffingtonpost.com/dave-cooper/a-first-hand-account-of-t_b_153828.html

In response to the threat of coal ash contaminating waterways, groundwater, and drinking water, the EPA established regulations to end wet storage of coal ash and required the closure of ash pond sites. The Disposal of Coal Combustion Residuals (CCR) from Electric Utilities final rule was signed in 2015, providing a set of requirements to dispose of coal ash[16] (2015 CCR Rule).

3.3. Cap-in-Place or Excavate?

The 2015 CCR Rule requires the closure of all wet storage of coal ash in ash ponds, giving utilities two options: 1) "cap-in-place" (i.e. cover the existing coal ash where it is) OR 2) excavate the ash and place it in a properly lined, upland landfill (i.e. dig it up and move it away from the river). Each utility is given some discretion to choose the option that it prefers based on the specific design and cost to close their ash pond site.

Figure 7. Alabama Power's Plant Barry.

However, there are some weaknesses with this rule.[17] Under the rule, it is possible for the utility to base its decision on the dollar value to the utility rather than the interests of the community. According to the Center for Responsive Politics, since 2008, the year of the Kingston coal ash disaster, electric utilities have spent more than $1.3 Billion lobbying for favorable legislation on rules like the CCR rule. Of the $1.3 billion dollars spent, Southern Company, Alabama Power's parent company, spent more than $133 million, ranking first in spending eight out of ten years and second in the other two.[18]

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16 EPA announces first federal regulations for coal ash waste. (2014, December 29;). LA Times. Retrieved from http://www.latimes.com/nation/nationnow/la-na-coal-ash-regulations-20141219-story.html

17 EPA unveils first-ever regulations for coal ash. (2014, December 19;). The Hill. Retrieved from http://thehill.com/policy/energy-environment/227714-epa-unveils-first-ever-coal-ash-regulations

18 Center for Responsive Politics. Retrieved from https://www.opensecrets.org/lobby/indusclient.php?id=E08

It is important to determine if potential impacts to the local community and environment are given priority in this decision-making process rather than cost savings and shareholder interests being the primary focus. Results contained in this report indicate, in the case of Plant Barry, the only safe option is to move the coal ash away from waterways into properly lined landfills not located near vulnerable communities and waterways.

3.4. Alabama Power's Plant Barry

Plant Barry, one of the largest facilities in the nation, is located in Bucks, AL in northern Mobile County roughly 30 miles north of downtown Mobile, Alabama. The ash pond at Plant Barry contains more than 21 million tons of toxic coal ash in a 597-acre ash pond - sitting right next to the Mobile River and the Mobile-Tensaw Delta and just a short distance upriver from the Port of Mobile and Mobile Bay.

Plant Barry has been operated by Alabama Power since 1952. Until recently, there were five coal burning units operating at this site. Two units have been converted to run on natural gas and one has been retired, leaving two coal burning units at the plant. When all five coal units were operating, they produced approximately 400,000 tons of coal ash each year.[19] The ash pond was built 13 years later mere feet from the Mobile River in 1965 without a liner to protect groundwater from contamination to wet store this coal ash. The ash pond structure has been expanded in 1972, 1992, 1998, and 2004.

At the time of Alabama Power's federally required November 2017 inspection, the coal ash in the pond was 33 feet deep with a volume of 21,000,000 cubic yards, which equals approximately 21 million tons of coal ash.[20] Fly ash, bottom ash, bioler slag, and flue gas emissions[21] are combined with water and enters through pipes into the northwest corner of the pond, travels through three

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[19] EPA 2010 CCW Assessment.

[20] http://www.alabamapower.com/about-us/ccr/pdf/APC_BARRY_WEB/OP_CRITERIA/Report%20of%20Annual%20Inspection%20-%20Ash%20Pond.pdf. In 2009, however, Alabama Power estimated a much smaller volume of CCR in the pond, approximately 6,305,645 yards. *See* EPA CCW Assessment.

[21] EPA 2010 CCW Assessment.

separate cells and is then discharged through a diversion dam. It then flows to a pond outlet pipe where it is discharged into the Mobile River. In additionto coal ash entering the ash pond, Alabama Power discharges other wastes into the ash pond like transport waste, pretreated metal cleaning waste, sanitary wastewater, car wash, stormwater runoff including coal pile runoff, and cooling tower blowdown from the carbon capture process.[22] Many of these wastes contain harmful substances that have the potential to negatively impact the environment.

Alabama Power is authorized to release or discharge treated wastewater from the coal ash pond only from one designated outfall, which flows into the Mobile River. Alabama Power is **not authorized** to have any other pollution coming from the coal ash pond including into groundwater. Any such discharge is a permit violation and is thus illegal under the Clean Water Act.

3.5. Alabama Power's Approach

Alabama Power has made a preliminary decision to "cap-in-place" its massive ash pond at Plant Barry. They plan to leave coal ash in an unlined pond surrounded by an earthen dam with the potential to pollute groundwater, waterways, or even worse, collapse and cause irreversible damage to the Delta and Mobile Bay and the ability for future generations to swim, fish, work, and play in these areas. This is in contrast to decisions made by other utilities across the Southeast. South Carolina, North Carolina, and Georgia have each committed to moving coal ash away from waterways and into safer, lined landfills. In South Carolina, excavation has resulted in a remarkable improvement in nearby groundwater pollution levels, with some monitoring showing a 95 percent decrease in arsenic in a matter of months.

Figure 8. Aerial of the Mobile River wrapping around the coal ash pond at Plant Barry.

[22] NPDES Permit No. AL0002879 (2008 final permit), 2010 permit modification (at ADEM permit rationale).

Alabama Power states that "Historically, we've always followed all environmental laws and tried to meet or exceed the standards required." However, it is worth noting that Alabama Power's parent company has spent more than $133 million over the past decade to influence these laws. While technically complying, Plant Barry released 33,706 lbs. of arsenic compounds from 2005-2014. Furthermore, as detailed in this report, Alabama Power is not actually complying with all laws and regulations. Groundwater monitoring required under the federal 2015 CCR Rule has shown more than 90 violations of nearby groundwater standards with arsenic found at levels up to 873% more than EPA limits in nearby groundwater. This pollution was known to Alabama Power starting in 2016 but was not made available to the public and ADEM until it was federally required to be released almost two years later in March 2018. Without the current CCR Rule, this data would have never been publicly available. These violations are consistent with Mobile Baykeeper's findings at Plant Barry's coal ash pond.

Figure 9. Wastewater is discharged from Plant Barry's permitted outfall into the Mobile River.

Alabama Power's preliminary decision to cap-in-place means that groundwater and surface water contamination documented by Mobile Baykeeper, Waterkeeper Alliance, and Alabama Power's own groundwater monitoring at the Plant Barry ash pond will continue. There is a very real possibility that the dam surrounding the ash pond could break, polluting the Mobile River, Delta, and Bay with toxic coal ash.

The plan Alabama Power has released is preliminary and there is still time for them to choose the most responsible course of action by removing the coal ash from the banks of the Mobile River.

4. ISSUES - LOCATION OF THE ASH POND

4.1. Location

Figure 10. Historical topography from 1940 showing Sister's Creek flowing through were the ash pond now sits.

The ash pond is encircled by environmentally sensitive areas: it is bordered by the Mobile River to the east and south, and by the plant's manmade cooling water discharge canal to the west. The ash pond was built over a marsh area where Sisters Creek, a tributary to the Mobile River, used to flow (Figure 10).

Sisters Creek now flows into the manmade cooling water discharge canal on the western side of the ash pond. The dam walls surrounding the pond are considered "earthen embankments", made up of sand, clay, soft organic silts, and coal ash.[23] A portion of the ash pond is considered a landfill, but despite the fact that the groundwater levels are very near to and in contact with coal ash, it is currently **unlined** - it does not have a protective layer in place like many new landfills contain as is required by 1984 Resource Conservation and Recovery Act (RCRA).

4.2. Reporting History

In a 1994 report, Alabama Department of Environmental Management (ADEM) stated that the ash pond is located **within** the 100-year floodplain (used to describe a flood event that has a 1% chance of occurring in a given year) of the Mobile River.[24] In its 2013 Operational Plan for the landfill

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[23]Alabama Power Co. *History of Construction for Existing CCR Surface Impoundment Barry Ash pond.* Report prepared for Alabama Power in accordance with Section 257.73 of the Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments. Date not shown. http://www.alabamapower.com/content/dam/alabamapower/Our%20Company/The%20Environment/CCR%20Rule%20Compliance%20Data%20and%20Information/Plant%20Barry/DESIGN_CRITERIA/History%20of%20Construction%20-%20Ash%20Pond.pdf

[24] ADEM Hydrogeological 1994.

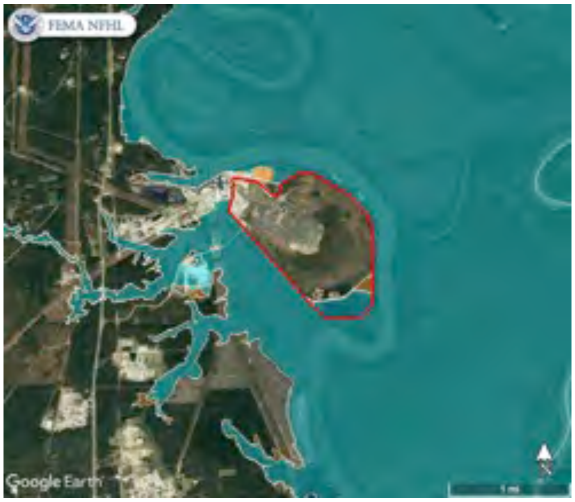

Figure 11. FEMA records showing the ash pond dam within the 100-year flood plain.

located within the ash pond, Alabama Power concurred, stating that although parts of the ash pond are outside the floodplain, the "current topographic elevations in and around the Barry Steam Plant site are located within the 100-year flood plain."[25]

An EPA consultant, tasked with determining possible pathways by which pollution could leave the site, noted that both groundwater and surface water pollution were serious concerns.[26] Alabama's environmental agency, ADEM, has said that the site is "highly susceptible to contamination from the surface due to the relatively flat terrain with very permeable [easy to absorb] soils"[27] and that "the underlying alluvium and deeper Miocene formation [types of soil deposits classification] are considered to be highly susceptible to groundwater contamination."[28]

Additionally, groundwater is very close to the surface. In 1994, ADEM conducted a hydrogeological evaluation of the landfill located within the ash pond[29] and concluded the levels for groundwater were less than five feet below where the coal ash waste sits in the unlined landfill, and therefore did not meet the regulatory standards for landfills.[30] The ADEM evaluation did not however investigate groundwater in the surrounding ash pond, but if the location of a solid waste landfill poses an unacceptable risk for polluting nearby groundwater and waterways, the same is true of tons of toxic coal ash.

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25 Operational Plan, Alabama Power Company Barry Steam Plant Landfill, Permit No. 49-18 (Sept. 30, 2013).
26 SSI 1991.
27 ADEM Hydrological 1994 at page 4.
28 ADEM Hydrological 1994 at page 5.
29 Exhibit 2, Memo from Whit Slagle, Hydrogeologist, ADEM to Gerald Hardy, Chief, Engineering Services Branch, ADEM, re: Hydrogeological Evaluation of Barry Steam Plant Inert Landfill, Permit No. 49-18R (May 17, 1994).
30 ADEM Hydrological 1994.

4.3. Hydrologic Concerns

Mobile Baykeeper retained expert analysis from Global Environmental LLC, an environmental consultant specializing in coal burning, hydrogeological investigations, and groundwater contamination, to look at potential hydrological concerns at Plant Barry. Their report indicated groundwater generally flows outward in all directions from the coal ash pond discharging into the Mobile River (Appendix M). These discharges have been confirmed to have delivered pollutants to groundwater from the ash pond since at least the 1990s. Because of a direct hydrologic connection between Plant Barry's ash pond and the Mobile River and since the source of groundwater pollution has not been removed, it is apparent the contamination is ongoing and will continue to occur.

Figure 12. Map of contamination discharges identified at Plant Barry's ash pond.

In the vicinity of the ash pond, there are two major aquifers, the alluvial coastal aquifer, which is of Holocene age, and the Miocene and Pleistocene aquifer. These aquifers are regionally important as they are unconfined, which means groundwater is in direct contact with the atmosphere through open pore spaces of soil or rock. They are considered to be highly susceptible to contamination because they are hydraulically connected to surface water and each other. The ash pond at Plant Barry is located directly over and within five feet of an aquifer that is connected to these aquifers, which are *directly* connected to the Mobile River.

5. ISSUES - KNOWN & CONTINUAL ILLEGAL DISCHARGES

In addition to discharges through the permitted wastewater outfall, results of investigations conducted by Mobile Baykeeper and Waterkeeper Alliance have found that Alabama Power illegally discharges pollutants from Plant Barry into both surface water and groundwater. Even more revealing is the fact that Alabama Power's own groundwater monitoring results show more than 90 exceedances of regulatory standards for arsenic resulting in fines from ADEM totaling $1.25 million. These unpermitted discharges, or "seeps," consist of contaminants that are leaking out of the ash pond, discharging directly into the Mobile River, the Sisters Creek cooling water discharge canal, and groundwater.

Figure 13. Satellite imagery showing seepage at Plant Barry's coal ash pond.

5.1. Findings Summarized

Since at least 1991, Alabama Power has been contaminating the soil, subsurface, and groundwater in and around the ash pond site. This contamination was first documented during a required Screening Site Inspection conducted by the NUS Corporation for the EPA to evaluate releases of hazardous substances that potentially pose a threat to human health or the environment and recommends next steps. The NUS Corporation carried out the inspection for the EPA's Superfund Division Region

Four of Plant Barry, sampling 18 sites, including nine soil, five groundwater, and four sediment samples. The sample results were compared to the EPA's Maximum Contaminant Levels (MCLs) and Minimum Quantitation Levels (MQLs). The results showed *significant amounts* of **arsenic** in the two groundwater wells downgradient (e.g. downstream) of the ash pond up to 2 orders of magnitude greater than the EPA limits (500 ug/L in one well and 130 ug/L in the other).[31] Barium, potassium, and calcium were also found at elevated levels in the wells downstream of the ash pond. Moreover, samples taken from the well within the ash pond contained elevated levels of arsenic, barium, calcium, chromium, iron, magnesium, manganese, nickel, potassium, selenium, and sodium – many of which are known carcinogens.

arsenic = 18 times the MQL
calcium = more than 20 times background
iron = 3 times background
manganese = 24 times background
potassium = almost 30 times background
sodium = almost 11 times the MQL
barium = almost 13 times background
chromium = almost 8 times the MQL
magnesium = 16 times background
nickel = 7 times the MQL
selenium = 3.5 times the MQL


Figure 14. Executive Director of Mobile Baykeeper taking a sediment sample near Plant Barry's ash pond.

In the NUS Corporation's report, it recommended that another, more rigorous site inspection be conducted given the magnitude of contamination found.[32]

Samples taken by Mobile Baykeeper and Waterkeeper Alliance were sent to certified, independent laboratories, Global Environmental LLC and Pace Analytical LLC for testing on four separate occasions: Sept. 2, 2015; Nov. 5, 2015; Feb. 4, 2016; and Aug. 8, 2017. Findings from each of these sampling activities can be seen in Appendix A and original reports can be found in Appendix K, L, M, and N, and O respectively. In summary, results reveal additional unauthorized discharges including: 1) elevated levels of arsenic, calcium, strontium, total dissolved solids, barium, selenium, aluminum, iron, manganese, cadmium, cobalt, copper, lead, vanadium, lead,

[31] Final Report, Screening Site Inspection, Phase II, Alabama Power Company – Barry Steam Plant, Bucks, Mobile County, Alabama, EPA ID #: ALD0821148800, Prepared for TDD No. F4-9001-181, Contract No. 68-01-7346, Revision 0, for the Waste Management Division, U.S. Environmental Protection Agency (Apr. 3, 1991) [hereinafter SSI].
[32] SSI 1991, at page 29.

sulfate and sulfur around the site and in soil, 2) selenium and lead were found in exceedance of ADEM's ecological standards, 3) EPA ecological water standards were exceeded for arsenic, lead, barium, selenium, vanadium, cadmium, manganese, aluminum, copper, calcium, and iron, 4) arsenic levels were extremely high and indicate leakage from the coal ash pond, 5) sediment samples revealed an increase in arsenic and selenium levels closer to the cooling water discharge. This is consistent with studies by the EPA, Mobile Baykeeper, and Alabama Power's federally required monitoring that have found arsenic in the groundwater, soil, and sediment samples at up to 80 times higher than the background levels found in nearby waterways.

Global Environmental LLC report (attached as Appendix M) found a great deal of "visual and field probe device (conductivity) evidence that the surface impoundment is leaking below and/or through the dikes. That leakage becomes surface water flow in the exterior sides of the dike". The report also found numerous exceedances of regulatory standards.[33] The report notes that all sampling conducted showed common coal ash contaminants. The report identifies several areas where satellite and aerial imagery shows apparent leakage through the dam as well as suspected recent repairs.

As required by the federal 2015 CCR Rule, Alabama Power collected groundwater monitoring data around the plant for the last two years. The data shows significant amounts of coal ash pollutants are leaving the dam and polluting nearby groundwater. The reports and data submitted also indicate that groundwater elevations at the site are actually higher than the bottom of coal ash in the pond. This means that coal ash at Plant Barry is literally submerged in the groundwater.

5.2. PERMIT COMPLIANCE

Alabama Power has also experienced prior issues with permit compliance. In 2003, the dam of the sediment pond breached, causing wastewater from the ash pond to spill out and stand around the

[33] Quarles, M. (2016). *Global Environmental, LLC Analytical Report*. Project Number: Global Area CCW. www.esclabsciences.com

pond.[34] In 2006, Alabama Power failed the survival portion of the required annual toxicity test and ADEM issued a notice of violation on September 20, 2006.

In March 2018, Alabama Power was fined for $1.25 million by the Alabama Department of Environmental Management after releasing preliminary groundwater monitoring data showing pollution violations at all six of its power plants across the state, including Plant Barry, located adjacent to the Mobile River in North Mobile County. This federally required report shows significantly high levels of pH and several coal ash pollutants - such as arsenic, boron, chloride, fluoride, and sulfate - in the groundwater beneath and around Plant Barry. Most concerning, monitoring uncovered **93** exceedances of EPA limits for **arsenic** with exceedances as much as **873%** more than the federal standards since 2016.

5.3. Other Important Findings

Figure 15. Mobile Baykeeper samples floating material later confirmed to be coal ash near Plant Barry's coal ash pond.

On February 4, 2016, Mobile Baykeeper observed floating fly ash in the backwater of the Mobile River, approximately 10 feet south of the southern tip of the ash pond. Samples were collected and sent to MVA Scientific Consultants for microscopic analysis.

Results confirmed the material was 60-80% (by volume) fly ash, mostly comprised of floating cenospheres [tiny spheres that are byproducts of burning coal ash] (Figure 16). Approximately 20-40% (by volume) consisted of organic debris (primarily wood particles). Results clearly indicate a strong presence of floating fly ash. By allowing fly ash to be discharged from its ash pond, Alabama Power is violating its permit provision prohibiting the discharge of floating solids.

34 Alabama Department of Environmental Management (ADEM) (2003). Compliance Inspection of Alabama Power Company's Barry Steam Plant Landfill. Permit #49-13 (Apr. 17, 2003).

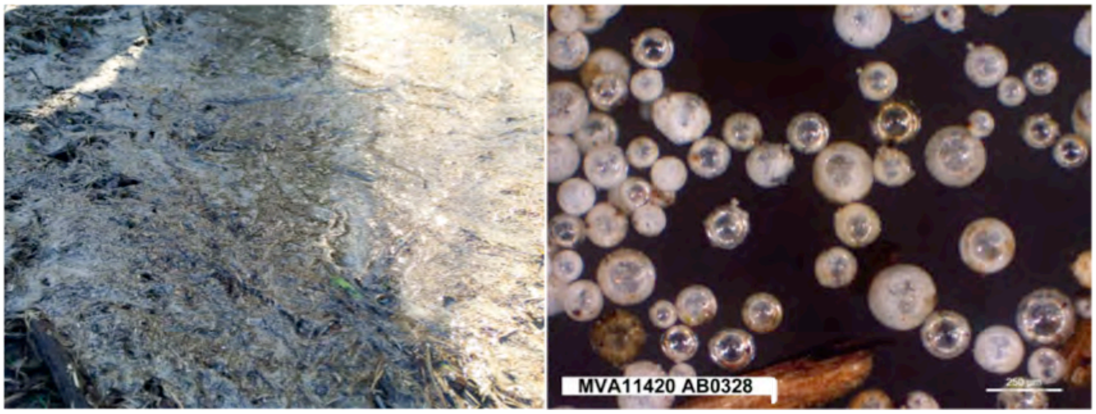

Figure 16. (Left) Material collected in the field, (Right) Polarized light microscope (PLM) image of fly ash cenospheres observed in collected sample.

A similar situation was encountered on February 9, 2018. Mobile Baykeeper staff observed floating debris near the discharge outfall that had a consentience similar to the material observed on February 4, 2016. A sample was taken and sent off to MVA Scientific Consultants for microscopic analysis. Results indicated the material was "determined to be approximately 55-75% (by volume) fly ash, mostly floating cenospheres" (Figure 17). The remaining material consisted of wood and cellulose particles (20-40% by volume).

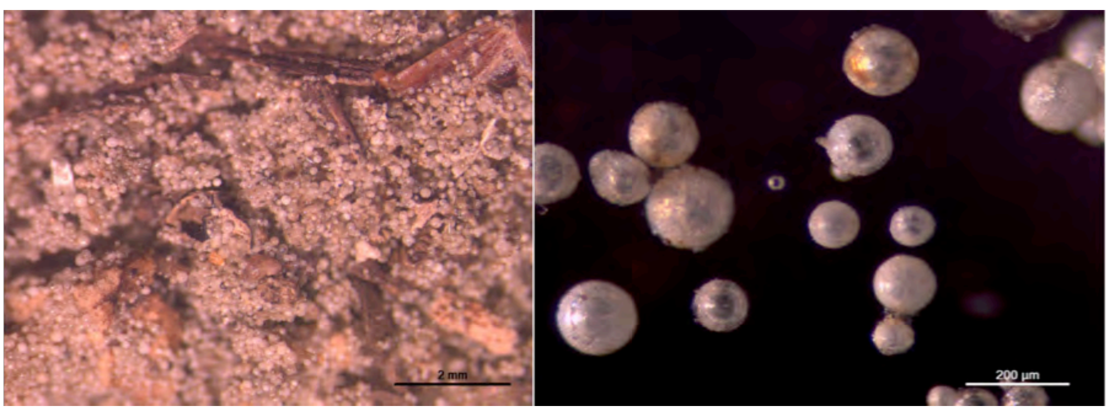

Figure 17. (Left) Stereoscope image of fly ash and plant material observed floating at the top of the sample, (Right) Polarized light microscope (PLM) image of fly ash cenospheres observed in collected sample.

6. ISSUES – POTENTIAL FOR DAM FAILURE

6.1. DAM INSPECTION

Plant Barry's ash pond is located in the southeast corner of the Plant Barry complex and is divided into the main storage area and transfer area downstream of the diversion dam. The dam is made up of a mixture of silty and sandy clays, fine sands, and sands underlain by a layer of soft organic material.

Mobile Baykeeper retained the services of Burgess Environment Ltd. to assess the Plant Barry ash pond's stability and safety. The report produced (hereinafter referred to as the "Burgess Dam Safety Report") evaluates technical documentation for the Barry ash pond relative to federal standards and generally accepted engineering procedures for maintaining dam safety. The objective of this review was to evaluate the long-term stability of the ash pond dam and understand the risks that the ash pond presents to downstream communities, the Delta, Mobile River, and Mobile Bay in the event of a breach or catastrophic failure of the dam.

A summary of the Burgess Dam Safety Report's major findings are listed below. Burgess Environmental Ltd. followed the U.S. EPA Standards for dam safety to determine these conclusions. The full report is attached as Appendix J.

1) *Location Restrictions -*

The ash pond at Plant Barry does not comply with the majority of the location restrictions under the relevant federal regulations (U.S. EPA Standards for dam safety).[35] The restrictions violated include:

a) It is within five feet of groundwater – the reports issued by Alabama Power indicate the groundwater levels in the area of the pond are higher than the bottom of the ash,

b) It was constructed in an unstable area surrounded by wetlands; and

[35] 40 C.F.R. § 257.50 2015. Local restrictions.

c) The ash pond is within the 100-year flood zone and the perimeter dam and pond are highly susceptible to flooding from the adjacent major river system.

2) Stability -

Alabama Power's own stability analysis for the ash pond did not include multiple important potential methods of failure. The Burgess Dam Safety Report indicated that the stability assessment "does not comply with the requirements [of the U.S. EPA Standards for dam safety]" because it did not include piping, liquefaction failure, and external erosion and these are "clearly relevant to the Barry ash pond."

Also concerning is the fact that many unsupported assumptions are made in the federally required safety assessment for the CCR Rule produced by the Southern Company consultant (parent organization to Alabama Power). The Burgess Dam Safety Report indicated that the assumptions made in Alabama Power's report were "not supported with any facts, studies, or analytical rigor." It seems that while the required stability assessments did meet with the federal standards by a "narrow margin", Alabama Power did the bare minimum and did not adequately assess several potential issues threatening the ash pond's integrity. The Burgess Dam Safety Report specifically mentions numerous neglected failure mechanisms including:

- **Piping** - One of the most concerning failure mechanisms not considered is "piping". Piping, also known as seeping, is when water seeps through the wall of the dam. It was not included in Alabama Power's evaluation. Piping has been documented at the ash pond by Mobile Baykeeper during site visits (*see* Figure 13) after high water events. The ash pond dam at Plant Barry is considered an earthen embankment (made up of dirt, clays, etc.) and piping is one of the most common methods of failure for these types of dams, accounting for ~40 percent of all dam failures.[36] The Burgess Dam Safety report states,

> "This is a particularly important consideration given that there is little or no design and construction information pertaining to the initial stages of construction of the

[36] New Hampshire Department of Environmental Services (2011). *Typical Failure Modes of Embankment Dams.* Environmental Fact Sheet. https://www.des.nh.gov/organization/commissioner/pip/factsheets/db/documents/db-4.pdf

> Barry ash pond. It is an important failure mechanism that needs to be considered when evaluating earth-filled dams and was specifically identified as a risk by the O'Brien & Gere (2010) assessment completed for the U.S. EPA".[37] – Burgess Dam Safety Report

Mobile Baykeeper's site visit with the dam safety expert on February 4, 2016 noted seepage or piping flowing out of the toe of the dam causing erosion of the dam walls. Seepage from this location is shown in a video taken the same day, which shows the resulting erosion and sand accumulation at the bottom of the slope. The same location where piping was noted also had a clearly evident change in the slope (apparent during all site visits and from aerial/satellite imagery) and slope repairs were also visible.

- **Liquefaction failure** – Another major assumption was that the dam is not prone to a process called liquefaction, where the soil becomes saturated and substantially loses its strength and stiffness becoming unable to support the dam. The Burgess Dam Safety Report states, "liquefaction failure was discounted as a potential failure mechanism in the Initial Factor of Safety Assessment [conducted by Southern Company consultant for Alabama Power].[38] This is a questionable assumption given that a large portion of the dam construction appears to lack design and construction information, and that at least portions of the dams are founded on bottom ash."

- **External Erosion** – The Burgess Dam Safety Report shows erosion is a significant threat to the ash pond dam and that it does not appear to have been properly considered: "The stability assessment does not consider the potential for erosion to undermine the integrity of the dikes, even though this stability concern is specifically referenced in the [U.S. EPA] Standards [for dam safety]. This is a particularly important consideration given that the Barry ash pond is located immediately adjacent to the Mobile River." And, "Over time, [erosion] and meandering of the river will infringe on the Barry ash pond unless significant measures are implemented to prevent this process from occurring."

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[37] EPA 2010 CCW Assessment.

[38] James Pegues (2016). *Initial Safety Factor Assessment Barry Ash Pond.* Report prepared for Alabama Power in accordance with Section 257.73 of the Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments (Oct. 14, 2016).

3) Flood Analysis -

Figure 18. Aerial showing a high water event at Plant Barry.

At certain times of the year and during high-water events, wetland and marsh areas surrounding the ash pond become submerged and standing water reaches the dam walls and may even overtop the dam walls of the ash pond.

Figure 19. High-water event on February 3, 2016 with water levels approaching dam sides.

To illustrate this, Mobile Baykeeper conducted an aerial survey following a high-water event on February 3, 2016. Photo documentation from this day illustrates the water level within and outside of the pond rose to within a few feet of the top of the dam walls. According to rainfall records published for Mobile Regional Airport, located south of Plant Barry, this event occurred in response to approximately four inches of rainfall over the week prior to the photo being taken. These images illustrate how significant the potential for flooding is at the ash pond.

Alabama Power's flood analysis shows water levels within the ash pond modelled to rise within an inch of the top of the dam during a 1 in 1,000 year, 24-hour rainfall event. This is a "razor thin" margin for error when considering dam safety. It is equivalent to 21.7 inches of rain in 24 hours; these events, while considered uncommon, happen quite regularly. In April 2014, 20 inches of rain was recorded in 24 hours in Silverhill, AL, just 35 miles from the ash pond. It is also important to note the area is subject to tropical weather, having six hurricanes in the past 10 years. The report states that this small of a margin of error could easily be affected by debris stuck in the outfall, damage to the outfall, or internal wave erosion that may occur during a major storm event associated with this type of flooding.

Equally concerning, the Burgess Dam Safety Report states “the flood analysis [by Alabama Power] did not consider the potential for flooding outside the [ash] pond, or the potential for erosion or overtopping from external flooding.” Additionally, through a review of recent storm events and aerial imagery of the ash pond, the report concludes that the flood analysis predictions do not accurately correlate with conditions observed during smaller storms in their recent past. *See* Figure 19.

This apparent discrepancy indicates the flood analysis done by Alabama Power for the ash pond may have been flawed.

4) *Records and Reporting* –

Alabama Power utilized the Southern Company, its parent company, to complete the necessary assessments and ultimately validate the safety of the ash pond. After a thorough examination, the Burgess Dam Safety Report expert indicated that the available review, planning, and reporting was basic and that Alabama Power should be using independent third parties to assess a hazard as significant as Plant Barry’s 597-acre four-billion-gallon ash pond.

> “One of the very striking aspects of this review is the degree to which Alabama Power relied on their own people and assessments to…validate the integrity of the Barry ash pond.” “It is more typical…to contract out an independent third party to assess critical dam structures with such significant hazard risk…The simplicity of the assessments is also striking...it is more typical to report more rigorous and comprehensive analyses when assessing the integrity of such an important structure. It is also unusual for such a large impoundment, in such an environmentally important area, not to be supported by instrumentation.” – Burgess Dam Safety Report

6.2. Closure Planning

The Burgess Dam Safety Report notes that Alabama Power intends to close the ash pond by capping it in place. The documents made available to the public are very brief and only satisfy the bare minimum requirements of the federal rule. The plans available include no drawings, specifications, or consideration of how erosion protection will be implemented along the Mobile River, "or the significant challenges associated with capping a CCR impoundment immediately adjacent to a major waterway and wetland."

The Burgess Dam Safety Report concludes that since the ash pond does not comply with the majority of the location restrictions, "closure of the Pond in-place is not advised."

> "The Mobile River will eventually meander through the Barry ash pond unless significant erosion protection measures are implemented to prevent this from occurring. Such measures would alter the natural environment of the riparian and wetland habitat along this portion of the river. They would also require monitoring and maintenance essentially in perpetuity to ensure that erosion and river meandering does not erode the contents of the ash pond into the Mobile River. It will be very difficult to ensure that these measures are implemented and effective over such a long-time frame." – Burgess Dam Safety Report

Additionally, per the recently released groundwater report, it is now publicly known that Alabama Power is polluting groundwater has been since at least 2016. This plan to cap-in-place does not define how Alabama Power will either stop continued pollution of groundwater or how they will clean up the existing contamination.

7. CONCLUSION

The evidence contained herein shows that the ash pond at Plant Barry has several major problems. The pond was built on wetlands, is unlined, and is located in an area with particularly shallow groundwater. The location of the ash pond is alarming. It is located mere feet away from and surrounded on three sides by the Mobile River – an immensely powerful river churning more than 60,000 cubic feet per second. Less than one mile away is the backup source of drinking water for more than 250,000 people, as well as thousands of businesses in Mobile and the Eastern Shore of Baldwin County. Leaving a pond holding more than 21 million tons of coal ash and toxic pollutants in such an area is irresponsible and puts the Coastal Alabama community, economy, and environment at risk.

Testing by both Alabama Power and Mobile Baykeeper show common coal ash pollutants are escaping through and beneath the ash pond dam into groundwater and emerging to the surface flowing into the Mobile River. Capping the ash pond in-place will not stop this ongoing and illegal pollution.

The ash pond dam could break, potentially releasing a volume of toxic coal ash 20 times larger than the BP Deepwater Horizon Oil Disaster. This type of catastrophic collapse could release a small tsunami of coal ash that covers up to 30 square miles – including huge swaths of the Delta and surging toward Mobile Bay. The Burgess Dam Safety Report finds inadequate planning and reporting, on-site evidence of common failure mechanisms, potential for overtopping of the pond during large flood events, and concludes, "closure of the Pond in-place is not advised." And "the Mobile River will eventually meander through the Barry ash pond unless significant erosion protection measures are implemented to prevent this from occurring…It will be very difficult to ensure that these measures are implemented and effective over such a long-time frame."

Alabama Power has said they are pursuing capping-in-place because it is a closure technique that is cost-effective and available under the federal 2015 CCR Rule. Based on the totality of the findings in this report, it is clear that capping-in-place on the side of the Mobile River will not stop ongoing groundwater pollution, will not fix location issues the ash pond inherently has, and will not fix the precarious situation of the ash pond dam. Alabama Power has a responsibility to the citizens of Coastal Alabama to dig up and move the coal ash at Plant Barry away from the Mobile River and nearby vulnerable communities. Capping the ash pond in place with the ongoing documented groundwater pollution is absolutely contrary to the health and safety of Alabama citizens.

8. APPENDIX A – SAMPLE RESULTS

SAMPLE RESULTS: SEPTEMBER 2, 2015

Mobile Baykeeper and Waterkeeper staff collected surface water samples on September 2, 2015 and sent samples to Pace Analytical Services for processing using EPA methods (200.7, 200.8, and 245.1). Samples were collected from six sites A) Surface Water Dry Channel - Toe of Dam, South, B) Toe of Dam, South, C) River, South, D River Bank Seep, Northeast, E) River Bank Seep, East Dam, F) Sisters Creek Cooling Channel (as shown in Figure 20).

Figure 20. Surface water sampling sites.

Table 1. Discharge from Sisters Creek Cooling Channel

Parameter	Standard Exceeded (mg/L)	Concentration Detected (mg/L)	Percentage Exceeded
Aluminum	EPA SMCL (0.05 to 0.2)	0.33	560% (using 0.05 standard)
			65% (using 0.2 standard)
Iron	EPA MCL (0.3)	2.7	800%
Manganese	EPA SMCL (0.05)	0.76	1420%
Arsenic	EPA MCL (0.01)	0.02	100%

**Maximum Contaminant Levels (MCL) and Secondary Maximum Contaminant levels (SMCL)

Table 2. Surface water discharge from River Bank Seep, East Dam

Parameter	Standard Exceeded (mg/L)	Concentration Detected (mg/L)	Percentage Exceeded
Aluminum	EPA SMCL (0.05 to 0.2)	0.95	1800% (using 0.05 standard)
			375% (using 0.2 standard)
Iron	EPA MCL (0.3)	3	900%

**Maximum Contaminant Levels (MCL) and Secondary Maximum Contaminant levels (SMCL)

Table 3. Surface water discharge from River Bank Seep, Northeast

Parameter	Standard Exceeded (mg/L)	Concentration Detected (mg/L)	Percentage Exceeded
Aluminum	EPA SMCL (0.05 to 0.2)	0.11	120% (using 0.05 standard)
Iron	EPA MCL (0.3)	46.8	15500%
Manganese	EPA SMCL (0.05)	5.4	10700%
Arsenic	EPA MCL (0.01)	0.041	310%
Total Dissolved Solids	EPA SMCL (500)	615	23%

**Maximum Contaminant Levels (MCL) and Secondary Maximum Contaminant levels (SMCL)

Table 4. Surface water channel at River, South

Parameter	Standard Exceeded (mg/L)	Concentration Detected (mg/L)	Percentage Exceeded
Aluminum	EPA SMCL (0.05 to 0.2)	0.2	300% (using 0.05 standard)
Iron	EPA MCL (0.3)	1.4	366.67%
Manganese	EPA SMCL (0.05)	0.38	660%
Selenium	EPA ecological Chronic (0.005); ADEM ecological Chronic (0.005)	0.01	100%

**Maximum Contaminant Levels (MCL) and Secondary Maximum Contaminant levels (SMCL)

Table 5. Groundwater emerging near Toe of Dam, South

Parameter	Standard Exceeded (mg/L)	Concentration Detected (mg/L)	Percentage Exceeded
Aluminum	EPA SMCL (0.05 to 0.2)	2	3900% (using 0.05 standard)
			900% (using 0.2 standard)
Iron	EPA MCL (0.3)	5.1	1600%
Manganese	EPA SMCL (0.05)	0.25	400%
Arsenic	EPA MCL (0.01)	0.015	50%
Selenium	EPA ecological Chronic (0.005); ADEM ecological Chronic (0.005)	0.011	120%

**Maximum Contaminant Levels (MCL) and Secondary Maximum Contaminant levels (SMCL)

Table 6. Surface water dry channel near Toe of Dam, South

Parameter	Standard Exceeded (mg/L)	Concentration Detected (mg/L)	Percentage Exceeded
Aluminum	EPA SMCL (0.05 to 0.2)	0.7	1300% (using 0.05 standard)
			250% (using 0.2 standard)
Iron	EPA MCL (0.3)	5.1	1600%
Manganese	EPA SMCL (0.05)	2.1	4100%
Arsenic	EPA MCL (0.01)	0.078	680%
Selenium	EPA ecological Chronic (0.005); ADEM ecological Chronic (0.005)	0.008	60%

**Maximum Contaminant Levels (MCL) and Secondary Maximum Contaminant levels (SMCL)

SAMPLE RESULTS: NOVEMBER 5, 2015

Additional surface water samples were taken by Mobile Baykeeper on November 5, 2015. These samples were sent to Pace Analytical Services for processing using EPA methods (200.7, 200.8, 245.1, and 300). Five sites were selected (Figure 21) A) Near River Bank, East, B) Surface Water Channel Downstream of Toe, South C) Surface Water Discharge from River Bank Seep, Northeast D Surface Water Discharge from River Bank Seep, Northeast.

Parameter	Units	2-A GW	2-B SW	2-C SW	2-D SW	2-X GW
Aluminum	ug/L	10500	97.2	1700	216	173
Arsenic	ug/L	19.1	21.1	9.6	13.1	ND
Boron	ug/L	60.0	357	1860	3640	ND
Cadmium	ug/L	ND	0.12	ND	ND	0.68
Calcium	ug/L	36800	30900	64800	98500	22800
Chromium	ug/L	21.1	1.3	3.8	1.0	1.3
Cobalt	ug/L	10.0	10.4	4.6	ND	90.2
Iron	ug/L	58700	2910	8010	892	5310
Lead	ug/L	13.1	ND	1.4	ND	ND
Magnesium	ug/L	8310	5980	10000	13900	12200
Manganese	ug/L	4220	1730	726	238	1120
Mercury	ug/L	ND	ND	ND	ND	ND
Molybdenum	ug/L	1.0	52.2	6.4	35.2	ND
Potassium	ug/L	2670	5340	3630	10000	1010
Selenium	ug/L	1.8	6.3	1.7	ND	ND
Sodium	ug/L	37200	33600	23000	27300	72900
Sulfate	ug/L	31500	60000	90600	120000	77900
Thallium	ug/L	ND	ND	ND	ND	ND
Vanadium	ug/L	29.5	7.6	4.9	ND	2.5
pH - GW	S.U.	6.45	6.27	NA	NA	5.13
pH - SW	S.U.	7.13	6.37	NA	NA	7.35
Conductivity - GW	µg/cm3	534	382	NA	NA	388
Conductivity - SW	µg/cm3	219	377.00	NA	NA	210
TSS - GW	ppm	263	189	NA	NA	194
TSS - SW	ppm	109	189.00	NA	NA	105

Figure 21. Surface water sampling sites.

Table 7. Surface water discharge from River Bank Seep, Northeast

Parameter	Standard Exceeded (mg/L)	Concentration Detected (mg/L)	Percentage Exceeded
Aluminum	EPA SMCL (0.05 to 0.2)	0.216	332% (using 0.05 standard)
			8% (using 0.2 standard)
Iron	EPA MCL (0.3)	0.892	197.33%
Manganese	EPA SMCL (0.05)	0.238	376%
Arsenic	EPA MCL (0.01)	0.0131	31%

**Maximum Contaminant Levels (MCL) and Secondary Maximum Contaminant levels (SMCL)

Table 8. Surface water discharge from River Bank Seep, Northeast

Parameter	Standard Exceeded (mg/L)	Concentration Detected (mg/L)	Percentage Exceeded
Aluminum	EPA SMCL (0.05 to 0.2)	1.7	3300% (using 0.05 standard)
			750% (using 0.2 standard)
Iron	EPA MCL (0.3)	8.01	2570%
Manganese	EPA SMCL (0.05)	0.726	1352%

**Maximum Contaminant Levels (MCL) and Secondary Maximum Contaminant levels (SMCL)

Table 9. Surface water channel Downstream of Toe, South

Parameter	Standard Exceeded (mg/L)	Concentration Detected (mg/L)	Percentage Exceeded
Aluminum	EPA SMCL (0.05 to 0.2)	0.097	94% (using 0.05 standard)
Iron	EPA MCL (0.3)	2.9	866.67%
Manganese	EPA SMCL (0.05)	1.73	3360%
Arsenic	EPA MCL (0.01)	0.0211	111%
Selenium	EPA ecological Chronic (0.005); ADEM ecological Chronic (0.005)	0.0063	26%

**Maximum Contaminant Levels (MCL) and Secondary Maximum Contaminant levels (SMCL)

Table 10. Near River Bank, East

Parameter	Standard Exceeded (mg/L)	Concentration Detected (mg/L)	Percentage Exceeded
Aluminum	EPA SMCL (0.05 to 0.2)	10.5	20900% (using 0.05 standard)
			5150% (using 0.2 standard)
Iron	EPA MCL (0.3)	58.7	29250%
Manganese	EPA SMCL (0.05)	4.22	8340%
Arsenic	EPA MCL (0.01)	0.019	90%

Lead	EPA ecological Chronic (0.0025)	0.013	420%
Vanadium	EPA ecological Chronic (0.027)	0.0295	9.26%

**Maximum Contaminant Levels (MCL) and Secondary Maximum Contaminant levels (SMCL)

Sample Results: February 4, 2016

Surface water sampling was conducted by Mobile Baykeeper on February 2, 2016 and sent to Global Environmental, LLC for processing. Samples were collected from five sites 1) Seep through Dam; Toe of South Dam; 2) Seep through Dam, Toe of South; 3) Dam Surface Water Discharge, near Toe of East Dam; 4) Surface Water Discharge into Wetland, near Northeast Dam; 5) Surface Water Discharge near Northeast Dam (Figure 22).

Figure 22. Surface water sampling sites.

Table 11. Surface water discharge near Northeast Dam

Parameter	Standard Exceeded (mg/L)	Concentration Detected (mg/L)	Percentage Exceeded
Calcium	EPA ecological Chronic (116)	155	33.62%
Manganese	EPA SMCL (0.05)	0.0845	69%
Arsenic	EPA MCL (0.01)	0.0158	58%
Barium	EPA ecological Chronic (0.22)	0.26	18.18%
Total Dissolved Solids	EPA SMCL (500)	637	27.40%
Sulfate	EPA SMCL (250)	264	5.60%

**Maximum Contaminant Levels (MCL) and Secondary Maximum Contaminant levels (SMCL)

Table 12. Surface water discharge into wetland, Near Northeast Dam

Parameter	Standard Exceeded (mg/L)	Concentration Detected (mg/L)	Percentage Exceeded
Aluminum	EPA SMCL (0.05 to 0.2)	0.225	350% (using 0.05 standard)
			12.50% (using 0.2 standard)
Iron	EPA MCL (0.3)	0.847	182.33%
Manganese	EPA SMCL (0.05)	0.238	376%
Arsenic	EPA MCL (0.01)	0.0139	39%

**Maximum Contaminant Levels (MCL) and Secondary Maximum Contaminant levels (SMCL)

Table 13. Surface water discharge, Near Toe of East Dam

Parameter	Standard Exceeded (mg/L)	Concentration Detected (mg/L)	Percentage Exceeded
Aluminum	EPA SMCL (0.05 to 0.2)	0.556	1012% (using 0.05 standard)
			178% (using 0.2 standard)
Iron	EPA MCL (0.3)	21.3	7000%
Manganese	EPA SMCL (0.05)	6.76	13420%

**Maximum Contaminant Levels (MCL) and Secondary Maximum Contaminant levels (SMCL)

Table 14. Seep through Dam, Toe of South Dam

Parameter	Standard Exceeded (mg/L)	Concentration Detected (mg/L)	Percentage Exceeded
Aluminum	EPA SMCL (0.05 to 0.2)	4.18	8260% (using 0.05 standard)
			1990% (using 0.2 standard)
Calcium	EPA ecological Chronic (116)	128	10.34%
Iron	EPA MCL (0.3)	15.2	4966.67%
Manganese	EPA SMCL (0.05)	3.84	7580%
Barium	EPA ecological Chronic (0.22)	0.246	11.82%
Lead	EPA ecological Chronic (0.0025)	0.0131	424%

**Maximum Contaminant Levels (MCL) and Secondary Maximum Contaminant levels (SMCL)

Table 15. Seep through Dam Toe of South Dam

<table>
<tr><th>Parameter</th><th>Standard Exceeded (mg/L)</th><th>Concentration Detected (mg/L)</th><th>Percentage Exceeded</th></tr>
<tr><td rowspan="2">Aluminum</td><td rowspan="2">EPA SMCL (0.05 to 0.2)</td><td rowspan="2">13.5</td><td>26900% (using 0.05 standard)</td></tr>
<tr><td>6650% (using 0.2 standard)</td></tr>
<tr><td>Iron</td><td>EPA MCL (0.3)</td><td>10.9</td><td>3533.33%</td></tr>
<tr><td>Manganese</td><td>EPA SMCL (0.05)</td><td>10.7</td><td>21300%</td></tr>
<tr><td>Barium</td><td>EPA ecological Chronic (0.22)</td><td>0.289</td><td>31.36%</td></tr>
<tr><td>Cadmium</td><td>EPA ecological Chronic (0.00025)</td><td>0.000505</td><td>102%</td></tr>
<tr><td rowspan="2">Copper</td><td>EPA ecological Chronic (0.009)</td><td rowspan="2">0.0192</td><td>113.33% (using 0.009 standard)</td></tr>
<tr><td>EPA ecological Acute (0.013)</td><td>47.69% (using 0.013 standard)</td></tr>
<tr><td rowspan="2">Lead</td><td>EPA ecological Chronic (0.0025)</td><td rowspan="2">0.0604</td><td>2316% (0.0025 standard)</td></tr>
<tr><td>EPA MCL (0.015)</td><td>302.67% (0.015 standard)</td></tr>
<tr><td>Vanadium</td><td>EPA ecological Chronic (0.027)</td><td>0.0317</td><td>17.41%</td></tr>
</table>

**Maximum Contaminant Levels (MCL) and Secondary Maximum Contaminant levels (SMCL)

SAMPLE RESULTS: AUGUST 8, 2017

Mobile Baykeeper collected sediment samples from two locations: one to show the potential impact from the coal ash pond referred to as A) Canal and a upgradient location to compare values, referred to as X) Background (Figure 23). Samples were collected using a AMS shallow water bottom dredge and sent to Pace Analytical Services for processing. Pace Analytical used EPA methods: 6010 and 7471.

Figure 23. Sediment sample sites.

Table 16. Sediment sample results.

Parameter	Background Sample Results (mg/kg)	Canal Sample Results (mg/kg)
Antimony	Not Detected	4.4
**Arsenic	5.1	64.9
Cadmium	Not Detected	2.5
Chromium	15.2	23.9
Cobalt	9	8.7
Lead	10.1	8.4
**Selenium	Not Detected	43
Thallium	Not Detected	Not Detected
Mercury	0.021	0.02

Most alarming of the sediment sample results are a clear spike in both arsenic (64.9 mg/kg in the canal and 5.1 mg/kg in the background sample) and selenium (43 mg/kg in the canal and not detected in the background sample).

9. APPENDIX B – TOXIC EFFECTS OF POLLUTANTS

Arsenic is a known carcinogen that causes multiple forms of cancer in humans. It is also a toxic pollutant, 40 C.F.R. § 401.15, and a priority pollutant, 40 C.F.R. Part 423 App. A. Arsenic is associated with non-cancer health effects of the skin and the nervous system.

Lead is a very potent neurotoxicant that is highly damaging to the nervous system. Health effects associated with exposure to lead include, but are not limited to, neurotoxicity, developmental delays, hypertension, impaired hearing acuity, impaired hemoglobin synthesis and male reproductive impairment. Importantly, many of lead's health effects may occur without overt signs of toxicity. Lead is also classified by the EPA as a "probable human carcinogen." Lead is a toxic pollutant, 40 C.F.R. § 401.15 and a priority pollutant, 40 C.F.R. Part 423, App. A. Chronic exposure to cadmium can result in kidney disease and obstructive lung diseases such as emphysema.

Cadmium may also be related to increased blood pressure (hypertension) and is a possible lung carcinogen. Cadmium affects calcium metabolism and can result in bone mineral loss and associated bone loss, osteoporosis, and bone fractures. It is a toxic pollutant, 40 C.F.R. § 401.15 and a priority pollutant, 40 C.F.R. Part 423, App. A.

Copper is toxic to aquatic organisms at high concentrations. It is a toxic pollutant, 40 C.F.R. § 401.15 and a priority pollutant, 40 C.F.R. Part 423, App. A. Chronic exposure can lead to adverse effects on survival, growth and reproduction. It can also alter brain function enzyme activity, blood chemistry and metabolism. Drinking water with higher than normal levels of copper can cause nausea, vomiting, cramps and diarrhea.

Selenium is a toxic pollutant, 40 C.F.R. § 401.15, and a priority pollutant, 40 C.F.R. Part 423, App. A, and excess exposure can cause a chemical-specific condition known as Selenosis, with symptoms that include hair and nail loss.

Vanadium, according to the U.S. Agency for Toxic Substances and Disease Registry (ATSDR), can cause nausea, diarrhea, and stomach cramps. And the International Agency for Research on Cancer (IARC) has determined that vanadium is possibly carcinogenic to humans.

Barium can cause gastrointestinal disturbances and muscular weakness. Ingesting large amounts, dissolved in water, can change heart rhythm and can cause paralysis and possibly death. Barium can also cause increased blood pressure.

Aluminum, according to ATSDR, some studies show that people exposed to high levels of aluminum may develop Alzheimer's disease. People with kidney disease have trouble removing aluminum from their system.

Iron can render water unusable by imparting a rusty color and a metallic taste and causing sedimentation and staining; to prevent these effects the EPA has set a secondary drinking water standard of 300 ug/L.

Manganese is known to be toxic to the nervous system. Manganese concentrations greater than 50 ug/L render water unusable by discoloring the water, giving it a metallic taste, and causing black staining. Exposure to high levels can affect the nervous system; very high levels may impair brain development in children.

Total Dissolved Solids, in high concentrations can make drinking water unpalatable and can cause scale buildup in pipes, valves and filters, reducing performance and adding to system maintenance costs.

Strontium can affect skeletal development, affecting all life stages, with infants, children and adolescents being of particular concern.

Sulfate, at high concentrations (greater than 500 mg/L – greater than what we've found) can result in a mild laxative response.

**Concurrent exposure to multiple contaminants may intensify existing effects of individual contaminants, or may give rise to interactions and synergies that create new effects. Where several coal ash contaminants share a common mechanism of toxicity or affect the same bodily organ or organ system, exposure to several contaminants concurrently produces a increased risk to health.

10. APPENDIX C – 1991 EPA CERLA SCREENING EVALUATION

R-586-4-1-3

DATE REPORT ACCEPTED 4/24/91

DISPOSITION HRS SCORE

SAM SIGNATURE [signature]

STATES Copy

MAY 1991
ADEM
SPECIAL PROJECTS

FINAL REPORT

SCREENING SITE INSPECTION, PHASE II
ALABAMA POWER COMPANY - BARRY STEAM PLANT
BUCKS, MOBILE COUNTY, ALABAMA
EPA ID #: ALD082148800

Prepared Under
TDD No. F4-9001-181
CONTRACT NO. 68-01-7346

Revision 0

FOR THE

WASTE MANAGEMENT DIVISION
U.S. ENVIRONMENTAL PROTECTION AGENCY

APRIL 3, 1991

NUS CORPORATION
SUPERFUND DIVISION

Prepared By	Reviewed By	Approved By
Betty Ann Pruner Project Manager	Bob Donaghue Assistant Regional Project Manager	Phil Blackwell Regional Project Manager

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EXECUTIVE SUMMARY

The Barry Steam Plant is located in a rural setting in Mobile County, Alabama, approximately 0.75 mile east of Bucks. Under the ownership of the Alabama Power Company, the currently active steam power plant has been in operation since 1952. Two waste disposal areas are located at the facility, a 5- to 8-acre landfill and a 625-acre ash pond. The 5- to 8-acre landfill has received concrete, metal, glass, and other building materials dating from the construction of the plant through the present time. Under National Pollution Discharge Elimination System (NPDES) Permit no. ALD0002879, Barry Steam Plant has discharged fly ash waste, as well as condenser cooling water waste, into the 625-acre ash pond. In the past, metal-cleaning waste and sewage from the plant were both deposited into the ash pond. Both the landfill and the ash pond continue to accept wastes.

The Alabama Power Company-Barry Steam Plant, is located in the Atlantic Coastal Plain Physiographic Province and the Gulf Coastal Plain groundwater region. This region is characterized by thick, gently sloping layers of unconsolidated sediments. The two underlying aquifers, the alluvial coastal aquifer and the Pliocene-Miocene aquifer, are interconnected. Near the facility, wells completed in the alluvial-coastal aquifer have an average depth of 95 feet below land surface (bls). Recharge to the aquifer system is through infiltration of rainwater.

The groundwater pathway was determined to be one of the primary concerns for this site. The majority of the residences within a 4-mile radius obtain drinking water from the LeMoyne and Mt. Vernon water systems, both of which depend on municipal wells located outside of the 4-mile radius. There are 32 private wells within a 3-mile radius, and 43 within a 4-mile radius. Wetlands and fisheries, another primary concern, could be impacted by the migration of contaminants off site. The surface water pathway is also of concern due to recreational activities, including sport fishing, along the Mobile River. Employees at the Barry Steam Plant could potentially be at risk through exposure to the onsite pathway.

Seventeen environmental samples were collected during the field investigation associated with this study. Several inorganic constituents were detected significantly above background. Arsenic was found in groundwater, surface and subsurface soil, and sediment samples in amounts up to 80 times background. The presence of these inorganic constituents can be traced to coal, the fuel for the power plant, which contains many metallic elements like beryllium, mercury, and arsenic. These metallic elements, which are not readily combustible, remain in higher concentrations in the fly ash waste. Other metallic elements found in high concentrations in the samples, such as lead and chromium, can be traced to the metal-cleaning waste which may have been discharged into the ash pond prior to 1980.

The facility is located in an extremely rural area with a population of 496 within a 4-mile radius. Private wells constitute the only aquifer use in the area; approximately 117 residences receive water from municipal systems whose wells are located outside of the target distance. However, the surface water pathway supports recreational fishing and sensitive environments, including wetlands and critical habitats. Additionally, the concentration of contaminants is high in and around the ash pond area and in the cool-down canal which drains into the Mobile River. Therefore, based upon high target values for the surface water pathway, FIT 4 recommends that Phase I of a Listing Site Inspection be initiated for Alabama Power Company - Barry Steam Plant.

1.0 INTRODUCTION

The NUS Corporation Region 4 Field Investigation Team (FIT) was tasked by the U.S. Environmental Protection Agency (EPA), Waste Management Division to conduct a Screening Site Inspection (SSI) at the Barry Steam Plant site in Bucks, Mobile County, Alabama. The investigation was performed under the authority of the Comprehensive Environmental Response Compensation and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA). The task was performed to satisfy the requirements stated in Technical Directive Document (TDD) number F4-9001-181. The field investigation was conducted April 30 through May 1, 1990.

1.1 OBJECTIVES

The objectives of this inspection were to determine the nature of contaminants present at the site and to determine if a release of these substances has occurred or may occur. Further, this inspection sought to determine the possible pathways by which contamination could migrate from the site and the populations and environments it would potentially affect. Through these objectives, a recommendation was made regarding future activities at the site.

1.2 SCOPE OF WORK

The objectives were achieved through the completion of a number of specific tasks. These activities were to:

- Obtain and review background material relevant to HRS scoring of the site.
- Obtain maps of site.
- Obtain information on local water systems.
- Evaluate target populations within a 4-mile radius of the site with regard to groundwater use, and possibility of direct contact and/or fire and explosion hazard, and within 15 downstream miles with regard to surface water use.
- Conduct a survey for private wells.

- Determine location and distance to nearest potable well.

- Develop a site sketch to scale.

- Collect environmental samples.

2.0 SITE CHARACTERIZATION

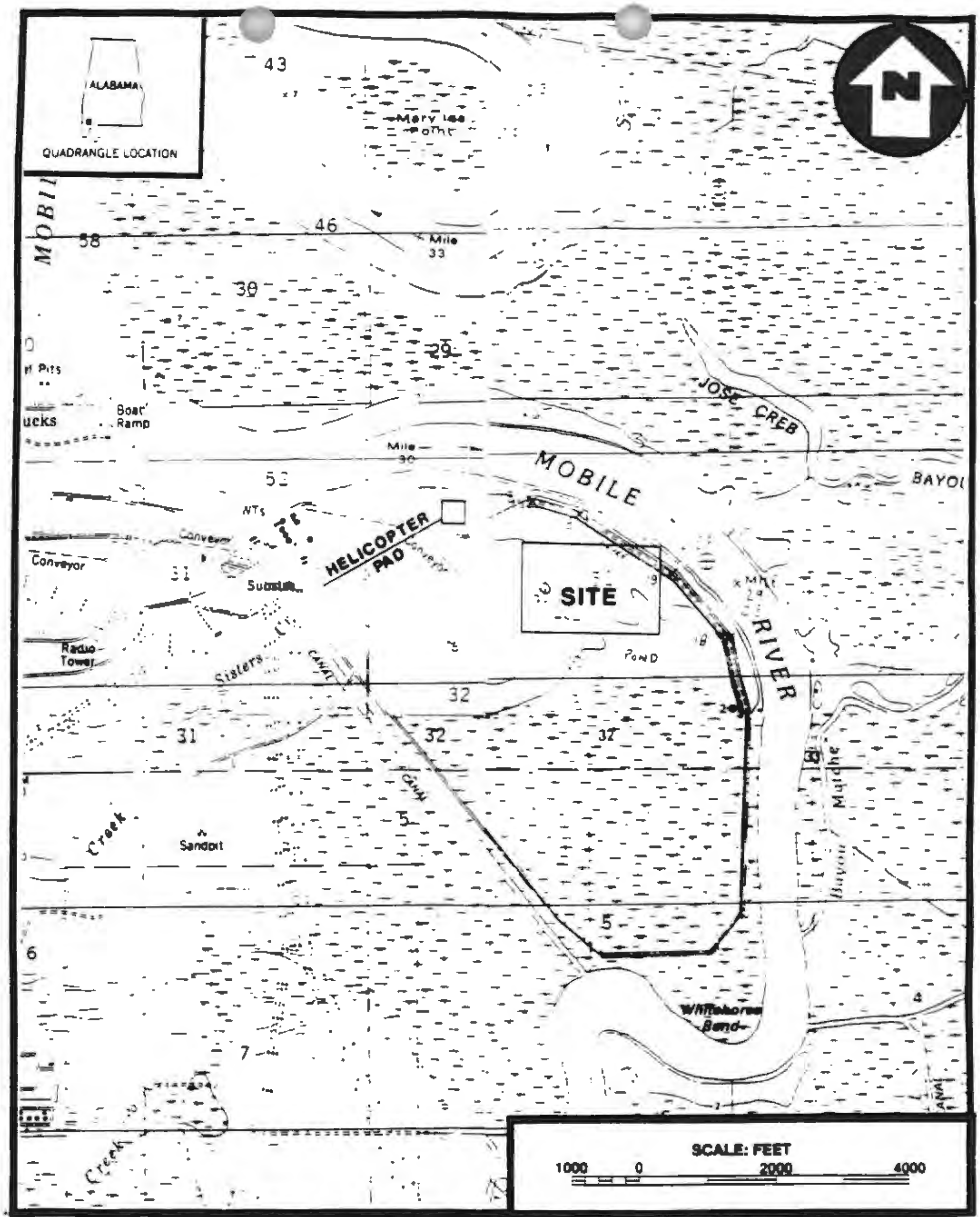
2.1 SITE BACKGROUND AND HISTORY

The Barry Steam Plant is located 2.2 miles north of Salco Road on the east side of Highway 43 in Bucks, Alabama. The 1,000-acre facility consists of a power plant and two waste disposal areas, a 625-acre ash pond and a 5- to 8-acre landfill (Ref. 1, Appendix B). Under the ownership of the Alabama Power Company, the currently active facility has been in operation from 1952, until the present time (Ref. 2).

Typically, electricity is generated at a coal-fired steam power plant by burning coal to produce steam from purified process water which is contained in large tanks. The steam generated by the boiling water is used to turn turbines which produce electricity (Ref. 3). After the generation of electricity, the plant then passes once-through cooling water around the condenser in order to reduce the steam back to a liquid state before recirculation through the boiler tubing (Ref. 4).

Fueled by approximately 3,000,915,272 tons of coal, the Barry Steam Plant generates 1,988,952,000 kilowatt hours of electricity annually (Ref. 5). The steam production process at the facility is self-contained; any contaminants or potentially hazardous wastes result from the cooling of the condenser, the periodic cleaning of the condenser and the tubing, and the intermittent production of demineralized water for use in the tanks. The steam condenser, as well as the internal boiler tubing, is cleaned with a solvent, usually hydroxy acetic formic acid, to remove corrosion products and residue from previous cleaning operations. At the present time, the facility incinerates the metal-cleaning waste at the plant under permit. Waste generated from the demineralization of process water is discharged to the ash pond, where it evaporates or percolates into the ground. The condenser cooling water is discharged into the cool-down canal (Ref. 4).

Waste effluents from the plant discharged into the ash pond or the cool-down canal are regulated under NPDES Permit no. ALD0002879. Since the permit was first issued in 1976, some parts of the permit are no longer applicable, due to changes in facility processes. Barry Steam Plant is working toward renewal of their NPDES permit in 1990. The following parts of their NPDES permit currently apply to the facility: 1) DSN001 to regulate the discharge of the condenser cooling water to the cool-down canal; 2) DSN002 to regulate discharge to the ash pond; 3) DSN007 to govern the incineration of the metal-cleaning waste; 4) DSN010 to monitor storm water runoff; 5) DSN011 and DSN012 to permit backwash discharge into the cool-down canal. In the past, additional permits DSN003,



BASE MAP IS A PORTION OF THE U.S.G.S. 7.5 MINUTE QUADRANGLE MAPS MOUNT VERNON, ALABAMA, 1982, STIGGINS LAKE, ALABAMA, 1983, CREOLA, ALABAMA, 1985 & THE BASIN, ALABAMA, 1985.

SITE LOCATION MAP
ALABAMA POWER COMPANY - BARRY STEAM PLANT
BUCKS, MOBILE COUNTY, ALABAMA

FIGURE 1

NUS CORPORATION

DSN005, DSN006, DSN008, and DSN009 governed sewer discharge to the ash pond and fan cooling-water discharge into the cool-down canal (Ref. 4).

Of the waste deposited at the facility, the only known quantities are for fly ash. During its 38 years of operation, Barry Steam Plant estimates that approximately 1,416 yd^3 of fly ash, a nonhazardous waste, has been deposited weekly in the ash pond at a depth of 8 to 10 inches. There are no company records kept on the quantity of wastes deposited in the 5- to 8-acre landfill, which receives concrete, metal, glass, fly ash waste, asbestos, paper, wood, and other construction materials at the present time. After 1983, the small landfill was permitted by the Alabama Department of Environmental Management under ADEM Permit no. 49-18 (Refs. 6, 7).

2.2 SITE DESCRIPTION

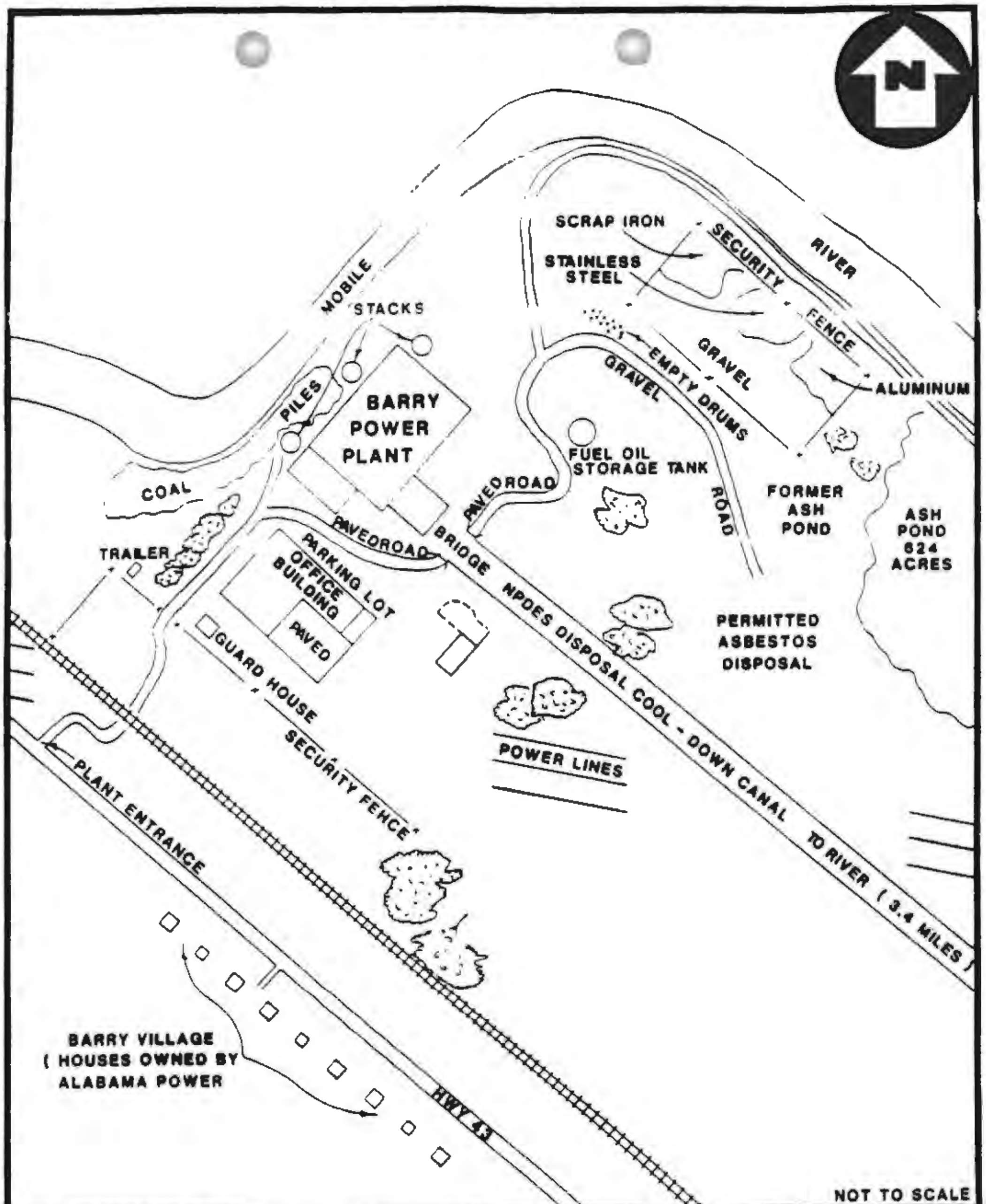
2.2.1 Site Features

The Alabama Power Company facility, which covers over 1,000 acres, is located east of Highway 23 and directly south of the Mobile River at 31°06'19" W latitude and 87°59'43" N longitude (Figure 2). The facility is situated approximately 0.5 mile east of Service Route 23 and, except for the plant smokestacks, cannot be seen from the road (Ref. 1, Appendix A).

A paved road, east of Service Route 43, across the road from Barry Village, leads to the facility's main entrance. A security fence surrounds much of the facility at the main entrance, but it is not known whether the entire 1,000-acre facility is fenced. The main entrance is monitored by a guard house. An office building/warehouse is located just past the guard house on the right side of the road. The power plant is situated due northeast about 1,000 feet from the main entrance. Large piles of coal for the power plant are located to the left (north) of the main entrance along the river and are carried to the plant by a conveyor system (Ref. 1, Appendix A).

In the northeast corner of the facility, there is a metal scrapyard enclosed by a security fence. A fuel oil storage tank is located across the road. The main facility road winds southeast around the power plant and crosses a canal. This canal carries the facility's NPDES discharge southeast for approximately 3.4 miles until entry into the Mobile River (Ref. 1, Appendix B).

On the northeast side of the facility, the main road, at this point unpaved, curves southeastward into the landfill and ash pond area. The ash pond covers about 625 acres on the southeastern portion of the property. The landfill includes 5 to 8 acres in the northwestern corner of the ash pond area shown in Appendix A. This portion of the pond is dry and sparsely vegetated. No debris was visible in the landfill area. Vegetation was extremely stressed or dead inside the levee, but outside the levee it appeared healthy and thriving (Ref. 1, Appendix B).



SITE LAYOUT MAP
ALABAMA POWER COMPANY -
BARRY STEAM PLANT
BUCKS, MOBILE COUNTY, ALABAMA

FIGURE 2

NUS CORPORATION

2.2.2 Waste Characteristics

Four types of waste are generated by the Barry Steam Plant: wastes from the intermittent production of demineralized water, routine hazardous wastes from maintenance and cleaning, and fly ash waste (Ref. 4). In a drum-type boiler system like the Barry system, impurities which become concentrated in the boiler water must be purged from the system. The most common method of purification for high-purity process water at power plants is the use of demineralizers (Refs. 2, 3). The wastes resulting from this process are routed to a concrete sump for elementary neutralization before discharge to the ash pond, where it either evaporates or percolates into the ground under National Pollution Discharge Elimination System (NPDES) Permit No. ALD0002879 (Refs. 2, 3, 4).

Routine hazardous wastes result from the periodic cleaning of the boiler and the tubing. Depending upon test results from residue within the boiler tubing, the plant uses cleaning agents, either hydrochloric acid, which was mainly used in the past, or hydroxy acetic formic acid, most often used in recent years. Previously, Barry Steam Plant had an NPDES permit to neutralize the hazardous metal-cleaning waste by onsite caustic injection before discharge into the ash pond. Currently, the facility incinerates the metal-cleaning waste at approximately 2,300°F in an incinerator unit on the plant property (Ref. 4).

In order to recirculate the purified water for future use, the once-through condenser cooling water is used to reduce the state of the steam to liquid. After monitoring for pH and temperature, the cooling water is released to the cool-down canal, which continues for 3.4 miles until entry into the Mobile River (Ref. 4).

In an average year, the plant generates fly ash from 3,000,915,272 tons of coal (Ref. 5). The Barry Steam Plant estimates that approximately 1,416 yd^3 of fly ash, the plant's largest waste, has been deposited weekly in the ash pond at a depth of 8 to 10 inches. The currently active ash pond area is located east of the former ash pond. The fly ash is transported to the ash pond via a conveyor belt (Ref. 6). There are no company records kept on the quantity of wastes deposited in the 5- to 8-acre landfill, which receives concrete, metal, glass, fly ash waste, asbestos, paper, wood, and other construction materials (Ref. 7).

The 5- to 8-acre landfill may have started as early as 1952, for the disposal of construction debris, gravel, and sludge dredge from the canal. A dump truck is used to transport the waste materials to the landfill. The landfill was first permitted on February 3, 1983, with the Alabama Department of Environmental Management. On February 4, 1988, a five-year permit was reissued for the landfill (Ref. 8). The Barry Steam Plant filed a Part A application in 1980. The application was withdrawn December 28, 1982.

There is no record of any violations for these discharge points in the file material. The facility currently has small-quantity generator status (Ref. 9).

3.0 REGIONAL POPULATIONS AND ENVIRONMENTS

3.1 POPULATION AND LAND USE

3.1.1 Demography

The Barry Steam Plant is located in a rural area approximately 1.0 mile west of Bucks, Alabama. The population within a 4-mile radius is primarily concentrated in small communities which border Highway 43. Based upon a house count taken from topographic maps of the area along with county population values, the total population distribution is 12 people between 0 and 1 mile; 60 people between 1 and 2 miles; 89 people between 2 and 3 miles; and 335 people between 3 and 4 miles (Ref. 10, Appendix A).

3.1.2 Land Use

Large-acreage wetlands and farmland cover most of the land area within a 4-mile radius. The rich, Upper Mobile River Delta supports the production of many crops, including soybeans, corn, and watermelon (Refs. 11, 12).

The nearest school, Chastang School, is located approximately 3.75 miles from Barry Steam Plant. No day-care centers are located in the immediate proximity of the facility (Ref. 13). The ranges of several threatened and endangered species occur in Baldwin and Mobile Counties, including the piping plover (Charadrius melodus), a threatened species; the ivory-billed woodpecker (Campephilas principalis), an endangered species; and the red-cockaded woodpecker (Dicoides borealis), an endangered species. A critical habitat for the endangered Alabama beach mouse (Peromyscus polionotus ammobates) occurs in Baldwin County (Ref. 14).

3.2 SURFACE WATER

3.2.1 Climatology

Mobile County has a humid, temperate climate. Winters are warm with infrequent cool spells. In summer, the average temperature is 81°F with a daily maximum temperature of 91°F. The winter temperature averages 53°F with a daily minimum temperature of 43°F. The 1-year, 24-hour rainfall is

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27 inches, with an average annual net precipitation of 3 inches. Rainfall occurs throughout the year at regular intervals with occasional heavy downpours (Refs. 11, 12).

3.2.2 Overland Drainage

The Barry Steam Plant is located in extremely flat topography. Typically, the surface water run-off pathway from the landfill and ash pond drains 500 feet overland by sheet drainage southward into the wetlands, which are bordered by the cool-down canal on the west and by the Mobile River on the east and the south. The surface water run-off pathway for the power plant and surrounding buildings continues overland north into the Mobile River (Appendix B).

3.2.3 Potentially Affected Water Bodies

The Mobile River, which continues southward, supports much recreational sport fishing, with catfish and flounder as the major catches (Refs. 14, 15).

Several sensitive environments are located along the 15-mile extended surface water migration pathway which is completed in the Mobile River beyond the Mobile corporate boundary near the point of entry of Williams Creek into the river. Wetlands, a sensitive environment, border nearly the entire length of the pathway. The extended surface water migration pathway contains several endangered species, including a critical habitat for the Alabama beach mouse (Peromyscus polionotus ammobates), an endangered species; and the American alligator (Alligator missipiensis) (Ref. 14).

This portion of the Mobile River is bordered by sparsely inhabited areas; there are no surface water intakes along an extended 15-mile migration pathway (Appendix B).

3.3 GROUNDWATER

3.3.1 Hydrogeology

The Alabama Power Company-Barry Steam Plant is located in the Atlantic Coastal Plain Physiographic Province and the Gulf Coastal Plain groundwater region (Refs. 16, plate 28; 17, pp. 270, 271). This region is characterized by thick, gently sloping layers of unconsolidated sediments (Ref. 17, p. 271). The topography of the area consists of low hills and marshy lowlands drained by numerous streams and rivers. Topographic relief near the facility ranges from 5 to 50 feet above mean sea level (Appendix B). The soil near the facility consists mostly of alluvium from the nearby Mobile River (Ref. 18).

The major aquifers in the area are the alluvial-coastal aquifer and the Pliocene-Miocene aquifer (Ref. 19, p. 1). The alluvial-coastal aquifer is divided into alluvial-low terrace-coastal deposits and high terrace deposits. The alluvial-low terrace-coastal deposits consist of fine-to coarse-grained sand interbedded with gravel and sandy clay. The high terrace deposits consist of interbedded sand, clay, and gravel (Ref. 19, p. 8). The alluvial-coastal aquifer which is unconfined is approximately 150 feet thick (Refs. 19, p. 6; A, p. 36). The depth to the water table beneath the facility is approximately 10 feet, with groundwater flow to the south (Appendix B). Sediments in the alluvial-coastal aquifer are similar to sediments with hydraulic conductivity values in the 1.0×10^{-5} to 1.0×10^{-3} cm/sec range (Ref. 20, p. 29).

The Pliocene-Miocene aquifer is hydraulically connected to the overlying alluvial-coastal aquifer (Ref. 19, p. 1). It is divided into the Citronelle Formation and the undifferentiated Miocene series. The Citronelle Formation consists of sandy clay interbedded with gravelly sand containing lenses of sand and clay (Ref. 19, p. 5). It ranges in thickness from 40 to 130 feet (Ref. A, p. 36). The undifferentiated Miocene series consists of laminated-to thinly-bedded clay, crossbedded sand, and fossiliferous sandy clay (Refs. 19, p. 5; A, p. 30).

Near the facility, wells completed in the alluvial-coastal aquifer have an average depth of 95 feet below land surface (bls). They yield 10 gallons per minute in sandy areas (Ref. 19, pp. 15, 17). Wells completed in the Pliocene-Miocene aquifer have an average depth of 700 feet bls. They yield approximately 1.5 gpm (Ref. 21, pp. 15, 16, 17). Recharge to the aquifer system is through infiltration of rainwater (Ref. 21, p. 9).

3.3.2 Aquifer Use

Residents within a 4-mile radius are served by two municipal water systems, Mt. Vernon Water System and Le Moyne Water System, Inc. The Mt. Vernon Water System extends south from Mt. Vernon along Highway 43 to include the communities of Movico and Chastang (Ref. 22). The Le Moyne Water System, Inc., extends north from Axis along Highway 43 to the LeMoyne/Salco Road located approximately 0.25 mile south of Cold Creek (Ref. 23). Both water systems rely on municipal wells which are located outside of a 3- and a 4-mile radius (Refs. 22, 23).

Other residents outside of the two distribution systems rely on private wells for drinking water. The nearest private well is located 1.5 miles west of the facility in Bucks. A house count on USGS topographic maps indicates 32 private wells within a 3-mile radius. When a 4-mile radius is considered, there are 43 houses (Refs. 2, 11, 22, 23, 24).

3.4 SUMMARY OF POTENTIALLY AFFECTED POPULATIONS AND ENVIRONMENTS

The surface water pathway is of primary concern at the site due to the recreational areas and sensitive environments located along the Mobile River.

A small number of groundwater users could potentially be affected by contamination from the Barry Steam Plant. The majority of the population is served by the LeMoyne and Mount Vernon water systems, which are both supplied by municipal wells located outside of the 4-mile radius. The air pathway is not of concern due to the lack of a potentially affected population.

4.0 FIELD INVESTIGATION

4.1 SAMPLE COLLECTION

4.1.1 Sample Collection Methodology

All sample collection, sample preservation, and chain-of-custody procedures used during this investigation were in accordance with the standard operating procedures as specified in Sections 3 and 4 of the Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual; United States Environmental Protection Agency, Region IV, Environmental Services, Division, April 1, 1986.

4.1.2 Duplicate Samples

Split samples were offered to representatives of the Alabama Power Company. The samples were accepted by Mr. Dave Roberson.

4.1.3 Description of Samples and Sample Locations

A total of nine soil, five groundwater, and four sediment samples were collected during the onsite inspection. The samples were collected from background locations, disposal areas, migration pathways, and surface water bodies which could potentially receive contaminants. Sample codes and descriptions are presented in Table 1. Sample locations are shown on Figure 3.

4.1.4 Field Measurements

Field measurements were recorded for the groundwater samples. Parameters measured included temperature, pH, and conductivity of the sample at time of collection. No field measurements were performed on the soil samples during the investigation. The groundwater data are presented in Table 2.

TABLE 1

SAMPLE CODES AND DESCRIPTIONS
ALABAMA POWER COMPANY - BARRY STEAM PLANT
BUCKS, MOBILE COUNTY, ALABAMA

Sample Code	Collection Time	Collection Date	Description
BS-SS-01	1030	4/30/90	Background surface soil sample was collected east of guard house at plant entrance. Sample consisted of reddish brown, sandy soil. HNu - 0 ppm
BS-SB-01	1040	4/30/90	Background subsurface soil sample was collected east of guard house at plant entrance. Sample was collected from 2 feet below land surface (bls) and consisted of brown, sandy soil. HNu - 0 ppm
BS-SS-02	1325	4/30/90	Surface soil sample was collected from ash pond. Sample consisted of brownish-black, sandy soil. HNu - 2 ppm
BS-SB-02	0815	5/1/90	Subsurface soil sample was collected from ash pond. Sample was collected from 2 feet bls and consisted of black, sandy soil with wood particles. HNu - 0 ppm
BS-SS-03	1350	4/30/90	Surface soil sample was collected downgradient of ash pond and upgradient of Mobile River. Sample consisted of light sandy soil with yellowish-green streaks. HNu - 0 ppm
BS-SB-03	1405	4/30/90	Subsurface soil sample was collected downgradient of ash pond and upgradient of Mobile River. Sample was collected from 7 feet bls and consisted of blackish-gray soil. HNu - 0 ppm
BS-SS-04	1000	5/1/90	Surface soil sample was collected downgradient of ash pond and upgradient of Mobile River. Sample consisted of black, clumpy soil. HNu - 0 ppm
BS-SB-04	1020	5/1/90	Subsurface soil sample was collected downgradient of ash pond and upgradient of Mobile River. Collected from 3 feet bls and consisted of grayish-black soil. HNu - 0 ppm
BS-SS-05	1610	4/30/90	Surface soil sample was collected from drum storage area. Sample consisted of black, sandy soil.

BS - Alabama Power Company - Barry Steam Plant
SS - Surface Soil
SB - Subsurface Soil
PW - Private Well
TW - Temporary Well
TB - Trip Blank
PB - Preservative Blank
SD - Sediment

TABLE 1

SAMPLE CODES AND DESCRIPTIONS
ALABAMA POWER COMPANY - BARRY STEAM PLANT
BUCKS, MOBILE COUNTY, ALABAMA

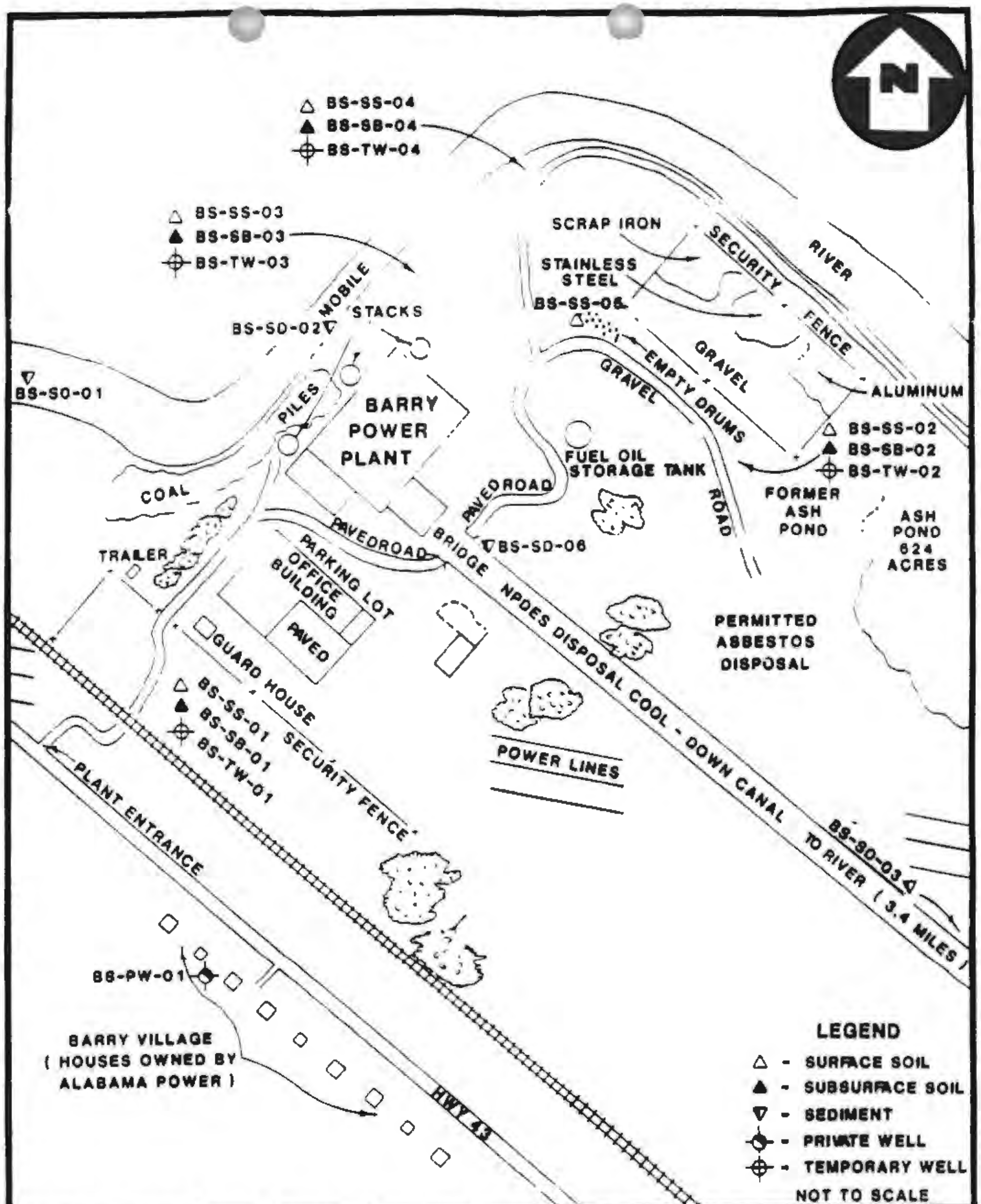
Sample Code	Collection Time	Collection Date	Description
BS-PW-01	1000	4/30/90	Private well was sampled in Barry Village. Barry Village is a small subdivision owned by Alabama Power Company for use by employees. Well is used for garden irrigation only.
BS-TW-01	1115	4/30/90	Groundwater sample was collected from temporary monitor well installed east of guard house for background purposes. Borehole was completed to a depth of 5 feet bls.
BS-TW-02	0900	5/1/90	Groundwater sample was collected from temporary monitor well installed in ash pond. Borehole was completed to a depth of 3 feet bls.
BS-TW-03	1430	4/30/90	Groundwater sample was collected from temporary monitor well installed downgradient of ash pond and upgradient of Mobile River. Borehole was completed to a depth of 8 feet bls.
BS-TW-04	1100	5/1/90	Groundwater sample was collected from temporary monitor well installed downgradient of ash pond and upgradient of Mobile River. Borehole was completed to a depth of 3 feet bls.
BS-TB-01	0630	4/30/90	Trip Blank
BS-PB-01	0630	4/30/90	Preservative Blank was preserved at the same time as last water sample.
BS-SD-01	0815	5/1/90	Sediment sample was collected from Mobile River upstream of facility.
BS-SD-02	0845	5/1/90	Sediment sample was collected from Mobile River adjacent to facility.
BS-SD-03	0910	5/1/90	Sediment sample was collected from Mobile River downstream of facility.
BS-SD-06	0940	5/1/90	Sediment sample was collected from cool-down canal.

BS - Alabama Power Company - Barry Steam Plant
SS - Surface Soil
SB - Subsurface Soil
PW - Private Well
TW - Temporary Well
TB - Trip Blank
PB - Preservative Blank
SD - Sediment

TABLE 2

FIELD MEASUREMENTS
GROUNDWATER SAMPLES
ALABAMA POWER COMPANY - BARRY STEAM PLANT
BUCKS, MOBILE COUNTY, ALABAMA

Sample Code	Temperature (C°)	Ph (s.u.)	Conductivity (umhos)
BS-PW-01	20	4.5	27.3
BS-TW-01	24	5.3	78.6
BS-TW-02	20	6.4	847
BS-TW-03	24	6.4	13.6
BS-TW-04	29	6.4	1130



SAMPLE LOCATIONS MAP
ALABAMA POWER COMPANY
BARRY STEAM PLANT
BUCKS, MOBILE COUNTY, ALABAMA

FIGURE 3

NUS CORPORATION

4.2 SAMPLE ANALYSIS

4.2.1 Analytical Support and Methodology

All samples collected were analyzed under the Contract Laboratory Program (CLP) and analyzed for all parameters listed in the Target Compound List (TCL). Organic analysis of soil and water samples was performed by Compu Chem Laboratories in Chapel Hill, North Carolina. Inorganic analysis of soil and water was performed by NET Mid-Atlantic, Inc. in Thorofare, New Jersey.

All laboratory analyses and laboratory quality assurance procedures used during this investigation were in accordance with standard procedures and protocols as specified in the Analytical Support Branch Operations and Quality Assurance Manual, United States Environmental Protection Agency, Region IV, Environmental Services Division, revised June 1, 1985; or as specified by the existing United States Environmental Protection Agency standard procedures and protocols for the contract analytical laboratory program.

4.2.2 Analytical Data Quality

All analytical data were subjected to a quality assurance review as described in the EPA Environmental Services Division laboratory data guidelines. In the tables, some of the concentrations of the organic and inorganic parameters have been flagged with a "J". This indicates that the qualitative analysis was acceptable, but the quantitative value has been estimated. A few other compounds are flagged with an "N", indicating that they were detected based on the presumptive evidence of their presence. This means that the compound was tentatively identified, and its detection cannot be used as positive identification to its presence. The complete analytical data sheets are presented in Appendix B. The preservative trip blank, BS-TB-01, indicated one unidentified extractable compound at 10 ug/l (estimated value).

4.2.3 Presentation of Analytical Results

This section presents a discussion of the analytical results from the environmental samples collected during the investigation at Alabama Power Company-Barry Steam Plant. Results of sediment, surface soil, and subsurface soil samples are presented in Tables 3, 4, 5, 6, 7, and 8. Interpretation of organic and inorganic follows. Background samples have been designated for each of the three media: surface soil, subsurface soil, and sediment. Values for background sample results are presented as either a real value if measurable or as the minimum quantitation limit (MQL) for that constituent. MQL values are qualified with a "U" for undetected. Throughout the following discussion of

TABLE 3

SUMMARY OF ORGANIC ANALYTICAL RESULTS
SOIL SAMPLES
ALABAMA POWER COMPANY - BARRY STEAM PLANT
BUCKS, MOBILE COUNTY, ALABAMA

PARAMETERS (ug/kg)	Background		Ash Pond		Downgradient of Ash Pond				Drum Storage Area
	BS-SS-01	BS-SB-01	BS-SS-02	BS-SB-02	BS-SS-03	BS-SB-03	BS-SS-04	BS-SB-04	BS-SS-05
PURGEABLE COMPOUNDS									
CHLOROFORM	6U	-	-	-	-	-	-	-	1J
EXTRACTABLE COMPOUNDS									
(3-AND/OR 4-)METHYLPHENOL	370U	-	91J	-	-	-	-	-	-
NAPHTHALENE	370U	390U	50J	110J	-	-	-	-	-
2-METHYLNAPHTHALENE	370U	390U	-	130J	-	-	-	-	-
PHENANTHRENE	370U	390U	370J	370J	-	-	-	-	-
ANTHRACENE	370U	-	50J	-	-	-	-	-	-
DI-N-BUTYLPHTHALATE	370U	-	49J	-	-	52J	-	-	-
FLUORANTHENE	370U	390U	580	410J	130J	-	-	-	-
PYRENE	370U	-	470	-	-	-	-	-	-
BENZO(A)ANTHRACENE	370U	-	350J	-	-	-	-	-	-
CHRYSENE	370U	-	390J	-	-	-	-	-	-
BENZO(B AND/OR K)FLUORANTHENE	370U	-	680J	-	-	-	-	-	-
BENZO-A-PYRENE	370U	-	280J	-	-	-	-	-	-
INDENO (1,2,3-CD) PYRENE	370U	-	150J	-	-	-	-	-	-
BENZO(GHI)PERYLENE	370U	-	170J	-	-	-	-	-	-
UNIDENTIFIED COMPOUNDS/NO.(1)			4000J/8	40,000J/13	300,000J/19		9000J/7	700J	

-   Material analyzed for but not detected above minimum quantitation limit
J   Estimated value
N   Presumptive evidence of presence of material
U   Material was analyzed for but not detected. The given number is the minimum quantitation limit.
(1)   Tentatively identified compound (TIC). This compound not on CLP Target Compound List (TCL) and is reported only as detected in individual samples, MQL not determined.

TABLE 3

SUMMARY OF ORGANIC ANALYTICAL RESULTS
SOIL SAMPLES
ALABAMA POWER COMPANY - BARRY STEAM PLANT
BUCKS, MOBILE COUNTY, ALABAMA

	Background		Ash Pond		Downgradient of Ash Pond				Drum Storage Area
PARAMETERS (ug/kg)	BS-SS-01	BS-SB-01	BS-SS-02	BS-SB-02	BS-SS-03	BS-SB-03	BS-SS-04	BS-SB-04	BS-SS-05
HEXADECANOIC ACID(1)			700JN						
METHYLPHENANTHRENE(1)			600JN						
ETHYLANTHRACENE(1)			600JN						
DIMETHYLNAPTHALENE(1)			300JN						
HYDROXYMETHYLNAPTHALENEDIONE(1)							2000JN		
PESTICIDE\PCB COMPOUNDS									
BETA-BHC	-	9 2U	-	19	-	-	-	-	-

- Material analyzed for but not detected above minimum quantitation limit
J Estimated value
N Presumptive evidence of presence of material
U Material was analyzed for but not detected. The given number is the minimum quantitation limit.
(1) Tentatively identified compound (TIC). This compound not on CLP Target Compound List (TCL) and is reported only as detected in individual samples; MQL not determined.

TABLE 4

SUMMARY OF ORGANIC ANALYTICAL RESULTS
SEDIMENT SAMPLES
ALABAMA POWER COMPANY - BARRY STEAM PLANT
BUCKS, MOBILE COUNTY, ALABAMA

	Upgradient	Adjacent to Facility	Downgradient	Ash Pond
PARAMETERS (ug/kg)	BS-SD-01	BS-SD-02	BS-SD-03*	BS-SD-06
EXTRACTABLE COMPOUNDS				
PHENANTHRENE	490U	-	-	62J
PYRENE	490U	-	-	58J
UNIDENTIFIED COMPOUNDS/NO.(1)	7000J/6			10,000J/12

- Material analyzed for but not detected above minimum quantitation limit
J Estimated value
U Material was analyzed for but not detected. The number given is the minimum quantitation limit.
(1) Tentatively identified compound. This compound is not on Target Compound List and is reported only as detected in individual samples; MQL not determined.
*Note: Sample SD-04 and SD-05 not collected.

TABLE 5

SUMMARY OF ORGANIC ANALYTICAL RESULTS
GROUNDWATER SAMPLES
ALABAMA POWER COMPANY - BARRY STEAM PLANT
BUCKS, MOBILE COUNTY, ALABAMA

	Trip Blank	Background	Ash Pond	Downgradient of Ash Pond		Private Well
PARAMETERS (ug/l)	BS-TB-01	BS-TW-01	BS-TW-02	BS-TW-03	BS-TW-04	BS-PW-01
PURGEABLE COMPOUNDS						
CARBON DISULFIDE	-	5U	-	-	2J	-
EXTRACTABLE COMPOUNDS						
UNIDENTIFIED COMPOUNDS/NO (1)	10J/1			50J/2	300J/2	

- Material analyzed for but not detected above minimum quantitation limit
J Estimated value
U Material was analyzed for but not detected. The number given is the minimum quantitation limit.
(1) Tentatively identified compound. This compound is not on Target Compound List and is reported only as detected in individual samples; MQL not determined.

TABLE 6

SUMMARY OF INORGANIC ANALYTICAL RESULTS
GROUNDWATER SAMPLES
ALABAMA POWER COMPANY - BARRY STEAM PLANT
BUCKS, MOBILE COUNTY, ALABAMA

	Preservative Blank	Background	Ash Pond	Downgradient of Ash Pond		Private Well
PARAMETERS (ug/l)	BS-PB-01	BS-TW-01	BS-TW-02	BS-TW-03	BS-TW-04	BS-PW-01
ALUMINUM	-	11,000	3300	4300	22,000	-
ARSENIC	-	6U	110J	500	130	-
BARIUM	-	47	610	1200	120	-
BERYLLIUM	-	1U	-	-	-	-
CADMIUM	-	1U	-	-	-	-
CALCIUM	-	6900	140,000	180,000	200,000	710
CHROMIUM	-	9U	69	-	37	-
IRON	-	5600	17,000	73,000	65,000	2800
MAGNESIUM	-	1000	16,000	31,000	42,000	-
MANGANESE	-	50	1200	2300	6000	33
NICKEL	-	13U	91	16	31	-
POTASSIUM	-	570	17,000	17,000	13,000	630
SELENIUM	-	4U	14	-	-	-
SILVER	-	2U	-	-	-	-
SODIUM	-	2400U	26,000	15,000	15,000	-
VANADIUM	-	16	16	15	58	-
ZINC	-	50U	-	-	-	55

- Material analyzed for but not detected above minimum quantitation limit
J Estimated value
U Material was analyzed for but not detected. The number given is the minimum quantitation limit.
R QC indicates that data unusable. Compound may or may not be present.

TABLE 7

SUMMARY OF INORGANIC ANALYTICAL RESULTS
SOIL SAMPLES
ALABAMA POWER COMPANY - BARRY STEAM PLANT
BUCKS, MOBILE COUNTY, ALABAMA

	Background		Ash Pond		Downgradient of Ash Pond				Drum Storage Area
PARAMETERS (mg/kg)	BS-SS-01	BS-SB-01	BS-SS-02	BS-SB-02	BS-SS-03	BS-SB-03	BS-SS-04	BS-SB-04	BS-SS-05
ALUMINUM	4500	6500	2500	9000	690	830	8000	7200	3500
ARSENIC	1.4U	1 4U	12J	100J	-	6.6J	37J	-	27J
BARIUM	9 9	15	69	240	-	6 9	170	24	300
CADMIUM	20U	.20U	-	2.1	-	-	-	-	-
CALCIUM	370	130	4700	19,000	140	200	2500	1100	3600
CHROMIUM	5.7	6.2	11	290	2 6	2.3	18	12	15
COBALT	1U	1.2	3.5	11	-	-	6 7	-	5.6
COPPER	3UJ	3UJ	-	120J	-	-	-	-	-
IRON	5200J	3900J	6600J	67,000J	690J	1100J	16,000J	7800J	17,000J
LEAD	5U	6U	-	120	-	-	-	-	-
MAGNESIUM	130	210	-	3200	99	-	640	480	990
MANGANESE	7U	6.8	45	690	2 8	5	120	45	120
MERCURY	.11UR	10UR	-	-	-	-	-	-	-
NICKEL	2 6U	2 6U	9.7	150	-	-	12	-	13
POTASSIUM	99	120	330	1100	140	75	790	480	370

- Material analyzed for but not detected above minimum quantitation limit
J Estimated value
U Material was analyzed for but not detected. The number given is the minimum quantitation limit.
R QC indicates that data unusable. Compound may or may not be present.

TABLE 7

SUMMARY OF INORGANIC ANALYTICAL RESULTS
SOIL SAMPLES
ALABAMA POWER COMPANY - BARRY STEAM PLANT
BUCKS, MOBILE COUNTY, ALABAMA

	Background		Ash Pond		Downgradient of Ash Pond				Drum Storage Area
PARAMETERS (mg/kg)	BS-SS-01	BS-SB-01	BS-SS-02	BS-SB-02	BS-SS-03	BS-SB-03	BS-SS-04	BS-SB-04	BS-SS-05
SELENIUM	80U	8U	-	61J	-	-	2 5J	-	4 3J
SILVER	40U	4U	-	-	-	-	-	-	-
SODIUM	120U	100U	-	420	-	-	-	-	-
VANADIUM	11	11	16	43	3.3	3 1	37	19	16
ZINC	20U	20	23	320	-	-	-	-	-
CYANIDE	2 5U	-	-	-	-	-	3.1	-	-

- \- Material analyzed for but not detected above minimum quantitation limit
- J Estimated value
- U Material was analyzed for but not detected. The number given is the minimum quantitation limit.
- R QC indicates that data unusable. Compound may or may not be present.

TABLE 8

SUMMARY OF INORGANIC ANALYTICAL RESULTS
SEDIMENT SAMPLES
ALABAMA POWER COMPANY - BARRY STEAM PLANT
BUCKS, MOBILE COUNTY, ALABAMA

PARAMETERS (mg/kg)	Mobile River			Cool Down Canal
	Upgradient	Adjacent to Facility	Downgradient	Ash Pond
	BS-SD-01	BS-SD-02	BS-SD-03*	BS-SD-06
ALUMINUM	7000	3100	7600	3600
ARSENIC	2.8U	5.7J	-	75J
BARIUM	65	31	40	240
CALCIUM	2100	5900	1600	4100
CHROMIUM	14	7.6	17	14
IRON	14,000J	9500J	18,000J	52,000J
MAGNESIUM	1100	200	810	290
MANGANESE	390	44	160	41
NICKEL	10	-	4.3	9.1
POTASSIUM	680	200	560	-
SELENIUM	80U	-	-	5J
VANADIUM	18	11	26	51
ZINC	40U	-	-	-
CYANIDE	10	-	2.7	6.6
COPPER	6UJ	-	-	19J

- Material analyzed for but not detected above minimum quantitation limit (MQL).

J Estimated value.

U Material was analyzed for but not detected. The number given is the MQL.

R QC indicates that data unusable. Compound may or may not be present.

*Note: Samples SD-04 and SD-05 were not collected because of sampling location inaccessibility analytical results, the concentrations of some of the contaminants detected have been described as "significant". This means that the concentration was found to be either three times the background sample, or it was three times the MQL of that contaminant in the background sample.

4.2.3.1 Summary of Organic Analytical Results

Table 3 presents organic analytical results for the surface and subsurface soil samples. No organics were detected at significant levels above background or the MQL in surface soil, subsurface soil, or sediment samples (Tables 3, 4). Beta-BHC was detected at two times MQL in subsurface soil BS-SB-02. The sample also contained 13 unidentified compounds at an estimated value of 40,000 ug/kg. Sample BS-SS-02, also collected in the ash pond, contained polycyclin-aromatic hydrocarbon (PAH) compounds, as well as eight unidentified extractable compounds, at an estimated value of 4,000 ug/kg.

Downgradient of the ash pond, two unidentified extractable compounds were found in each of the temporary wells, BS-TW-03, and BS-TW-04, respectively.

4.2.3.2 Summary of Inorganic Analytical Results

Table 6 presents inorganic analytical results for the groundwater samples. Temporary well, BS-TW-01, which was used as a background well, contained measurable quantities of calcium, iron, magnesium, and manganese.

Two temporary wells, BS-TW-03 and BS-TW-04, located downgradient from the ash pond, both contained significant amounts of arsenic. Arsenic was detected in sample BS-TW-03 (500 ug/l, 80 times MQL), and in BS-TW-04 (130 ug/l, 20 times MQL). Coal, which is used as a fuel at the power plant, contains substantial amounts of sulfur, nitrogen, and mineral matter, including significant amounts of toxic materials like beryllium, mercury, and arsenic. Arsenic compounds are not readily combustible; therefore, high concentrations of these remain in the ash.

Other significant contaminants found in these two well samples include barium (26 times background in BS-TW-04), potassium (8,000 times background in BS-TW-03; 5,000 times background in BS-TW-04), and calcium (26 times background in BS-TW-03; 30 times background in BS-TW-04). A sample from a well located in the ash pond indicated chromium at eight times MQL. Eight inorganic metallic metallic contaminants were detected at significant levels above background, ranging from 3 times background to 46 times background.

Table 7 presents inorganic analytical results for surface and subsurface soil samples obtained from the Alabama Power Company-Barry Steam Plant. Arsenic was detected in both surface and subsurface soil samples at locations BS-SS-02 (12 mg/kg, 9 times MQL), BS-SB-02 (100 mg/kg, 70 times MQL), BS-SB-03 (6.6 mg/kg, 5 times MQL), BS-SS-04 (37 mg/kg, 26 times MQL), and BS-SS-05 (27 mg/kg, 19 times MQL) at estimated values. In the ash pond area, chromium was detected at 3 times MQL at location BS-SS-04. Lead was found in subsurface soil sample BS-SB-02 at 20 times MQL. Chromium and arsenic were detected at various locations in and around the ash ponds, while lead was detected solely in the ash pond sampling points. Thirteen of the inorganic contaminants were detected at significant levels above background, ranging from 2 times background to 146 times background.

Table 8 presents inorganic analytical results for four sediment samples. Sample BS-SD-01, located upstream of the facility in the Mobile River, was designated as the background sample. Cyanide, chromium, and nickel were found in notably high levels in sample BS-SD-01. Arsenic was detected in sample BS-SD-06 at 25 times MQL, estimated value. The sample also contained barium, copper, lead, and selenium at levels ranging from 2 to 5 times background. No significant levels of contamination above background or MQL were found in samples collected downstream of the facility in the Mobile River. Often solvents, like the hydroxy acetic acid used at the plant to clean the boiler and tubing, can leach metals from the metal tubing. The high levels of metals in the ash pond could result from this process.

5.0 SUMMARY

The groundwater and surface water pathways are of primary concern at the Barry Steam Plant. The majority of the population within a 4-mile radius obtains drinking water from the LeMoyne and Mt. Vernon water systems, both of which depend upon municipal wells located outside of the 4-mile radius. There are only 32 private wells within a 3-mile radius, 43 within a 4-mile radius. However, the surface water pathway supports recreational fishing and sensitive environments, including wetlands and critical habitats. Additionally, the concentration of contaminants is high in and around the ash pond area and in the cool-down canal which drains into the Mobile River.

The sampling investigation consisted of the collection of eighteen environmental samples: nine soil, five groundwater, and four sediment samples. Arsenic was detected in all media at significant levels above background. Arsenic appeared especially concentrated in the ash pond area, with decreasing concentrations in the surface water migration pathway.

Based on the analysis of possible migration pathways, the results of the sampling investigation, and the information obtained from the references, FIT 4 recommends Phase I of a Listing Site Inspection be initiated for Alabama Power Company - Barry Steam Plant.

REFERENCES

1. NUS Corporation Field Logbook No. F4-2225 and attached site map for Alabama Power Co.-Barry Steam Plant, TDD No. F4-9001-181. Documentation of screening site inspection, April 30 - May 1, 1990.

2. Potential Hazardous Waste Site Preliminary Assessment (EPS Form 3012-111), and attachments for Alabama Power Co. - Barry Steam Plant. Filed by Steven M. Hornung, Environmental Protection Systems, August 2, 1984.

3. USEPA, Office of Solid Waste and Emergency Response, Coal by Electric Utility Power Plants: Report to Congress (Washington, D.C.: GPO, February 1988).

4. Don Barton, Alabama Power Co. - Barry Steam Plant, telephone conversation with Betty Ann Pruner, NUS Corporation, August 31, 1990. Subject: Production processes at the Barry Steam Plant.

5. Don Barton, Alabama Power Company - Barry Steam Plant, telephone conversation with Betty Ann Pruner, NUS Corporation, September 19, 1990. Subject: Production figures at the Barry Steam Plant.

6. Lori Conway, NUS Corporation, memo to file for Alabama Power Company-Barry Steam Plant, August 21, 1990. Subject: Conversation with Betty Ann Pruner, NUS Corporation, concerning waste disposal.

7. Landfill Permit Application for Inert Type Solid Waste Landfill (Section 4-181.08) for Barry Steam Plant, Bucks, Alabama. Filed by J.R. Beggerly, owner, January 26, 1983.

8. Don Fuqua, Environmental Compliance Section, Alabama Power Company, telephone conversation with Betty Ann Pruner, NUS Corporation, September 4, 1990. Subject: History of the 5- to 8-acre landfill.

9. Barbara Smith, Alabama Department of Environmental Management, telephone conversation with Betty Ann Pruner, NUS Corporation, November 1, 1990. Subject: RCRA status of Barry Steam Plant.

10. U.S. Bureau of the Census, Estimates of Households for Counties: July 1, 1985, Current Population Reports, Series P-23, No. 156 (Washington, D.C.: GPO, 1988).

11. U.S. Department of Agriculture, Soil Conservation Service, Soil Survey of Baldwin County, Alabama (December 1964).

12. U.S. Department of Agriculture, Soil Conservation Service, Soil Survey of Mobile County, Alabama (July 1979).

13. Reconnaissance Checklist for HRS2 Concerns for Alabama Power Company - Barry Steam Plant, Bucks, Alabama, July 27, 1989; obtained from NUS Corporation file on Barry Steam Plant (NUS: Atlanta, Georgia).

14. U.S. Fish and Wildlife Service, Endangered and Threatened Species of the Southeastern United States (Atlanta, Georgia, 1988).

15. James Harbin, Alabama Department of Conservation and Natural Resources, telephone conversation with Scott Singleton, NUS Corporation, July 3, 1989. Subject: Fishing in the Mobile River.

16. Oscar R. Meinzer, The Occurrence of Groundwater in the United States, U.S. Geological Survey Water-Supply Paper No. 489 (Washington, D.C.: GPO, 1923), plate 28.

17. Linda Aller, et al., DRASTIC: A Standardized System for Evaluating Ground Water Pollution Potential Using Hydrologic Settings, EPA-600/2-87-035 (Ada, Oklahoma: EPA, April 1987).

18. U.S. Department of Commerce, Climatic Atlas of the United States (Washington, D.C.: GPO, June 1968) Reprint: 1983, National Oceanic and Atmospheric Administration.

19. U.S. Department of Commerce, Rainfall Frequency Atlas of the United States, Technical Paper Number 40 (Washington, D.C.: GPO, 1961).

20. Will S. Mooty, Geohydrology and Susceptibility of Major Aquifers to Surface Contamination in Alabama; Area 13, U.S. Geological Survey Water Resources Investigations Report 88-4080, (Tuscaloosa, Alabama, 1988).

21. R. Allan Freeze and John A. Cherry, Groundwater (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1979).

22. Ms. Jackson, Mt. Vernon City Hall, telephone conversation with Betty Ann Pruner, NUS Corporation, August 27, 1990. Subject: Mt. Vernon water system.

23. Larry Parker, LeMoyne Water System, Inc., telephone conversation with Betty Ann Pruner, August 29, 1990. Subject: LeMoyne Water System, Inc.

11. APPENDIX D – 2010 EPA ASSESSMENT

FINAL REPORT

Dam Safety Assessment of CCW Impoundments

James M. Barry Electric Generating Plant

United States Environmental Protection Agency
Washington, DC

December 8, 2010

O'BRIEN & GERE
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FINAL REPORT

13498/46122

Dam Safety Assessment of CCW Impoundments

James M. Barry Electric Generating Plant

Prepared for:
US Environmental Protection Agency
Washington, DC

ROBERT R. BOWERS, P.E. – VICE PRESIDENT
O'BRIEN & GERE ENGINEERS, INC.

12/8/2010

WILLIAM H. DIXON, P.E. – PROJECT ASSOCIATE
O'BRIEN & GERE ENGINEERS, INC.

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1. INTRODUCTION

1.1. GENERAL

In response to the coal combustion waste (CCW) impoundment failure at the TVA/Kingston coal-fired electric generating station in December of 2008, the U. S. Environmental Protection Agency has initiated a nationwide program of structural integrity and safety assessments of coal combustion waste impoundments or "management units".

A CCW management unit is defined as a surface impoundment or similar diked or bermed management unit or management units designated as landfills that receive liquid-borne material and are used for the storage or disposal of residuals or by-products from the combustion of coal, including, but not limited to, fly ash, bottom ash, boiler slag, or flue gas emission control residuals. Management units also include inactive impoundments that have not been formally closed in compliance with applicable federal or state closure/reclamation regulations.

The U.S. EPA has authorized O'Brien & Gere to provide actual site specific impoundment assessments at selected facilities. This project is being conducted in accordance with the terms of BPA#EP10W000673, Order No. EP-CALL-0001 dated June 14, 2010.

1.2. PROJECT PURPOSE AND SCOPE

The purpose of this work is to provide Dam Safety Assessment of CCW management units, including the following:

- Identify conditions that may adversely affect the structural stability and functionality of a management unit and its appurtenant structures
- Note the extent of deterioration, status of maintenance, and/or need for immediate repair
- Evaluate conformity with current design and construction practices
- Determine the hazard potential classification for units not currently classified by the management unit owner or by state or federal agencies

O'Brien & Gere's scope of services for this project includes performing a site specific dam safety assessment of all CCW management units at the subject facility. Specifically, the scope includes the following tasks:

- Perform a review of pertinent records (prior inspections, engineering reports, drawings, etc.) made available at the time of the site visit to review previously documented conditions and safety issues and gain an understanding of the original design and modifications of the facility.
- Perform a site visit and visual inspection of each CCW management unit and complete the visual inspection checklist to document conditions observed.
- Perform an evaluation of the adequacy of the outlet works, structural stability, quality and adequacy of the management unit's inspection, maintenance, and operations procedures.
- Identify critical infrastructure within 5 miles down gradient of management units.
- Evaluate the risks and effects of potential overtopping and evaluate effects of flood loading on the management units.
- Immediate notification of conditions requiring emergency or urgent corrective action.
- Identify all environmental permits issued for the management units
- Identify all leaks, spills, or releases of any kind from the management units within the last 5 years.

- Prepare a report summarizing the findings of the assessment, conclusions regarding the safety and structural integrity, recommendations for maintenance and corrective action, and other action items as appropriate.

This report addresses the above issues for the CCW Management Unit (the Barry Ash Pond or pond) at the James M. Barry Electric Generating Plant in Bucks, Alabama. The Barry Ash Pond is owned and operated by Alabama Power Company (Alabama Power), a subsidiary of the Southern Company. In the course of this assessment, O'Brien & Gere representatives obtained information from representatives of Alabama Power, the Southern Company, and the law firm of Balch & Bingham, LLP.

2. PROJECT/FACILITY DESCRIPTION

The James M. Barry Electric Generating Plant (Plant Barry) is located along the west bank of the Mobile River at 15300 U.S. Highway 43 North, Bucks, Alabama 36512, approximately 30 miles north of Mobile, Alabama, and is owned and operated by Alabama Power. A Site Location Map is included as Figure 1. Plant Barry is a seven unit electric generating facility, and it includes two, natural gas fired combined cycle units and five coal fire units with a total generating capacity of 2,657,200 KW. The five coal units produce approximately 400,000 tons of coal combustion waste (CCW) by-products per year, including bottom ash and fly ash. CCW that is produced during power generation is managed on-site with a single CCW management unit (Barry Ash Pond). Currently, only generating unit #5 at Plant Barry - the largest of the five coal-fired units - is equipped with a flue-gas desulphurization (FGD) scrubber, which helps to remove emissions such as sulphur dioxide and nitrous oxide.

A byproduct of the emission scrubbing process is synthetic gypsum, which is also currently disposed of in the Barry Ash Pond. Future plans call for the gypsum to be collected in a new Gypsum Collection Basin (GCB) currently under construction with an anticipated operational date of October 29, 2010. After the GCB is operational, the only gypsum byproduct disposed of in the Barry Ash Pond will be the decant water from the GCB. .

This safety assessment report summarizes the July 7, 2010 inspection performed by the O'Brien & Gere team of the Barry Ash Pond management unit at Plant Barry.

2.1. MANAGEMENT UNIT IDENTIFICATION

The location of the Barry Ash Pond inspected during this safety assessment is identified on Figure 2 – Site Layout.

The Barry Ash Pond is located on the east to southeast side of the power plant. The pond area is bounded on the north by Plant Barry, on the east and south by the Mobile River. The southwest side of the Barry Ash Pond area is bounded by the Plant Barry cooling water discharge canal. The pond dam structure is not listed in the National Inventory of Dams (NID) database and therefore not rated. No federal or state agency regulates the Barry Ash Pond dam structure relative to the NID. Currently, there are no dam safety regulations in the State of Alabama.

The Barry Ash Pond was reportedly placed into service in 1965 and is approximately 600 acres in size. As of March 25, 2009, the total approximate ash storage capacity of the pond utilizing wet sluicing methods was estimated to be 9,623,753 cubic yards. At the same time the approximate volume of ash stored in the pond based on wet sluicing was estimated to be 6,305,645 cubic yards. As of December 2009, the approximate remaining available capacity based on wet sluicing was calculated to be 1,278,500 cubic yards. Using dry stacking operations, the approximate available capacity was calculated to be 8,000,000 cubic yards. These capacity estimates are based on surveys and calculations performed by Southern Company Services, a corporate affiliate of Alabama Power Company.

The pond is a diked impoundment formed by east, south and west embankments; the west and east embankments appear to tie into natural ground on the north side of the impoundment. The embankment has reportedly been modified four different times, in 1972, 1992, 1998, and 2004. Records of the 1972 and 1992 modifications were not available. In reviewing the literature, it was noted that the embankment was raised 3 feet in 1992. There have been no major modifications to the pond outfall structure. The pond was built on a marsh area and continues to support marsh-like wildlife, such as cat-tails, water hyacinths, alligators, swamp rats (nutria), and wild hogs.

According to documentation provided to USEPA by Alabama Power, CCW materials contained in the Barry Ash Pond include fly ash, boiler slag, flue gas emission control residuals, and other regulatory permitted low volume wastes, i.e., waste that is not hazardous for purposes of RCRA Subtitle C and is otherwise permitted under applicable regulations such as 40 C.F.R. §423.11. These materials, including storm water runoff from the Plant Barry, are transferred to the pond via the plant's storm water pump station.

Water flows from north to south through the pond and through two bridge openings in the diversion dike near the southeastern end of the pond, and, ultimately, into the outfall structure for discharge to the Mobile River. The riser portion of the concrete outfall structure is made up of a four-sided, 8-feet square overflow weir. The discharge conduit is a 48-inch diameter corrugated metal pipe (CMP). The outfall structure is protected by a timber debris barrier. The discharge is permitted under NPDES permit number AL0002879.

2.2. HAZARD POTENTIAL CLASSIFICATION

Currently, the State of Alabama does not have a Dam Safety law. Legislation under *HB 454: Alabama Dam Inventory and Classification Act* has been pending in the Alabama Legislature since February 2008. Should the State of Alabama implement the pending legislation into the law, the Barry Ash Pond would meet the definition of a regulated dam and be assigned a hazard classification. An opinion on potential hazard classification per the proposed Alabama legislation is beyond the scope of this report.

The definitions for the four hazard potentials (Less than Low, Low, Significant and High) to be used in this assessment are included in the EPA CCW checklist found in Appendix A. Based on the checklist definitions and as a result of this assessment, the hazard potential rating recommended for the Barry Ash Pond is **SIGNIFICANT.** The eastern embankment of the Barry Ash Pond is located adjacent to the Mobile River with the toe of slope of the embankment within approximately 100 feet of the edge of the river in some locations. A failure of embankments impounding the Barry Ash Pond could cause significant environmental damage if the CCW was released into the Mobile River thereby damaging the surrounding area, wildlife and habitat. The power station is located in a semi-rural area; therefore, damage to critical infrastructure or lifeline facilities in the event of a dam failure would likely be limited to the power plant facilities.

2.3. IMPOUNDING STRUCTURE DETAILS

The following sections summarize the structural components and basic operations of the Barry Ash Pond. A site plan showing the location of the pond on the plant property and its relevant features is shown on Figure 2. Also shown on Figure 2 is the approximate location of the Gypsum Collection Basin presently under construction. Note that Figure 2 was adapted from the available aerial imagery as noted and may not depict all of the present features and conditions. Additionally, photos taken of the Barry Ash Pond during the visual inspection are incorporated in a Photographic Log provided as Appendix B. The locations of the photos are shown on Figures 2A, 2B, 2C.

2.3.1. Embankment Configuration

The Barry Ash Pond is a diked earthen embankment structure that impounds an area of approximately 600 acres and has a capacity of approximately 9,623,753 cubic yards (5,965 acre-feet) according to the EPA ICR Response, dated March 26, 2009.

There is no indication or record of the pond being lined. The pond is divided into the main ash storage area and the decant area downstream of the diversion dike. Both areas are delineated on Figure 2. The crest of the main ash storage area, including the east and west embankments and the diversion dike, is at approximately elevation (EL) 24.5 feet above mean sea level. The south embankment elevation surrounding the decant area downstream of the diversion dike is at approximately EL 21.5 above mean sea level. The original pond bottom is at approximately EL 3.0 and the original dike side slopes before the 1998 raise and the construction of the diversion dike were approximately 3H:1V.

The embankment was originally constructed to a top elevation of approximately EL 18 feet above mean sea level. According to the *Plant Barry Ash Pond South Dike and Diversion Dike Slope Stability Report (September 2004)*, in 1992, the east and west embankments were raised three feet (approximate EL 21 feet above mean sea level) to obtain additional storage capacity. In 1998, the east and west embankment crest elevation was raised to between approximately EL 23 to EL 24.5 feet above mean sea level. A flow diversion dike was also constructed in 1999 near the south end of the pond to create a decant area prior to discharge through the outlet structure. The diversion dike crest elevation was constructed to approximately EL 18 feet above mean sea level. In 2004, the diversion dike crest elevation was raised to approximately EL 24.5 feet above mean sea level, and the crest of the south embankment was raised to approximately EL 21.5 feet above mean sea level. The side slopes were constructed at approximately 3H:1V.

There are no records or reports of major breaches or repairs to the structure. There have been minor repairs over the years such as filling of animal burrows, repairs to shallow slides, regular maintenance and mowing, stump removal at toe of slope, filling and compaction of surface erosion features, and placement of riprap along water's edge at south end of pond to help reduce wave action erosion.

There are no toe drains in the embankment. There is currently no operating instrumentation or monitoring piezometers.

2.3.2. Type of Materials Impounded

Influent into the Barry Ash Pond includes surface water runoff from Plant Barry, water with fly ash, bottom ash, boiler slag, flue gas emission control residuals, and other (regulatory permitted low volume wastes, i.e., waste that is not hazardous for purposes of RCRA Subtitle C and is otherwise permitted under applicable regulations such as 40 C.F.R. §423/11) wastes.

2.3.3. Outlet Works

The Barry Ash Pond is a diked impoundment that receives sluiced flows, plant storm water runoff, and direct precipitation. CCW enters the pond through the sluice pipes on the north end of the pond. The ash/water mixture travels through three separate cells in a "stream" where it begins the settling process. The flow path is shown on Figure 2. The ash settles out in the main part of the pond, and water is discharged to the decant area through the diversion dike where it flows to the pond outlet structure where it is discharged to the Mobile River. The pond outlet structure, located approximately near the center of the southern embankment of the impoundment, consists of a four-sided concrete weir riser box with a 48-inch CMP discharge barrel (See Appendix B - Photo B12 thru B16). The pond discharge to the Mobile River is permitted under ADEM NPDES permit # AL0002879. There have been no reported major modifications to the outfall structure since it was originally constructed according to plant personnel and the *Plant Barry Ash Pond South Dike and Diversion Dike Slope Stability Report (September 2004)*.

3. RECORDS REVIEW

A review of the available records related to design, construction, operation and inspection of the Barry Ash Pond was performed as part of this assessment. The documents provided by Alabama Power, with their document designations, are listed below:

Table 3.1 *Summary of Barry Ash Pond Documents Reviewed*

Document	Dates	By	Description
BAR-API-0001	2010	Alabama Power	Aerial Photo of James M. Barry Electric Generating Plant, Aerial Photo of Barry Ash Pond, Aerial Photo of New Gypsum Collection Basin under Construction
BAR-API-0002	2010	Alabama Power	Aerial Photo/Topo of Barry Ash Pond
BAR-API-0003	Jan. 1998	Alabama Power	Alabama Power Plant Barry Report of Ash Pond Dike Proposed Modifications
BAR-API-0004	Sept. 2004	Alabama Power	Plant Barry Ash Pond South Dike and Diversion Dike Slope Stability Report
BAR-API-0005	June 16, 2010	Southern Company	Barry Steam Plant Ash Pond Dam – 2010 Dam Safety Inspection
BAR-API-0006	June 16, 2009	Southern Company	Barry Steam Plant Ash Pond Dam – 2009 Dam Safety Inspection
BAR-API-0007	Nov. 7, 2007	L.F. Dunlap & R.L. Mickwee	Barry Steam Plant Ash Pond Dam – Report of Biennial Dam Safety Inspection, November 7, 2007
BAR-API-0008	June 5, 1998	Synergy Earth Systems, Inc.	Summary Design Report – Existing Ash Pond Dike Impoundments, Barry Steam Plant – Bucks, Alabama
BAR-API-0009	Jan. 15, 2010	Alabama Department of Environmental Management	NPDES Permit No. AL0002879
BAR-API-0010	Oct. 1, 2009	Alabama Power	Barry Steam Plant – Ash Pond Visual Inspection Check List and Report Template
BAR-API-0011	Mar. 29, 2010	No Author Indicated	Barry Electric Generating Plant, BMP Site Plan, Figure 1
BAR-API-0012	Oct. 6, 2004	Southern Company Services, Inc.	Barry Steam Plant – Diversion Dike & South Main Dike Raise-Geologic Cross Sections & Typ. Dike Raise Sections
BAR-API-0013	Sept. 28, 2004	Southern Company Services, Inc.	Barry Steam Plant – Ash Pond Dike Raise-Geologic & Typical Dike Cross Sections
BAR-API-0014	Aug. 16, 1999	Southern Company Services, Inc.	Barry Ash Pond – Dike Extension-Phase 1 (1998) General Arrangement
BAR-API-0015	July 7, 1999	Southern Company Services, Inc.	Barry Steam Plant – Dike Crest Modifications-Sections West Side

Table 3.1 *Summary of Barry Ash Pond Documents Reviewed*

Document	Dates	By	Description
BAR-API-0016	July 7, 1999	Southern Company Services, Inc.	Barry Steam Plan – Dike Crest Modifications-Sections-East Side
BAR-API-0017	July 7, 1999	Southern Company Services, Inc.	Barry Steam Plant – Plans & Sections 1A & 5A
BAR-API-0018	Aug. 16, 1999	Southern Company Services, Inc.	Barry Ash Pond – Dike Extension-Phase 2 (1998) General Arrangement
BAR-API-0019	Nov. 17, 2004	Southern Company Services, Inc.	Plant Barry Ash Pond Discharge
BAR-API-0020	Mar. 25/Dec. 2009	Alabama Power	Estimate of Remaining Storage Capacity
BAR-API-0021	July 16, 2010	Southern Company Services, Inc.	Slope Stability Analysis of Main Ash Pond Dike
BAR-API-0022	June 29, 2009	Southern Company Services, Inc.	Safety Procedure for Dams and Dikes
BAR-API-0023	July 16, 2010	Southern Company Services, Inc.	Ash Pond Storm Event Hydraulic Capacity

3.1. ENGINEERING DOCUMENTS

Review of the design drawings, reports and calculations revealed information on the design details, construction chronology, and modifications of the Barry Ash Pond are summarized below.

- Original design drawings were not available; however, the Barry Ash Pond was reportedly placed into service in 1965.
- No information on an engineered pond liner system was noted in the records reviewed.
- No indication of former spills or releases of impounded materials from the Barry Ash Pond was noted in the records reviewed.
- A review of the *1998 Summary Design Report* prepared by Synergy Earth Systems, Inc. indicate that the earth fill of the original embankment section varied in soil type and consistency, but generally consists of a mixture of silty and sandy clays, clayey fine sands and sands underlain by a layer of soft organic silts and clays. According to the report, the underlying soils are the naturally existing marsh deposits over which the embankments were constructed.
- Southern Company issued a report on the stability of the Barry Ash Pond embankment structure in 1998 analyzing the effects of raising the crest of the embankment to increase the available storage of ash in the pond. Slope Stability Analysis results from the existing (1998) embankment cross-section indicated a minimum safety factor of 1.3 for a deep seated failure. The report recommended that the embankment be constructed on the upstream side against the existing slope and be raised no more than 3 feet at that time and constructed using a reinforcing grid. The report also recommended that fill material be tested to determine the most effective method of placement of the materials and that specifications be included in the final design to describe backfill materials, placement and compaction requirements, construction quality control measures, and monitoring of the construction activities.
- Record drawings for the 1998-99 embankment raise indicate that the typical section included a bottom layer of 2 to 3-feet deep of bottom ash placed on the inside slope of the existing embankment out to a point a minimum of 6-feet past the proposed new toe of slope. A double layer of Tensar Bx1200 geogrid 50% side lap (oriented perpendicular to centerline) extending to the proposed toe of slope was placed on top of the bottom ash. The existing embankment slope was double keyed with a layer of bottom ash placed on top of

the geogrid into the lower keyed section. A single layer of Tensar Ux1500HS geogrid was placed on the layer of bottom ash with the final lift of the embankment consisting of a clay layer keyed into the bottom ash and the existing embankment. The side slopes were constructed to 2H:1V. The top of the embankment was raised approximately 3 feet above the existing embankment.

- Design drawings provided as part of the 1998-99 embankment raise indicate that the diversion dike was also constructed in 1998-99.
- The 2004 Slope Stability Report referenced in Section 2.3.3 of this report was prepared in anticipation of raising the south main embankment and the diversion dike. The report indicated that the south main embankment could be raised 3 feet with a fly ash bolster, geogrid using bottom ash and clay fill with loads applied and still maintain a safety factor of 1.7. The diversion dike could be raised 4 feet with slopes laid back 4:1 with a 30 foot fly ash bolster on either side using a well compacted clay and still maintain a safety factor of 1.8. According to design drawings provided, construction of the south main embankment and the diversion dike would meet or exceed the specifications outlined above.
- As-built drawings were not provided in the records reviewed for the 2004 modifications.
- Southern Company prepared an *Ash Pond Storm Event Hydraulic Capacity*, dated July 16, 2010. This report was received from Alabama Power after the on-site inspection. The report concludes the following:

  The ash pond has a present capacity of 414 acre-ft above the operating pool (Elev. 15 in the lower pond) using the July, 2009 topographical survey. The rainfall volume during 100-yr, 24-hour storm event is 204 acre-ft. Additional inflow to the pond from sluicing, plant storm water, and other sources, using maximum pump rates, is about 54 MGD. For the 24-hour event, the minimum freeboard is about 2.9 feet. During the critical 100-year, 2-hour storm, the minimum freeboard of the pond is 1.3 feet.

  The report indicates that the conclusions are based on the following methodology:

  The topography and layout of the ash pond was obtained from Drawing ES Topo-Plant Barry Ash Pond. Existing pond volumes were computed from the topography using AutoCad Civil 3D. The 100-year Intensity-Duration-Frequency Data for Plant Barry was obtained from the Rainfall Atlas of Alabama, published by the University of Alabama. The rainfall cases from 30 minutes to 24-hours were evaluated to determine the critical rain event. The critical rain event and the design 24-hour precipitation case were evaluated using the Rational Method to determine the peak level of stored water.

- Southern Company prepared a report entitled, *Slope Stability Analyses of Main Ash Pond Dike*, dated July 16, 2010. This report was received from Alabama Power after the on-site inspection. This analysis was performed to support the embankment modifications in 1998 and 2004. The analysis also addresses supplemental loading conditions, particularly earthquake seismic loading. A review of the report states that the slope stability computer model was run using the following assumptions and design criteria:

  - *According to the USGS earthquake acceleration probability maps for the vicinity of Plant Barry, the ground motion having a 2% probability of exceedance in 50 years is 0.06g.*
  - *The current required minimum criteria (factors of safety) were taken from the US Corps of Engineers Manual EM 1110-2-1902, October 2003.*
  - *The soil properties of unit weight, phi angle, and cohesion were obtained from historical laboratory results.*
  - *Soil stratigraphy and piezometric data was estimated from the historical boring logs*

  According to the Summary of Conclusions presented in the report, the South Main Dike and the North East Main Dike factors of safety for various slope stability failure conditions under steady state and seismic conditions exceed the typical minimum factors of safety published in USACE Manual EM-1110-2-1902. The report concluded that *based on the results of these analyses all structures are stable*.

3.1.1. Stormwater Inflows

According to the *Ash Pond Storm Event Hydraulic Capacity* Analysis prepared by Southern Company, July 16, 2010 the Barry Ash Pond has a present capacity of 414 acre-ft above the operating pool (EL 15 in the lower pond i.e, the containment area south of the diversion dike) using the July 2009 topographical survey. It also states that the rainfall volume during the 100-year, 24-hour storm event is 204 acre-ft, and additional flow from sluicing, plant storm water runoff, and other sources, using maximum pump rates is about 54 MGD. The analysis states that for the 24-hour event, the minimum freeboard is about 2.9 feet, and during the 2-hour event the minimum freeboard is 1.3 feet. Based on this analysis, the Barry Ash Pond and the outlet structure have the capacity to contain and pass the design storm without overtopping the embankment.

3.1.2. Stability Analyses

Slope Stability Analyses were performed for existing and proposed conditions prior to the 1998 and 2004 embankment modifications. These reports concluded that the embankments would have adequate stability after the modifications.

As noted in Section 3.1 a report entitled, *Slope Stability Analysis of Main Ash Pond Dike*, dated July 16, 2010 was performed by Southern Company and provided to O'Brien & Gere after the July 7 site inspection. The slope stability analysis was performed to support the embankment modifications constructed in 1998 and 2004, and also provide additional analysis to address supplemental loading conditions, in particular earthquake seismic loading.

Slope stability was evaluated by preparing an embankment model and a static, steady-state stability analysis was performed using GeoStudio 2007 v 7.16, Build 4840 software for comparison to previously reported values from the 1998 and 2004 studies. No new field information was obtained for the preparation of the report. The soils information used in the analyses was obtained from information in the 1998 and 2004 reports.

The following table lists the factors of safety for various slope stability failure conditions.

South Main Dike		
Case	Computed Factor of Safety	Typical Minimum Factor of Safety
Barry South Main Dike Static Steady-State	1.5	1.5
Barry South Main Dike with Seismic	1.2	1.1
Barry South Main Dike Upstream Steady State	3.6	1.5
Barry South Main Dike Upstream with Seismic	1.5	1.1
Barry South Main Dike Full Pool	1.4	1.3
Barry South Main Dike Full Pool Upstream	3.5	1.3

North East Main Dike		
Case	Computed Factor of Safety	Typical Minimum Factor of Safety
Barry North East Dike Static Steady-State	1.6	1.5
Barry North East Dike with Seismic	1.4	1.1
Barry North East Dike Upstream Steady State	6.4	1.5
Barry North East Dike Upstream with Seismic	3.6	1.1
Barry North East Dike Full Pool	1.6	1.3
Barry North East Dike Full Pool Upstream	11.7	1.3

Based on our review of the dike stability evaluation reports, the soil strength parameters were based on in-situ standard penetration tests, dilatometer tests, and cone penetration test data of the materials forming the dikes and natural foundation soils. Parameters for the new materials used to raise the dikes were based on laboratory testing and prior experience with similar materials. The soil strength parameters used in the slope stability analyses appear to have been conservatively estimated based on the lower bound results of the in-situ testing. The stability analysis methods appear to have been performed in general accordance with USACE Slope Stability Analysis Engineer Manual EM 1110-2-1902, and the computed factors of safety for the various loading conditions and dike sections analyzed appear to meet the minimums required by US Army Corps of Engineers for embankment dams.

3.1.3. Modifications from Original Construction

As noted above, the Barry Ash Pond has undergone modifications since its original construction. A review of the documentation provided indicates that Barry Ash Pond has undergone major modifications on four different occasions, 1972, 1992, 1998, and 2004. A summary of the available details from each modification follow:

1) 1972 – From the interview with plant personnel, it was learned that the embankment was raised slightly in 1972. No other information available concerning the 1972 modifications
2) 1992 – In 1992, the east and west embankments were raised 3 feet to obtain additional storage capacity.
3) 1998 – In 1998, the embankments were raised an additional four feet on the inboard side. The embankments were raised on the inboard due to outboard stability concerns and to avoid taking of wetlands. The internal raise sections were founded on existing deposited fly ash. During this modification, the diversion dike was also added to the pond. It was constructed on top of existing fly ash deposits using bottom ash as the dike fill. During the previous modifications, the south embankment was not raised.
4) 2004 – In 2004, the south main embankment and the diversion dike were raised. The south main embankment was raised approximately 3 feet and the diversion dike was raised approximately 4 feet. The cross-sections show that the material used to raise the diversion dike is a clay soil placed over the existing dike with a bolster of fly ash on both sides of the dike. The main south dike raise consisted of a clay fill material over a compacted bottom ash material placed on a fly ash bolster on the upstream side of the embankment.

3.1.4. Instrumentation

No instrumentation is present; however, there is a staff gauge which is read and recorded weekly by plant personnel.

3.2. PREVIOUS INSPECTIONS

As noted above in this report, there is not a Dam Safety Regulation in the State of Alabama. Alabama Power's parent company, Southern Company through its Hydro Services Group performs an annual inspection of the Barry Ash Pond. Records of the 2007, 2009, and 2010 inspections were provided for review. Prior to 2009, the inspections were performed on a biennial basis.

A summary of the 2009 inspection,performed on January 20, 2009 follows:

Main Ash Pond Dam – West Dike

- Full length of dam was inspected
- Shallow slides were noted in embankment at few locations, but not indicative of any kind of deep seated failure, although some tension cracks were observed near the dam crest. Similar areas have been repaired in past and seem to be performing well.
- Small nutria rat burrows observed on downstream face of dam and some locations show significant damage from 'rooting' activities by feral hogs
- Small seeps observed on west dike. Flow was not perceptible, and it did not appear that material was being removed from the dike, but it was observed that feral hog rooting was common in the small seep areas. Condition may be influenced by frequent and heavy rains experienced through December and January in State of Alabama

Main Ash Pond Dam - South Dike

- Many of same observations observed along western portion of dike were common along southern portion, but did not include any zones of seepage or significant damage from feral hogs.
- Crest observed to be in good condition except for one fairly sizable surface drainage rill along its interior or upstream side. Several smaller rills were also noted. Just east of outlet structure, a shallow slide was observed on downstream face of embankment.

Discharge Structure

- Inspected and observed to be in good condition

Main Ash Pond Dam – East Dike

- Crest and roadway generally observed to be in excellent condition
- Noted stumps from past clearing operations had been left in place near toe of slope
- Shallow slide observed on face of dike
- Notable surface drainage rills in portions of crest
- Feral hog activity and nutria rat burrows observed.

The Southern Company Hydro Services Group recommendations resulting from 2009 Inspection included the following:

1. Continue regular maintenance and mowing of embankment slopes
2. Conduct inspections of the ash pond dam at least weekly, with close observation of the dam toe by walking once per month
3. Fill in any nutria rat burrows with concrete or flowable fill material and repair any areas damaged by feral hog wallowing or rooting
4. Repair shallow slides along embankment face as time and budgeting allow. The first area that the inspection recommends be repaired is located near the midpoint of the eastern portion of the dam

5. The removal of stumps along the dam toe is recommended. Any stump removal must be performed conscientiously to prevent damage to the embankment structure, and any resulting holes should be refilled with compacted soil fill.
6. Repair the two noted surface drainage erosion features noted on the crest of the dam south and east dikes with compacted soil fill and re-vegetate.
7. Pay close attention to area of seepage along west dike. Any detrimental changes to seepage flow and/or any indications of materials being removed from the dike by flow should be reported to SCG Hydro Services immediately

The report from the 2010 inspection (June 16, 2010) indicates that all items recommended for maintenance and/or repair in the 2009 inspection were completed satisfactorily. A summary of the 2010 inspections follows:

Main Ash Pond Dam – West Dike

- Full length of dam was inspected
- Roadway along crest appeared to be in excellent condition
- Portion of embankment adjacent to bridge crossing canal recently repaired
- Vegetation is well maintained and mowed
- Nutria rat burrows observed, but far less than in 2009
- Several zones of soil cracking (15 feet to 100 feet long) were observed adjacent to downstream edge of the crest. These cracks historically have been indicators of future shallow slope slides or slumps. This condition is not seen as a credible threat to dam safety, but the cracks are a long-term and recurring maintenance item for plant staff once slide occurs.

Main Ash Pond Dam – South Dike and Discharge Structure

- Full length of dam was inspected
- Generally in good condition, suitably vegetated, and adequately mowed
- Some scour on upstream face on the western side of the south dike – most likely due to increased water velocities in this area
- Vegetation observed near interface between embankment and the ash pond waterline
- Discharge Structure observed to be in good condition

Main Ash Pond Dam – East Dike

- Full length of dam was inspected
- Vegetation was adequate and well maintained
- Crest and roadway generally noted to be in excellent condition
- Soil cracking along crest of dam, but to lesser extent than on West Dike
- Small surficial slides
- Feral activity, or rooting noted, but to lesser extent than in 2009 inspection

Diversion Dike

- Appeared to be performing adequately
- No signs of excessive erosion or settlement
- Old wooden plank bridges noted during 2009 inspection have been replaced with concrete bridges

The Southern Company Hydro Services Group recommendations resulting from 2010 inspection were as follows:

No.	Description	Location
1	Continue regular maintenance and mowing of embankment slopes	All Earth Embankment Structures
2	Burrows and /or areas of feral hog disturbance be repaired as they are located	All Earth Embankment Structures
3	When shallow slides on the embankment occur, the disturbed areas are should be repaired, revegetated, and protected with erosion protection material (such as Geomat or similar product). It is noted that in past slope repairs the plant has elected to flatten the slope somewhat, and it is recommended that this practice continue.	All Earth Embankment Structures (most common on East and West Dike)
4	It is recommended that the upstream portion of the South Dike embankment disturbed by scour be armored against erosion by the replacement of rip-rap. Alternatively, the upstream crest could be repaired by grading and revegetating.	All Earth Embankment Structures
5	The removal of stumps along the South Dike embankment toe is recommended. Any stump removal must be performed conscientiously to prevent damage to the embankment structure, and any resulting holes should be refilled with compacted soil fill.	South Dike
6	Vegetation in the lower portion of the pond where water is on the embankment should be removed so the interface can clearly be observed	South Dike

It is noted that during O'Brien & Gere's July 7, 2010 that Item 4 had been implemented. The other items are ongoing maintenance items, and based on our interview with the plant staff, these items are being implemented as needed.

3.3. OPERATOR INTERVIEWS

Numerous plant and corporate personnel took part in the inspection proceedings. The following is a list of participants for the inspection of the Barry Ash Pond:

Table 4 *List of Participants*

Name	Affiliation	Title
Gerrad Wilson	Southern Company	Engineer II/Earth Science & Environmental Engineering
Clifton Bennett	Alabama Power	Security Team Leader/Plant Barry
Rick Anderson	Alabama Power	Compliance & Support Manager/Plant Barry
Charleen Sikes	Alabama Power	TL-Compliance/Plant Barry
Dana Pizarro, PE	O'Brien & Gere Engineers, Inc.	Senior Managing Engineer
Billy Dixon, PE	O'Brien & Gere Engineers, Inc.	Project Associate
Tommy Ryals	Alabama Power	Environmental Affairs Supervisor
Stan Connally	Alabama Power	Plant Manager/Plant Barry
Jim Pegues, PE	Southern Company	Principal Engineer/Earth Science & Environmental Engineering
Steve Burns	Balch & Bingham, LLP	Attorney

Facility personnel provided a good working knowledge of both the Barry Ash Pond, provided general plant operation background and provided requested historical documentation. In addition to the facility personnel (Alabama Power), Engineers from Southern Company (Owner of Alabama Power) were present to provide additional information from previous impoundment inspections. Also present was legal counsel representing Southern Company and Alabama Power. These personnel also accompanied O'Brien & Gere throughout the visual inspections to answer questions and to provide additional information as needed in the field.

A summary of the interview follows:

- No known spills or releases of impounded materials from the Barry Ash Pond have occurred.
- There is no indication of major seepage
- An annual inspection is performed by Southern Company's Hydro Services Group
- Weekly top of dam inspections are performed by Plant Barry staff
- Monthly top of dam inspections are performed by Plant Barry staff
- If minor deficiencies are noted during inspections, plant staff work to make repairs immediately
- The plant has dedicated materials for embankment repairs stockpiled north of cell 1 area .
- Major deficiencies are brought immediately to the attention of plant management for resolution.
- Hydro Services Group provides formal dam inspection training to Plant Barry staff
- No major modifications to outfall structure
- There are no design drawings available for the original embankment structure
- There have been minor repairs over the years such as filling in minor rutting, animal burrows, removal of stumps, but no major repairs have been required.
- Plant Barry is owned and operated by Alabama Power. Alabama Power is a subsidiary of Southern Company
- Plant Barry has written Emergency Response Plan and Spill Prevention Control and Countermeasure Plan
- The embankment has no toe drains
- Major modifications to the embankments were performed in 1998-99 and 2004-2005 consisting of raising the embankment height 4 feet and 3 feet, respectively.

4. VISUAL INSPECTION

The following sections summarize the inspection of the Barry Ash Pond, which occurred on July 7, 2010. Following the inspection, O'Brien & Gere completed the EPA inspection checklists for the Pond, which was submitted electronically to EPA on July 12, 2010. A copy of the completed inspection checklist is included as Appendix A.

4.1. GENERAL

The weather on the dates of the inspection was partly cloudy, humid and approximately 91 degrees. The visual inspection consisted of a thorough site walk along the entire perimeter of the Barry Ash Pond as well as along the entire length of the diversion dike. O'Brien & Gere team members walked the crest and outward toe of the embankment, and made observations along the toe, outboard slope, and crest of the embankment, and along exposed portions of the inboard slopes. We also observed the inlet/outlet structures and current operation. At the time of the inspection, O'Brien & Gere completed an EPA inspection checklist which was submitted electronically to EPA on July 12, 2010. A copy of the completed checklist is included in Appendix A.

Although not part of the inspection, the O'Brien & Gere team also observed the Gypsum Collection Basin currently under construction.

Photos of relevant features and conditions observed during the inspection were taken by O'Brien & Gere and are provided in Appendix B for the Barry Ash Pond. A Site Plan of the Barry Ash Pond is presented as Figure2. Figures 2A, 2B, and 2C provide photograph locations and directions.

4.2. SUMMARY OF FINDINGS

The following observations were made during the inspection:

- Sluiced CCW by-product discharge enters the pond near the northeast corner and is routed to the southeast end of the pond through three separate cells where it begins the settling process (Appendix B –Photo B33).
- Water flowing out of the final cell into the main body of the ash pond continues to flow southeastward (Appendix B – Photo B34) towards a diversion dike (Appendix B – Photos B27, B28 and B29) where it is decanted over one or two concrete outfall weir structures (Appendix B – Photos B26 and B30) into the ash pond decant/discharge pool and eventually through the outlet structure to the Mobile River (Appendix B – Photo B12 and B16). The primary outfall weir is positioned at a lower elevation, and the only flow observed during the inspection was a discharge of clear water through the primary outfall. There was no flow through the secondary outfall.
- The outboard slope is well vegetated and appears well maintained and had been mowed prior to the inspection. Previous removal of brush and trees from the outboard slope was evident in the form of stumps and roots. The crest of the embankment is well maintained with a stone surface and is also used as a roadway completely encircling the ash pond (Appendix B – Photo B5). Recently completed repairs of minor sloughing and from the removal of a temporary mound placed for drilling were observed on the east embankment.
- Standing water/wetlands was observed against downstream toe for significant portions of the embankment on the east side of the pond. Water does not appear to result from any seepage. No discoloration or sediment is apparent.
- A few small animal burrows were noted on the outboard slopes of the eastern embankments due mainly to feral hogs and nutria swamp rats (Appendix B – Photo B3)

- There is some minor surficial sloughing at numerous locations and some bulging at locations where recent embankment raising meets previous embankment, but no cracks or scarps were observed in these areas (Appendix B – Photo B5).
- Approximately 5-7 trees on downstream embankment just up from toe of slope near stabilized portion of pond on Northwest end (Appendix B – Photo B23).
- The outlet structure appeared to be in good condition and functioning normally (Appendix B – Photos B12 and B16). Flow over the discharge weirs appeared clear.

5. CONCLUSIONS

Based on the ratings defined in the BPA Task Order Performance Work Statement (Satisfactory, Fair, Poor and Unsatisfactory), the information reviewed and the visual inspection, the overall condition of the Barry Ash Pond is considered to be **SATISFACTORY**. Acceptable performance is expected under all loading conditions.

The owner has implemented regular inspections and maintenance which enable the impoundment to be kept in good working order.

Our interviews with plant engineering personnel responsible for the operation of the impoundment indicate that a regular operations plan (*Safety Procedure for Dams and Dikes* prepared by Southern Company) is in use at the Barry Ash Pond facility. Since 1998, any modifications to the existing embankments have been supported with engineering analyses to ensure that such modifications will not impact the stability of the embankment. The regular operating procedures of the facility do not appear to be impacting the structural integrity of the impounding embankments.

The plant engineering staff maintain all design documents and inspection reports in a well organized manner. Plant personnel participated and cooperated with this inspection and provided all information requested. The plant operations personnel have received training in dam safety inspections and currently perform weekly inspections of the embankment with monthly inspections of the toe of the embankment. The Southern Company Hydro Services Group performs a yearly inspection and publishes a detailed inspection report containing findings and recommendations for the Plant Barry management. Based on these findings, we are of the opinion that the operations and maintenance procedures being practiced at the Barry Ash Pond are adequate, provided that recommended maintenance items identified in the most recent Southern Company Hydro Services Group inspection are carried out.

6. RECOMMENDATIONS

Based on the findings of our visual inspection and review of the available records for the Barry Ash Pond, O'Brien & Gere recommends that Plant Barry continue with the inspection and maintenance program in place, and additional maintenance of the embankments be performed to correct the miscellaneous deficiencies cited in the most recent Southern Company Hydro Services Group inspection.

6.1. URGENT ACTION ITEMS

None of the recommendations are considered to be urgent, since the issues noted above do not appear to threaten the structural integrity of the dam in the near term.

6.2. LONG TERM IMPROVEMENT

The deficient conditions observed during the inspection do not require immediate attention, but should be addressed in the near future as part of a regular maintenance plan.

6.3. MONITORING AND FUTURE INSPECTION

O'Brien & Gere recommends continued participation in annual inspections performed by Southern Company's Hydro Services Group as well as the weekly and monthly inspections performed by Plant Barry personnel. Since standing water from the river and wetlands in East Dike area make it difficult to assess whether or not seepage is coming from the dam, we recommend that the inspector(s) pay special attention when performing the monthly toe of slope inspections in this area to look for sediment in the water or discoloration that may indicate a potential for loss of embankment material. O'Brien & Gere also recommends that the inspection procedures in the Southern Company's *Safety Procedure for Dams and Dikes* continue to be followed, and that the document be updated as new Federal, State and Local rules and regulations are implemented.

6.4. TIME FRAME FOR COMPLETION OF REPAIRS/IMPROVEMENTS

Based on our conversations with representatives of Alabama Power the maintenance/repair items noted above are currently underway and being implemented without delay. We recommend that the owner continue toward this schedule as planned.

6.5. CERTIFICATION STATEMENT

I acknowledge that the Barry Ash Pond CCW management unit referenced herein was personally inspected by me on July 7, 2010 and was found to be in the following condition:

SATISFACTORY
~~FAIR~~
~~POOR~~
~~UNSATISFACTORY~~

ALABAMA LICENSED No. 30128 PROFESSIONAL ENGINEER WILLIAM HENRY DIXON

Signature: ____________ Date: 12/8/2010
William H. Dixon
AL PE # 30128

12. APPENDIX E – 1994 ADEM HYDROGEOLOGICAL EVALUATION

ADEM

ALABAMA
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

James W. Warr, Director

Jim Folsom
Governor

Mailing Address:
PO BOX 301463
MONTGOMERY AL
36130-1463

Physical Address:
1751 Cong. W. L.
Dickinson Drive
Montgomery, AL
36109-2608

(205) 271-7700
FAX 270-5612

Field Offices:

110 Vulcan Road
Birmingham, AL
35209-4702
(205) 942-6168
FAX 941-1603

400 Well Street
P.O. Box 953
Decatur, AL
35602-0953
(205) 353-1713
FAX 340-9359

2204 Perimeter Road
Mobile, AL
36615-1131
(205) 450-3400
FAX 479-2593

May 17, 1994

MEMORANDUM

TO: Gerald Hardy, Chief WGH
Engineering Services Branch

FROM: CWS Whit Slagle, Hydrogeologist
Hydrogeology Unit

RE: Hydrogeological Evaluation of Barry Steam Plant Inert Landfill
Permit No. 49-18R
Mobile County, Alabama

SUMMARY

A hydrogeological evaluation of the Barry Steam Plant Inert Landfill in Mobile County, Alabama was requested by the ADEM Engineering Services Branch, on 3/29/94. The subject inert landfill has received certified nonhazardous wastes consisting of solid ion exchange resin beads, sandblasting waste of non-lead based paints, treated wood, scrap metals, asbestos, tires, paper products, and construction and demolition debris. Coal fly ash continues to be deposited in the landfill and small amounts of other permitted wastes will be deposited there in the future. At present no groundwater monitoring system exists at the landfill.

On Wednesday, April 6, 1994, a site evaluation was conducted with Mr. Jeff Waites, staff environmental affairs specialist from Alabama Power Company. This report is the summation of literature research, and the site evaluation which included, a site specific and perimeter investigation, and the digging of 3 pits to confirm site geology.

This hydrogeologic evaluation is one component of the overall permit review process, over which the Land Division of ADEM has primary authority. The recommendations and conclusions presented in this report are in no way offered as a sole determination of the suitability of the site for permit renewal.

LOCATION

The Barry Steam Plant Inert Landfill is located approximately in the eastern 1/2 of section 31 and the western 1/2 of section 32 , of Township 1 North, Range 1 East , of the Mt. Vernon, 7.5 minute quadrangle in Mobile County, Alabama (Figure 1). Access to the site is via Highway 43 near Bucks, Alabama.

TOPOGRAPHY AND SURFACE WATER

The landfill is located in the Alluvial-Deltaic Plain physiographic region of the East Gulf Coastal Plain physiographic section. The area is characterized by a broad, level plain with relatively little or no relief, underlain by alluvial and terrace deposits from rivers. Elevations within a one (1) mile radius of the plant range from 7 to 50 feet above mean sea level (MSL).

The Mobile River is the primary drainage feature in the area which encircles the plant and landfill. Sister Creek is the only secondary drainage feature indicated in the general vicinity of the plant and landfill. The creek's dendritic drainage pattern discharges into the discharge canal for the plant which is located southwest of the landfill. Numerous low-lying swampy areas can be observed on maps of the general area. The subject landfill is located within the 100-year floodplain of the Mobile River as illustrated by Figure 2.

SOILS

Soils of the inert landfill area are described by the Soil Survey of Mobile County as Dorovan-Levy association, 0 to 1 percent slopes, and Izagora-Bethera association, gently undulating.

Dorovan-Levy association, 0 to 1 percent slopes, is very poorly drained soils in a regular and repeating pattern in depressional swamps and first bottoms along the Mobile and Tensaw Rivers. These soils are dissected by meandering streams. Levy soils are around the perimeter of the Dorovan soils adjacent to natural levees that parallel the stream channels. They are on slightly higher positions than the Dorovan soils.

Dorovan soils are very slowly permeable and have high available water capacity. The surface layer is very dark grayish brown muck about 8 inches thick. Below this is black muck to a depth of 80 inches. Soils have organic layers with redder hue are considered Dorovan. Reaction is strongly acid or very strongly acid throughout. A water table is above or near the surface most of the year, and the soils are frequently flooded. Subsidence is a problem in drained areas of the Dorovan soils. Potential is poor for cultivated crops, pasture, and urban uses because of wetness and flooding.

Typically, Levy soils have a surface layer that is gray silty clay loam about 6 inches thick. The underlying material to a depth of 75 inches is gray clay that has mottles of yellow land brown in the upper part. They are slowly permeable and have high available water capacity. Reaction is strongly acid to extremely acid throughout. Water is near or above the surface most of the year, and the soils are frequently flooded.

Izagora-Bethera association, gently undulating, consists of moderately well drained and poorly drained soils in a regular and repeating pattern on broad Coastal Plain terraces. The loamy Izagora soils are on broad flats and gently sloping side slopes, and the clayey Bethera soils are in narrow to broad depressions and narrow drainageways.

The surface layer of Izagora soils typically, is very dark grayish brown sandy loam about 5 inches thick. The subsurface layer is brown sandy loam about 3 inches thick. The upper part of the subsoil, to a depth of about 54 inches, is yellowish brown and light yellowish brown clay loam that has mottles in shades of light gray, yellow, and red; and the lower part, to 80 inches, is light gray and light brownish gray clay that has mottles in shades of red , yellow, and brown. Izagora soils are moderately permeable in the upper part of the subsoil and slowly permeable in the lower part. The available water capacity is high. These soils have a water table 2 to 3 feet below the surface during winter months. They are subject to brief flooding during periods of unusually high rainfall.

Bethera soils are moderately slowly to slowly permeable and have high available water capacity. Typically, the surface layer is very dark gray loam about 4 inches thick. The subsurface layer is gray loam about 2 inches thick. The subsoil to a depth of 12 inches is light brownish gray clay loam and to 80 inches is light gray clay loam that has mottles in shades of gray, brown, yellow, and red. These soils have a water table near the surface mostly during winter and spring; they are subject to occasional brief flooding.

GEOLOGY

As noted above the site is underlain by alluvial and terrace deposits from the Mobile River. These unconsolidated sediments typically consist of beds and lenses of fine to coarse gravel, fine- to coarse-grained sand, silty sand, silt, sandy clay, soft to stiff clay and carbonaceous material (Riccio, Hardin, and Lamb, 1973). The alluvial deposits reach thicknesses of one-hundred-fifty feet (150) near the City of Mobile. Bedding is typically lenticular and discontinuous. No exploratory drilling has been performed in the immediate vicinity of the landfill.

Stratigraphically beneath the alluvial and terrace deposits is the Miocene Series Undifferentiated. The upper portion of these deposits are composed of a low permeable Miocene clay that acts as an impermeable confining unit at the base of the alluvial/terrace deposits. This clay is laterally persistent throughout many parts of Mobile and Baldwin Counties and is present beneath other facilities in the local area including Ciba Geigy, Olin, Dupont, Hoechst Celanese, M&T and Redwing Carriers. The remainder of the Miocene Series Undifferentiated beneath the clay is composed of mainly laminated to thinly-bedded clays, sands, and sandy-clays. The Miocene Series is approximately 400 feet thick (Reed, 1971).

Three pits, located on Figure 3, were excavated during the site evaluation to determine the geologic profile, and water table.

<u>Pit #1</u>

0 - 12"	dark gray to black fly ash from steam plant
12 - 16"	yellowish gray sand and clayey sand
16 - 30"	dark gray plastic clay with construction debris (wood and metal) present
30 - 42"	first natural soil profile yellow brown to orange stiff plastic clay mottled with some light gray sandy lenses water bubbling into pit at 40"

<u>Pit #2</u>

0 - 4"	gray to dark gray soil and fly ash with vegetation roots
4 - 32"	dark gray plastic clay with carbonized tree roots and cherty gravel
32 - 85"	yellow to tan plastic clay with limonitic staining sandy lenses present as in Pit 1, dark gray stratified clay with black streaks water coming into pit at 79" and hole sloughing in quickly

Pit #3

0 - +86"	light tan to white unconsolidated coarse to fine grained alluvial sand with pockets of shells and some gray laminations in natural levee next to pit #3
0 - 48"	same as material composing bank next to pit - coarse to fine grained unconsolidated light tan to white sand with water bubbling into pit at 44" below ground surface.

HYDROGEOLOGY

The site is underlain by an unconfined surficial aquifer developed in the alluvial material. The site area is highly susceptible to contamination from the surface due to the relatively flat terrain with very permeable soils. Groundwater levels essentially occur at or slightly above the level of the Mobile River which is approximately at mean sea level. The groundwater level is also correlative with the flood stage level of the river and rises and falls accordingly.

The major aquifer that underlies the site is the Alluvial-coastal aquifer. The Alluvial -coastal aquifer is hydraulically connected to the Pliocene-Miocene aquifer, the major aquifer that underlies the Alluvial coastal aquifer. Recharge to the aquifers is by rainfall of which the area averages 62 inches per year. Approximately 28 inches/year of rainfall runs off during and immediately after storms while approximately 8 inches infiltrates the ground as recharge and the remainder is returned to the atmosphere via evaporation and transpiration (Reed and McCain, 1971). The two aquifers respond to stresses as a single aquifer and are typically shown as having one potentiometric surface. The Alluvial-coastal aquifer is believed to be directly connected to present day Mobile River channels in areas where buried channels adjoin the present-day river channel. Both the Alluvial-coastal aquifer and the Pliocene-Miocene aquifer are capable of yielding significant quantities of potable water from sand and gravel deposits (Mooty, 1988).

Regional groundwater movement in northeast Mobile County is east to east-southeast towards the Mobile River. Regions underlain by the alluvial and coastal sediments generally are areas of groundwater discharge. The likelihood of a contaminant migrating into the deep groundwater system is diminished, however, withdrawals of groundwater from these areas could cause water levels to decline and could change the direction of groundwater flow. If this were to happen, the discharge area would become a recharge area and, because the topography is flat and the region is underlain by permeable sediments, this part of the aquifer would become highly susceptible to surface contamination. This has already occurred to some extent in an area north of the city of Mobile along the Mobile River.

Coal fly ash is being deposited in a slurry form from a pipeline in the fly ash pond area directly east of the landfill. This waste deposition method causes mounding of the water table directly underneath the fly ash storage pond which is adjacent to the inert landfill. The inert landfill and fly ash pond are located in a meander of the Mobile River and are encircled by the river in 3 directions (Figure 1). Due to the mounding of the water table directly beneath the site and the regional groundwater movement, the groundwater flow direction is toward the Mobile River.

Records of water wells in Mobile County list 4 wells at Barry Steam Plant and 1 well belonging to Radcliff Materials, Inc. which is within 1 mile of the plant. The well total depths range from 25 feet below ground surface for a dewatering battery that pumped 3600 gpm in 1967 to an average depth of 120 feet bgs for the other 3 wells at Barry Steam Plant. The three wells completed in the alluvium tested rates of 500 to 556 gpm and a drawdown of 13 feet after 8 hours of pumping at that rate in 1951. Radcliff Materials, Inc. had their well drilled to a total depth of 220 feet bgs into the Miocene Series undifferentiated.

CONCLUSIONS AND RECOMMENDATIONS

1. The Barry Steam Plant inert landfill is located within the 100-year floodplain of the Mobile River (Figure 2).

2. The subject site is located within a wet area on the quadrangle map and a determination should be made as to its status as a wetland.

3. There is no evidence of sinkholes in the immediate area. The geology in the area is not carbonate in lithology. The activity associated with karst, of dissolution and collapse from underlying limestone units is not present.

4. The subject landfill is unlined and the underlying alluvium and deeper Miocene formation are considered to be in communication and highly susceptible to groundwater contamination. The soils are highly permeable and groundwater is above the level of the Mobile River. Groundwater is expected to flow toward the river, carrying any potential contamination to it. Any present or future pumping wells are highly susceptible to contamination due to high permeabilities, high drawdown rates, fluctuations in the surface of the water table and the physical characteristics of possible contaminants.

5. Groundwater was found to be less than 5 feet below ground surface in two of the three pits dug. This water table may be a mounding effect induced from the coal fly ash pond and coal fly ash mound which is higher than the natural topography. This locally induced water table is groundwater and is a transport mechanism for possible contaminants to the waters of the State, therefore the required siting standard of 5 feet of separation between the water table and the solid waste is not present.

REFERENCES

Alabama Highway Department, General Highway Map, 1977, "Areas In Which Sinkholes Have Occurred Or Can Occur In Mobile County, Alabama"

Hickman, L. Glen and Owens Charles, 1980, Soil Survey of Mobile County, U. S. Department of Agriculture, 134p.

Gillett, Blakeney, and Moore, James D., 1992, Ground-Water Levels In Alabama: 1990 Water Year (October 1, 1989--September 30, 1990)

Mooty, Will S., 1988, Geohydrology and Susceptibility of Major Aquifers to Surface Contamination In Alabama; Area 13, U. S. Geologic Survey Water Resources Investigation Report 88-4080, 29p.

Reed, P. C. and McCain, J. F., 1972, Water Availability, Mobile County, Alabama, Geological Survey of Alabama, 45p.

Reed, Philip C., 1971, Geologic Map of Mobile County, Alabama, Map 93.

Reed, P. C., and McCain, J. F., 1971, Water availability of Baldwin County, Alabama: Geological Survey of Alabama Map 96, 55p.

Riccio, Joseph F., Hardin, J. D., and Lamb, George M., 1973, Development Of A Hydrologic Concept For The Greater Mobile Metropolitan-Urban Environment, Geological Survey of Alabama, Division of Water Resources, Bulletin 106, 171p.

cc: Gary Hawkins

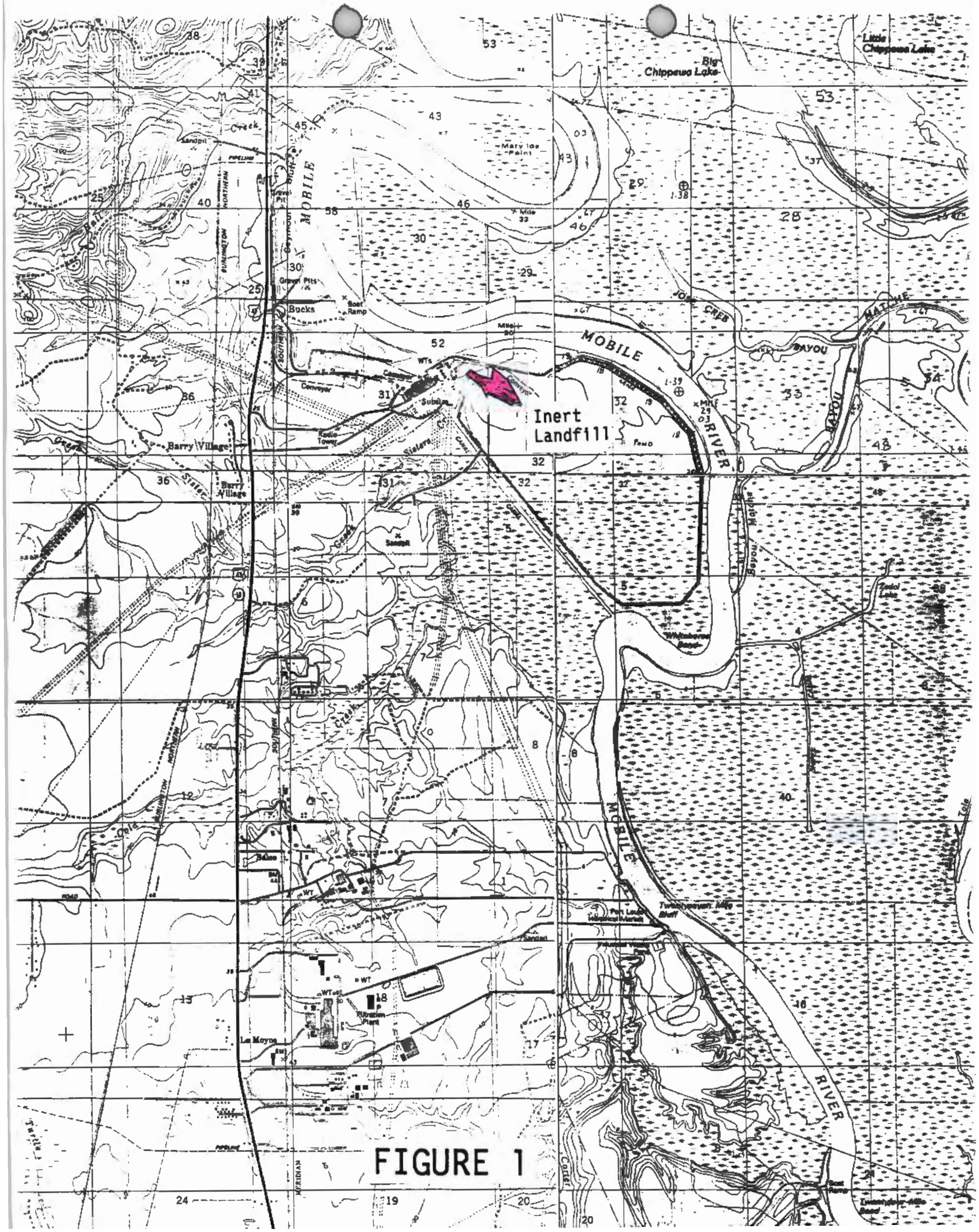

Inert
Landfill
MOBILE
RIVER
Big Chippewa Lake
Little Chippewa Lake
Bucks
Barry Village
Le Moyne
Filtration Plant

FIGURE 1

13. APPENDIX F – 1994 ADEM LETTER

ADEM

ALABAMA
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

James W. Warr, Director

Jim Folsom
Governor

Mailing Address:
PO BOX 301463
MONTGOMERY AL
36130-1463

Physical Address:
1751 Cong. W. L.
Dickinson Drive
Montgomery, AL
36109-2608

(205) 271-7700
FAX 270-5612

Field Offices:

110 Vulcan Road
Birmingham, AL
35209-4702
(205) 942-6168
FAX 941-1603

400 Well Street
P.O. Box 953
Decatur, AL
35602-0953
(205) 353-1713
FAX 340-9359

2204 Perimeter Road
Mobile, AL
36615-1131
(205) 450-3400
FAX 479-2593

June 13, 1994

Mr. W.L. Bowers
Environmental Affairs Department
P.O. Box 2641
Birmingham, AL 35291-2641

RE: Hydrogeological Site Evaluation Report
Barry Steam Plant Landfill
Permit Number 49-18R
Mobile County

Dear Mr. Bowers:

The Land Division of the Alabama Department of Environmental Management received a copy of the Hydrogeological Evaluation Report prepared for the Barry Steam Plant Inert Landfill by Mr. Whit Slagle of the Department's Groundwater Branch on 17 May 1994. Mr. Slagle's report (copy enclosed) states that the groundwater elevation at the landfill is less than 5 feet below ground surface. This is in violation of the required 5 foot separation from the bottom of the liner system for the landfill. Since the landfill has no liner the 5 foot separation would be from the waste.

Mr. Slagle's report also states that the landfill is located within the 100-year floodplain of the Mobile River. The regulations require that a landfill shall not be located within the 100-year floodplain. Upon review of the original permit issued to the Barry Steam Plant, 3 February 1983, the 100-year floodplain was not mentioned, but it was stated that:

> "The permittee shall take all reasonable steps to minimize any adverse impact to surface or ground waters resulting from non-compliance or the applicable regulations"

Therefore, from the review of Mr. Slagle's report, Barry Steam Plant should present to the Department a set of plans showing how the waters of the state will be protected. Also, a set of plans which confirms the 5 foot separation between groundwater and disposed waste, should be submitted for review.

If you should have any questions, please call Mr. Gary L. Hawkins of the Engineering Services Branch at 205-270-5644.

Sincerely,

Wm. Gerald Hardy, Chief
Engineering Services Branch
Land Division

WGH/GLH/mah:SWT#1201

Enclosure

CC: Russell Kelly
Solid Waste

Whit Slagle
ADEM, Groundwater

File: Barry Steam Plant/Proposed Renewal/#49-18R
Mobile County

GLH 6/14
WGH 6/14/94

14. APPENDIX G – 1994 RESPONSE TO ADEM LETTER

Alabama Power Company
600 North 18th Street
Post Office Box 2641
Birmingham, Alabama 35291
Telephone 205 250-1000

RECEIVED
JUL 26 1994
ADEM
LAND DIVISION

Alabama Power
the southern electric system

July 22, 1994

CERTIFIED MAIL

Mr. Gerald Hardy, Chief
Engineering Services Branch - Land Division
Alabama Department of
Environmental Management
1751 Cong. W. L. Dickinson Drive
Montgomery, AL 36109-2608

Dear Mr. Hardy:

Alabama Power Company is today responding to your June 13, 1994 letter regarding the Hydrogeological Site Evaluation Report for the renewal of our inert landfill at Alabama Power Company's Barry Steam Plant, permit # 49-18R. This letter stated two areas of concern. First, that the groundwater elevation at the landfill is less than 5 foot below ground surface. Secondly, the landfill is located within the 100-year floodplain. APCo would like to respond to these two points.

The issue of the 5 foot separation from the waste to the groundwater elevation can be remedied by placement of additional fill material to bring the ground surface up to a point that insures the waste from groundwater is at least a distance of 5 feet or greater. The majority of Cell 1 as drawn on the site map is already above this elevation. Fill material will be added to any area in the landfill that is to be used for disposal of waste at the time the cell is developed. Therefore, APCo proposes that within the boundaries of Cell 1, fill material be added to insure the 5 foot separation. As subsequent cells are developed, soil borings will be conducted to insure that the 5 foot separation is achieved.

Mr. Slagle states that the landfill is located within the 100-year floodplain of the Mobile River. Mr. David Frings, APCo Geologist, has reviewed this data and determined that the landfill is above the 100 year flood plain elevation. Mr. Frings used a map produced by the Federal Emergency Management Agency (FEMA) that was prepared in December, 1984. This map may not have been available to Mr. Slagle. This map shows that the 100 year flood plain elevation for this portion of the river is 15 feet above mean sea level (MSL). The zone that includes the area of the Plant and landfill are designated as Zone A8 by FEMA. This designation means that FEMA has determined the base flood elevations and flood hazard factors for the area. Attached is a map which has highlighted the limits of the 15 feet flood elevation. Drawing number D-377468 sheet 1 of 5 which was prepared by Alabama Power Company's PGTS - Civil group shows that all areas of the landfill are above 15 MLS with the exception of two (2) small sump areas located in the extreme southeast corner of the site. These areas are not to receive any fill but are at a lower elevation to insure proper drainage and removal of water.

If there are additional questions, please contact Mr. Jeff Waites of this office at 250-4462. Thank you for your time and cooperation.

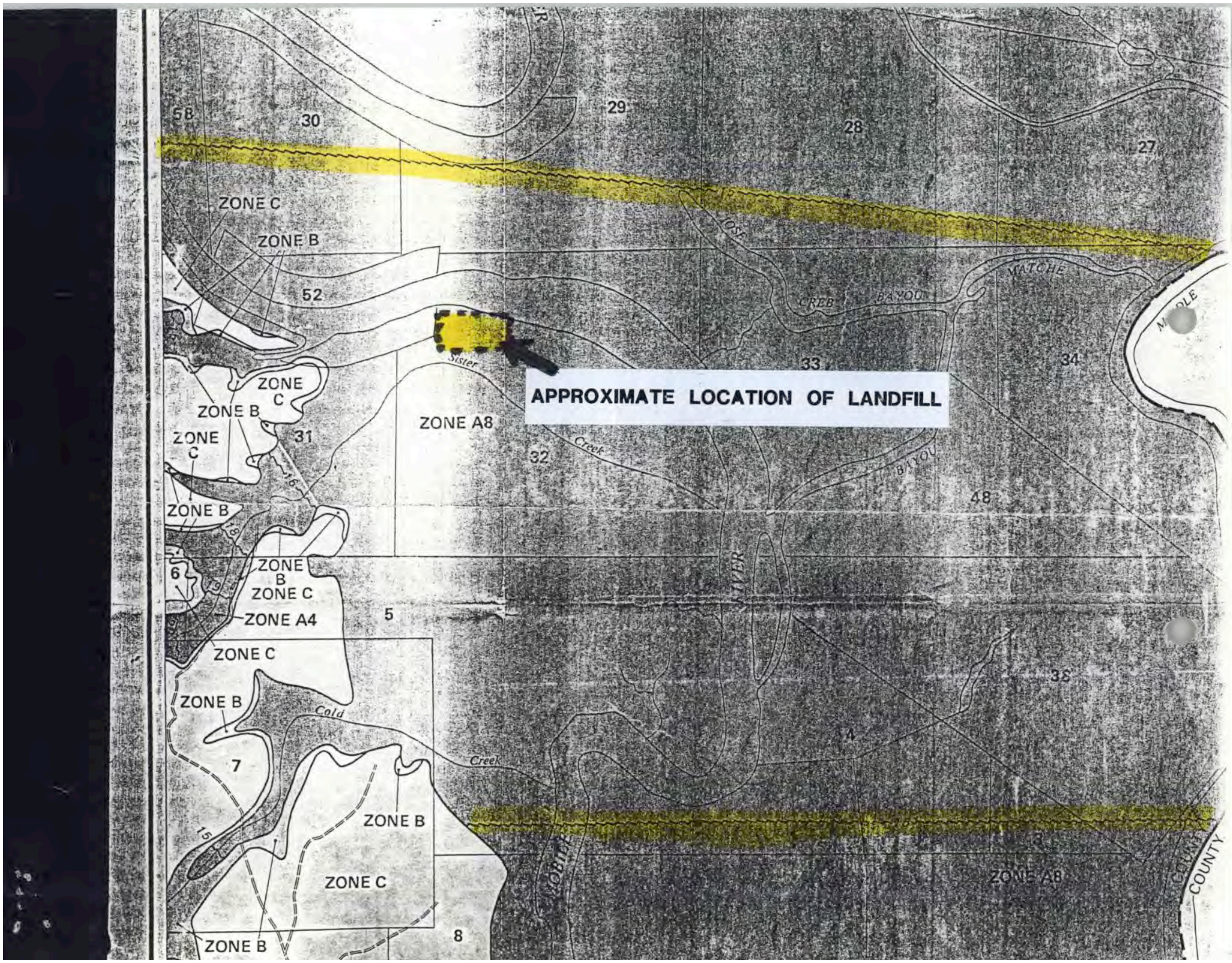
Sincerely,

Jeff Waites for

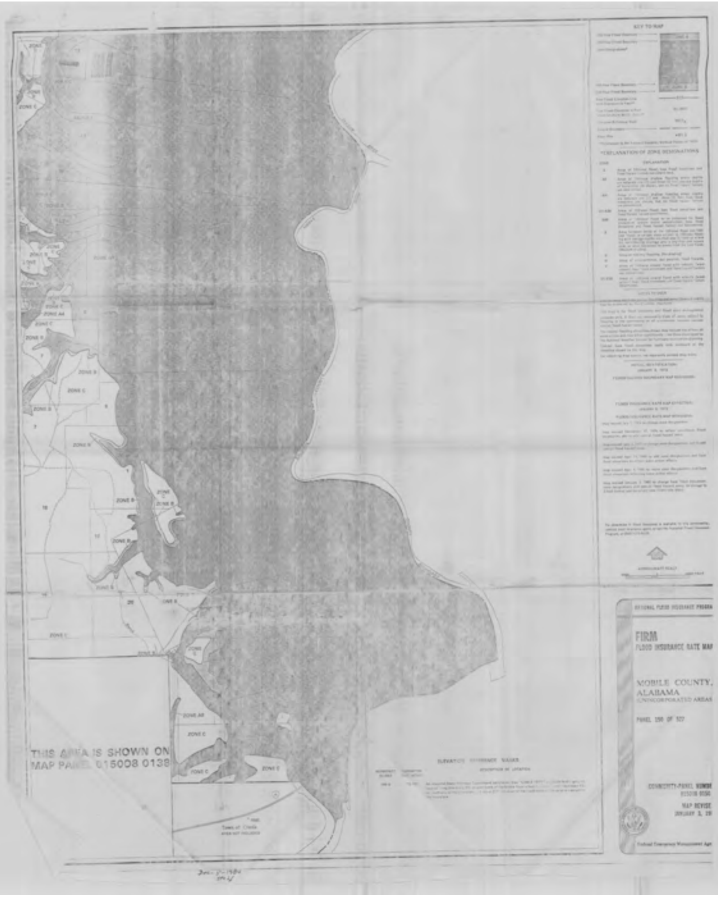
John D. Grogan, Manager
Environmental Compliance

:wjw

Attachments



APPROXIMATE LOCATION OF LANDFILL
ZONE A8
ZONE C
ZONE B
ZONE A4
Sister
Creek
Cold
Creek
BAYOU
RIVER
COUNTY



THIS AREA IS SHOWN ON
MAP PANEL 015008 0138
FIRM
FLOOD INSURANCE RATE MAP
MOBILE COUNTY,
ALABAMA
UNINCORPORATED AREAS

15. APPENDIX H – 2003 ADEM INSPECTION REPORT

ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
COMPLIANCE INSPECTION REPORT

A

FACILITY NAME	~~GEN~~	TRN	TRT	MSWLF	C/D LF	ILF	CLOSED	UAD
AL Power - Barry Steam Plant						✓		

ADDRESS	CITY	STATE	ZIP CODE
Hwy 43	Bucks	AL	36512

PERMIT NUMBER	DATE OF INSPECTION	PAGE	OF
49-18	4/17/03		

During an inspection completed this date to determine compliance with the requirements of Division 13 of the Alabama Department of Environmental Management Administrative Code, following items of noncompliance were identified.

Breach in dike of sediment pond has caused water to stand around landfill. Facility is working on locating problem in order to resolve it. Within 45 days Al. Power must submit to ADEM a written report detailing status of abatement.

This information is provided to document the Department's inspection of your facility and/or to call your attention to areas of potential noncompliance at the earliest possible time. This report does not constitute a Notice of Violation nor a compliance order issued pursuant to the Code of Alabama 1975, § 22-27-7, 22-22A-5, and 22-22A-8 and may not be a complete listing of all areas of noncompliance which may be identified as a result of this inspection.

Signature of Preparer Beverly Blagg Printed Beverly Blagg

The undersigned person hereby acknowledges that he/she received a copy of this report and has read and understands same and does not constitute agreement with the report.

SIGNATURE	PRINTED NAME
M. Hall	M. Hall
TITLE	**DATE**
Compliance Specialist	4/17/3
FOR OFFICE USE ONLY	

SOLID WASTE LANDFILL INSPECTION FORM

FACILITY NAME: AL Power Plant PERMIT NO.: 49-18

MSWLF: ______ C/DLF: ______ ILF: ✓

INSPECTOR: Bragg DATE: 4/17/03 TIME: (AM/PM): 2:30

SITE CONTACTS: TITLE:

Michelle Hall

PURPOSE OF INSPECTION

ROUTINE INSPECTION: ✓ COMPLAINT INVESTIGATION: ______
SAMPLING: ______

FOLLOW-UP INSPECTION: ______ (DATE OF INITIAL INSPECTION: ______)

OTHER: ______

FINDINGS

NO VIOLATIONS ✓ WARNING LETTER ______ NOTICE OF VIOLATION ______
(FORM A) (FORM B)

REMARKS/COMMENTS: ______

REGULATION	MOST USED RULE	REQUIREMENT	IN COMPLIANCE? YES/NA	NO
		GENERAL OPERATIONAL REQUIREMENTS		
13-4.15(2)	4	Alternative daily cover approved/used	✓	
13-4-.16(2)(c)	5	Explosive gas monitoring and reporting plan prepared and on file	✓	
13-4-.16(2)(c)2.	6	Explosive gas monitoring conducted as required (Quarterly for MSWLF, Annually for CDLF/ILF)	✓	
13-4-.16(2)(c)2.(i)	7	Reports submitted to the Department as required	✓	
13-4-.16(2)(c)3.		Exceedences reported, remedial action taken as required	✓	
13-4-.16(2)(c)4.	8	Monitoring points located as required	✓	
13-4-.17(1)	9	Run-on system constructed and maintained	✓	
13-4-.17(2)	10	Run-off system constructed and maintained	✓	
13-4-.17(3)	11	On-site drainage structure constructed and maintained	✓	
13-4-.19	12	Access control measures adequate	✓	
13-4-.21(1)(a)	30	Operation as stipulated on permit	✓	
13-4-.21(1)(b)	31	Only approved waste streams accepted Permitted waste streams: __________ No free liquids, regulated hazardous waste, medical waste, or PCBs	✓	
13-4-.21(1)(c)	32	Certifications for industrial and/or medical waste received on file and copy submitted to Department	✓	
13-4-.21(1)(c)4&5.	36	Written certification for Industrial Wastes renewed biennally & kept on file Approved waste streams: __________	✓	
13-4-.21(1)(d)	39	No water pollution or unauthorized discharge	✓	
13-4-.21(1)(e)	40	Facility boundary adequately marked	✓	
13-4-.21(1)(f)	41	Measuring/weighing devices in & operating	✓	
13-4-.21(2)(a)		Open Burning	NA	
		MSWLF REQUIREMENTS		
13-4-.22(1)(a)1.	47	All waste covered daily/minimum 6 inches	NA	
13-4-.22(1)(b)	49	Waste confined to small area < 2 foot thick layers Appropriate slope? (less that 4:1)		
13-4-.22(1)(c)	50	All waste thoroughly compacted		
13-4-.22(1)(d)	51	Operation in accordance with plans and permit		
13-4-.22(1)(e)	52	Adequate personnel provided		
13-4-.22(1)(f)	53	Adequate equipment provided		
13-4-.22(1)(g)	54	Adverse weather provisions provided		
13-4-.22(1)(h)	55	Site adequately secured		
13-4-.22(1)(i)	56	Information sign located at entrance		
13-4-.22(1)(j)	57	Special provisions-large dead animals-etc.		
13-4-.22(1)(l)		Large Empty Containers rendered unsuitable for holding liquids		
13-4-.22(2)(a)	60	Scavenging prohibited & salvaging controlled		
13-4-.22(2)(b)	61	Litter controlled		
13-4-.22(2)(c)	62	All-weather access road to dumping face		
13-4-.22(2)(d)	63	Vector control measures adequate		
13-4-.22(2)(e)	64	Monitoring and treatment structures protected and maintained in good repair		
13-4-.22(2)(f)	65	Completed areas properly closed		
13-4-.22(2)(g)	66	Records maintained on daily volumes		

REGULATION	MOST USED RULE	REQUIREMENT	IN COMPLIANCE? YES/NA	NO
		C/DLF & ILF REQUIREMENTS		
13-4-.23(1)(a)1.	67	All waste covered weekly/minimum 6 inches	✓	
13-4-.23(1)(b)	69	Waste spread in layers < or = to 2 feet and thoroughly compacted weekly	✓	
13-4-.23(1)(c)	70	Waste confined to small area on appropriate slope (less than 4:1)	✓	
13-4-.23(1)(d)	71	Operation in accordance with plans and permit	✓	
13-4-.23(1)(e)	72	Site adequately secured	✓	
13-4-.23(1)(f)	73	For public use sites, is sign adequate	✓	
13-4-.23(1)(g)	74	Adverse weather operating provisions provided	✓	
13-4-.23(1)(h)	75	Adequate personnel provided	✓	
13-4-.23(1)(i)	76	Equipment adequate	✓	
13-4-.23(1)(k)	78	Containers > 10 gallons rendered unsuitable for holding liquids	✓	
13-4-.23(2)(a)	79	Scavenging prohibited and salvaging controlled	✓	
13-4-.23(2)(b)	80	Litter controlled	✓	
13-4-.23(2)(c)	81	Completed sites or portions or sites properly closed	✓	
13-4-.23(2)(d)	82	All-weather access road to dumping face	✓	
13-4-.23(2)(e)	83	Monitoring and treatment structures protected and maintained in good repair	✓	
13-4-.23(2)(f)	84	Records maintained on daily volumes	✓	
13-4-.23(2)(g)	85	Vector control satisfactory	✓	
		RECORDS/PERMIT/GROUNDWATER		
13-4-.27(2)(g)	88	Groundwater monitoring plan submitted and approved (indicate N/A if not applicable)	✓	
13-4-.27(2)(n)		Groundwater monitoring and statistical analysis completed and submitted	✓	
13-4-.27(3)(b)	92	Groundwater monitoring done semi-annually, or as specified by Department	✓	
13-4-.27(2)(c)2.		Well location, design, construction, and abandonment submitted	✓	
13-4-.29(1)	93	Recordkeeping maintained as required: (a) Permit, (b) Operating record, (c) Gas, inspection records, groundwater, volume, waste certifications		
13-5-.02(2)	94	Permit valid? Expiration date:________	✓	
13-5-.02(3)	95	Permit renewal filed 180 days prior to expiration date	✓	
		Permit renewal request received by Department	✓	
13-5-.06(1)(a)1.	99	All waste received from permitted service area	✓	
13-5-.06(2)(a)5.	100	Permitted volume not exceeded by 20% or 100 tons	✓	

updated 9/1/99

16. APPENDIX I – 2003 ALABAMA POWER RESPONSE TO ADEM INSPECTION REPORT

[illegible] North [illegible] Street
Post Office Box [illegible]
[illegible], Alabama [illegible]

Tel [illegible]

ALABAMA POWER
A SOUTHERN COMPANY

May 30, 2003

JUN 2003
RECEIVED
LAND DIVISION

CERTIFIED MAIL

Mr. James L. Bryant, Chief
Solid Waste Branch - Land Division
Alabama Department of Environmental Management
Post Office Box 301463
Montgomery, AL 36130-1463

Dear Mr. Bryant:

As required by the findings of Ms. Beverly Blagg's April 17, 2003 compliance inspection of Alabama Power Company's Barry Steam Plant landfill, permit #49-13, we provide the following report:

1. The existing water pump system used to control surface water near the landfill at the plant has been re-designed. A new, larger capacity pump is in the process of being installed. This pump has several times more pumping capacity than the existing system and will be more than capable of controlling the water ponding issue in the landfill. Barring unforeseen circumstances, the new system should be operational on or before June 7, 2003.

2. The source of the excess water in the area around the landfill continues to be evaluated. A geological investigation is underway to attempt to ascertain the exact source of the excess water.

We anticipate that the upgraded water pumping system will control the ponding of water within the landfill. When the results of the geological investigation are available, a plan will be developed to address those findings.

Should you have questions or need additional information, please contact Mr. Mark Lester of this office at (205) 257-4462.

Sincerely,

Mr. John D. Grogan, Manager
Environmental Compliance

17. APPENDIX J – 2018 BURGESS DAM SAFETY REPORT

Barry Ash Pond Review
Barry Power Generating Facility
Mobile, Alabama

Submitted to:
Mobile Baykeeper

Date:

March 23, 2018

Burgess Environmental
24 Strathlorne Crescent SW
Calgary, Alberta, T2P 1M8
Telephone: (403) 249 1684
Email: burgess@shaw.ca

Author:
Gordon J. Johnson, M.Sc., P.Eng. (AB)

Burgess Environmental

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EXECUTIVE SUMMARY

Alabama Power operates the Barry Electric Generating Plant (the Plant) that is located approximately 30 miles north of Mobile, Alabama. The Plant uses both coal-fired and natural gas-fired power generation. The coal combustion residuals (CCR), which primarily comprise fly-ash and bottom-ash generated from burning coal, are disposed as a slurry in a large impoundment (the Barry Ash Pond) located immediately adjacent to the Plant and the Mobile River.

Burgess Environmental Ltd. (Burgess) was retained by Mobile Baykeeper to assess the Barry Ash Pond relative to 40 CFR Part 257, Subpart D - Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments (the Standards) and generally accepted practices for dam safety. Burgess' assessment is based on technical documentation that was available to Burgess at the time that this report was prepared, as well as a site visit. The findings of this assessment are presented in accordance with the primary requirements of the Standards, which include the following:

- location restrictions
- requirements for stability assessment
- flood analysis
- groundwater monitoring and corrective action
- closure planning
- record keeping and reporting

Location Restrictions

The Barry Ash Pond site does not comply with 3 of the 5 locations restrictions included in the Standards; the bottom of the ash pond is within 5 feet (vertically) of groundwater, it was constructed over a wetland and the area is unstable. It was also constructed into Mobile River and over Sisters Creek, a tributary of Mobile River. The base of the Barry Ash Pond is partially constructed on sandy soils that are saturated to the surface and are in hydraulic connection with the Mobile River and a regional surface aquifer. This was noted in a site assessment that was completed by ADEM (1994). It is clear that the Barry Pond was constructed over wetlands and riparian habitat that is prone to flooding. Any failure of the Barry Ash Pond would have far-reaching detrimental impacts to very important aquatic habitat (National Parks Service, 2016 and University of Alabama, 2013). The location is prone to river and wave erosion, and the dikes of the Pond are founded on soils that are likely prone to differential settlement; hence, this area is considered 'unstable' and is not appropriate for locating a CCR impoundment. These are important concerns that are specified in the U.S. EPA Standards and should be considered if the Barry Pond is to remain in use or be closed in its current location.

Stability

The stability assessments completed by the Plant concluded that factors of safety for the impoundment dikes complied with the requirements of the Standards by a narrow margin; however, important potential methods of failure were not included in these assessments. For example, differential settlement, erosion and potential for piping failure were not included in the stability assessment even though these are potential failure mechanisms that are clearly relevant to the Barry Ash Pond. Further, the factor of safety assessment assumed that the dikes are not potentially prone to liquefaction failure. This assumption was not supported with any facts, studies, or other analytical rigor.

Flood Analysis

The flood analysis completed by the Plant modelled the water levels in the Barry Ash Pond resulting from the 1 in 1,000 years, 24-hour rainfall event. The predicted water levels rose to within an inch of the top-of-dike elevation. This is not an acceptable level of safety given the potential for wave action and clogging of the Pond outfall during such events. Further, the flood analysis did not consider the potential for flooding outside of the Pond, or the potential for erosion or overtopping resulting from external flooding. The flood analysis also failed to correlate predictions with flood conditions observed during similar but smaller storms in the recent past.

Groundwater Monitoring

Groundwater monitoring data collected in 2016 and 2017 confirm the presence of an aquifer underlying the ash pond. ADEM (2018) has recently fined the Alabama Power Company $250,000 for groundwater pollution by arsenic, caused by the Barry Ash Pond and selenium from the nearby lined Gypsum collection basin. The groundwater report, which was issued by the Southern Company as required by the Standards, does not provide any meaningful technical analysis of the chemical impacts to groundwater and surrounding surface water by the Barry Ash Pond.

Closure Planning

The Barry Plant has issued a Closure Plan that contemplates initiating closure of the Barry Ash Pond in 2019 by capping the CCR in place. Given that the location of the Barry Ash Pond does not comply with 3 of the 5 location restrictions in the Standards, closure of the Pond in-place is not advised. Closure of the Barry Pond in place would require significant protective measures to combat erosion and the long-term meandering of the Mobile River, which would need to be supported by monitoring and maintenance, in perpetuity. These measures would need to be maintained into perpetuity as the Mobile River will continue to threaten the Barry Ash Pond well beyond the 30 year post closure care period required by the Standards.

Records and Reporting

The Plant has complied with the assessment and reporting requirements of the Standards. The Plant has relied on its owner, the Southern Company, to assess and validate the integrity of the Barry Ash

Pond. While this is consistent with the Standard, it is more typical for an organization to contract out an independent third party to assess important dam structures. The simplicity of the assessments is striking. It is more typical to include more rigorous and comprehensive analyses when assessing the integrity of such an important structure.

1 INTRODUCTION

1.1 Background

Alabama Power operates the Barry Electric Generating Plant (the Plant) that is located approximately 30 miles north of Mobile, Alabama (Figure 1-1). The Plant uses both coal-fired to natural gas-fired power generation. The coal combustion residuals (CCR), which primarily comprise fly-ash and bottom-ash generated from burning coal, are disposed as a slurry in a large impoundment (the Barry Pond) located immediately adjacent to the Mobile River and upstream of Tensaw Delta and Mobile Bay.

Mobile Baykeeper is concerned with maintaining and improving the water quality and ecosystem of Mobile Bay and by extension the upstream reaches of Mobile River. The Barry Electric Generating Plant and associated Barry Ash Pond are seen as potential risks to these water bodies. Accordingly, Mobile Baykeeper retained the services of Burgess Environmental Ltd. (Burgess) to assess the Barry Ash Pond in the context of applicable federal legislation pertaining to the management of CCR and generally accepted practices for dam safety.

1.2 Purpose and Scope

This report evaluates the technical documentation for the Barry Ash Pond relative to standards required by 40 CFR Part 257, Subpart D - Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments (the Standards). It also evaluates the Barry Ash Pond relative to generally acceptable engineering procedures for assessing and maintaining dam safety. The objective of this review is to evaluate the long-term stability of the Barry Pond to assist Mobile Baykeeper in understanding the risks that the Plant presents to the water quality and ecology of the Mobile River, Mobile-Tensaw Delta and Mobile Bay. The basis of information and analyses that support this review includes the following:

- a site visit to inspect the outer portions of the Barry Ash Pond and the surrounding watershed
- review of any documentation for the Barry Ash Pond that has been made available publicly by Alabama Power
- information and documentation provided by Mobile Baykeeper
- the judgment and experience of the author

1.3 Documents Reviewed

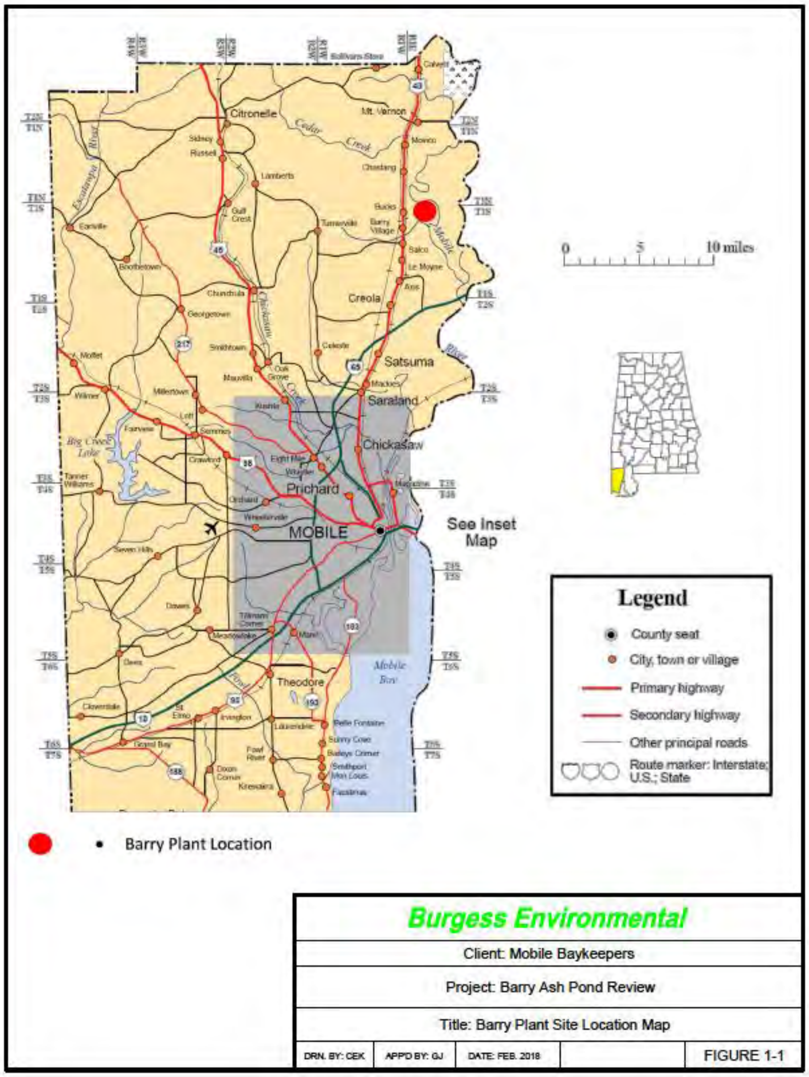
The following documents that were prepared on behalf of the Barry Plant were reviewed to understand the technical basis, composition and stability of the Barry Ash Pond:

- 2015 and 2016 Inspection Reports (by Mickwee and Wilson, P.E.)
- 2017 Annual Groundwater Monitoring and Corrective Action Report
- CCR Fugitive Dust Control Plan (Wyman Turner, P.E.)
- CCR Surface Impoundment Emergency Action Plan (James Pegues, P.E.)
- Closure Plan for Existing CCR Surface Impoundment Barry Ash Pond (James Pegues, P.E.)
- History of Construction for Existing CCR Surface Impoundment Barry Ash Pond (James Pegues, P.E.)
- Inflow Design Flood Control System Plan Barry Ash Pond (James Pegues, P.E.)
- Initial Hazard Potential Assessment Barry Ash Pond (James Pegues, P.E.)
- Initial Safety Factor Assessment Barry Ash Pond (James Pegues, P.E.)
- Initial Structural Stability Assessment Barry Ash Pond (James Pegues, P.E.)
- Liner Design Criteria 40 CFR Part 257.71 Barry Ash Pond (James Pegues, P.E.)

Additional background information pertaining to the Barry Ash Pond was obtained from 'Dam Safety Assessment of CCW Impoundments James M. Barry Electric Generating Plant', a report prepared for the U.S. EPA by O'Brien and Gere (2010). A complete list of references is summarized in Section 7.

Figure 1-1

Barry Plant Location Map



2 SITE DESCRIPTION

2.1 Barry Power Generating Facility

The James M. Barry Electric Generating Plant (Plant) is located along the west bank of the Mobile River at 15300 U.S. Highway 43 North, Bucks, Alabama approximately 30 miles north of Mobile, Alabama, and is owned and operated by Alabama Power. In 2010, the Plant operated seven electric generating units; two natural gas-fired combined cycle units and five coal-fired units providing a total generating capacity of 2.66 GW. At the time of writing this report only two of the coal-fired units (4 and 5) were understood to be in operation.

In 2010, Plant Barry produced approximately 400,000 tons of coal combustion waste (CCR) by-products per year. The CCR produced by burning coal was managed on-site within a single impoundment (the Barry Ash Pond) located immediately southeast of the power generating facilities (O'Brien and Gere, 2010). A plan view of Barry Plant development area is presented in Figure 2-1.

Generating Unit #5 is equipped with a flue-gas desulphurization (FGD) scrubber, which reduces pollutants such as sulphur dioxide and nitrous oxide. The primary by-product of the emission scrubbing process is synthetic gypsum, which was also disposed of in the Barry Ash Pond. A Gypsum Collection Basin (GCB) was put into service in late 2010 to contain the synthetic gypsum by-product and is located west of the Barry Ash Pond. Since the GCB was put into service, the decant water (the water left on top of the GCB after solids have mostly settled out) from the GCB is directed through the Barry Ash Pond (O'Brien and Gere, 2010).

2.2 Coal Ash Pond

The Barry Ash Pond is located southeast of the power generating complex (Figure 2-1). The pond is bounded to the north by the Plant, to the east and south by the Mobile River, and to the west and southwest by the Plant cooling water discharge canal. Through essentially all of its history the Barry Ash Pond has not been subject to regulatory oversight.

The Barry Ash Pond was reportedly placed into service in 1965 and is approximately 600 acres in size. The total storage capacity of the Barry Ash Pond is approximately 18 million cubic yards and is reported to be over 90% full. These capacity estimates are based on a Closure Plan submitted under Section 257.102 of the Standards (Pegues, 2017). This volume is significantly larger than those calculated by Southern Company Services, a corporate affiliate of Alabama Power Company, and reported by O'Brien and Gere (2010).

Dikes surround the east, south and west edges of the Barry Ash Pond embankments; the west and east embankments appear to tie into natural ground on the north side of the impoundment. The pond was reportedly constructed in 1965 and the dikes expanded on four occasions, in 1972, 1992, 1998, and 2004. Additional dike construction work was in progress at the time of the site visit, which was completed on February 9, 2018. There have been no major modifications to the pond outfall structure. The pond was built on a marsh area and continues to support marsh vegetation, such as cattails and water hyacinths. Portions of the pond extend into Mobile River and the pond was constructed over Sisters Creek and its confluence with the Mobile River.

According to documentation provided to USEPA by Alabama Power, CCR materials contained in the Barry Ash Pond include fly ash, boiler slag, flue gas emission control residuals, and other regulatory-permitted, low volume wastes. Historically, the pond also accepted metal cleaning wastes (Pruner, 1991). These types of wastes can contain elevated concentrations of heavy metals. These materials, including storm water runoff from the Plant, are transferred to the pond via the plant's storm water pump station. Water flows from north to south through the pond and through two bridge openings in the diversion dike near the southeastern end of the pond. Decant water ultimately discharges to the Mobile River through an outfall structure.

The riser portion of the concrete outfall structure is made up of a four-sided, 8-feet square overflow weir. The discharge conduit is a 48-inch diameter corrugated metal pipe (CMP). The outfall structure is protected by a timber debris barrier. The discharge is permitted under NPDES permit number AL0002879.

The Barry Ash Pond is not lined (Pegues[F], 2016).

2.3 Pond Dikes

The Pond is divided into the main ash storage area and the decant area downstream of the diversion dike. The crest of the main ash storage area, including the east and west embankments and the diversion dike, is at approximately elevation 24.5 feet above mean sea level (ft asl). The south embankment elevation surrounding the area downstream of the diversion dike is at approximately 21.5 ft asl. The original pond bottom is reported to be at approximately 3.0 ft asl and the original dike walls before the 1998 raise and the construction of the diversion dike were at a slope of approximately 3H:1V (1 foot of vertical rise for every 3 feet of horizontal distance).

The embankment was originally constructed to a top elevation of approximately 18 ftasl. According to the Plant Barry Ash Pond South Dike and Diversion Dike Slope Stability Report (September 2004), in 1992, the east and west embankments were raised three feet to approximately 21 ftasl. In 1998, the east and west embankments were raised to between approximately 23 and 24.5 ftasl using compacted fill.

A diversion dike was also constructed in 1999 near the south end of the pond to create a decant area prior to discharge through the outlet structure. The diversion dike crest elevation was originally constructed to approximately 18 ftasl and in 2004 was raised to approximately 24.5 ftasl, and the crest of the south embankment was raised to approximately 21.5 ftasl. The side slopes were constructed at approximately 3H:1V.

There have been documented minor repairs over the years such as filling of animal burrows, repairs to shallow slides, regular maintenance and mowing, stump removal at toe of slope, filling and compaction of surface erosion features, and placement of riprap along water's edge at south end of the Pond to help reduce wave action erosion.

The O'Brien and Gere (2010) review of the 1998 Summary Design Report prepared by Synergy Earth Systems, Inc. indicates that the earth fill of the original embankment section varied in soil type and consistency, but generally consists of a mixture of silty and sandy clays, clayey fine sands and sands underlain by a layer of soft organic silts and clays. According to the report, the underlying soils are the naturally existing marsh deposits over which the embankments were constructed.

There are no toe drains or engineered, low-permeability cut-off walls in the embankment, and there is no embankment instrumentation. These are standard features incorporated into the designs of important dikes and dams. Groundwater monitoring is being implemented as required by the Standards and 2017 monitoring results are available to the public.

2.4 Surface Geology

Regional

Mobile Bay and estuaries along the Gulf of Mexico margin typically originate as incised fluvial valleys that formed during the most recent drop in sea level and were then inundated by the subsequent postglacial sea-level rise. Most of these estuaries have been filling with sediment from fluvial and marine sources. The Mississippi-Alabama shelf province is defined by characteristics resulting from deltaic deposition advancing and receding as the sea level rose and fell (USGS, 2018).

According to the Quaternary Geologic Map of the Mobile 4^{o} to 6^{o} Quadrangle (USGS, 1988) the Barry Pond is underlain by Alluvial Delta Loam, which is described as inter-bedded yellowish gray to brownish gray, poorly sorted to well sorted, coarse to fine sand, silt and clay of Holocene age. The deposit may include organic muck, lenses of peat, and freshwater marsh deposits. The deposits within and above the Mobile River estuary are reported to be present to an elevation of 10 ftasl and may exceed 100 ft in thickness. Thinner accumulations are anticipated in the Barry area.

The surface deposits adjacent to and west of (and potentially underlying) the Alluvial Delta Loam deposit consist of Delta Deposits of Miocene and Pleistocene age. Delta Deposits are described as inter-bedded gray to yellowish gray to brownish gray, poorly sorted to well sorted, clay, silt and sand. They may contain zones of peat and marsh deposits of Holocene age. The Delta Deposit thickness is reported to vary between 10 and 30 ft.

Site Conditions

Soils underlying the Barry Ash Pond are reported by Alabama Power in their Initial Factor of Safety Analysis Report and by reports issued by ADEM (1994) and the U.S. EPA (Pruner, 1991). Portions of the Pond are underlain by soft clayey marsh deposits and portions are underlain by alluvial sands of Miocene age. These deposits are consistent with the range of soil conditions reported regionally.

Additional insight into the shallow soil conditions underlying the Barry Ash Pond was obtained during the site visit, by inspecting eroded surfaces along the Mobile River adjacent to the pond. These eroded surfaces confirm the site conditions reported above. Portions of the pond appear to be underlain by organic clay marsh deposits and portions of the pond appear to be underlain by both Holocene and pre-Holocene sands.

2.5 Hydrogeology

Two major aquifers are reported regionally (ADEM, 2010), the alluvial coastal aquifer, which is of Holocene age, and the Miocene and Pleistocene aquifer, which is reported to be up to 100 feet thick and extends throughout the area of the Mobile River estuary. These aquifers are unconfined, are in hydraulic connection to each other and to surface water, and are viewed as being highly susceptible to contamination because they are hydraulically connected to surface water.

The sandy deposits underlying the Barry Ash Pond are hydraulically connected to the Mobile River and the Miocene and Pleistocene aquifer. The top of the sand deposits and hence the top of the aquifer is coincident with the ground surface and the base of the ash deposit, wherever the clayey organic marsh deposits are not present.

2.6 Hydrology

The Mobile River is located in southern Alabama and flows below the confluence of the Tombigbee and Alabama rivers. The Mobile River is approximately 45 miles long and drains an area of 44,000 square miles, which includes Alabama, Mississippi, Georgia, and Tennessee. It is one of the largest stream drainage basins located entirely in the United States and has historically provided the principal navigational access for Alabama.

The Tombigbee and Alabama River join to form the Mobile River approximately 50 miles northeast of Mobile, along the county line between Mobile and Baldwin counties. The combined river flows south, in a winding course. Approximately 6 miles downstream of this confluence, the channel of the river divides, with the Mobile flowing along the western channel. The Tensaw River, a bayou of the Mobile River, flows alongside to the east, separated by approximately 2 to 5 miles. The Mobile River flows through the Mobile-Tensaw River Delta and reaches Mobile Bay on the Gulf of Mexico just east of downtown Mobile

Plant Barry is located within the Big Chippewa Lake watershed, which has a total area of 48,052 acres and is part of the wetland located immediately northeast of the Barry Plant and Mobile River.

Plant water, which includes process water (ash sluice water and low-volume waste) and stormwater from various sumps located within the generating plant, is directed through the Barry Ash Pond.

A cooling water discharge canal is located west side of the Barry Ash Pond. This canal also intercepts water flowing through Sisters Creek, which was a natural stream that was displaced and filled with CCR by the construction of the Barry Ash Pond.

Figure 2-1

Site Plan - Barry Ash Pond

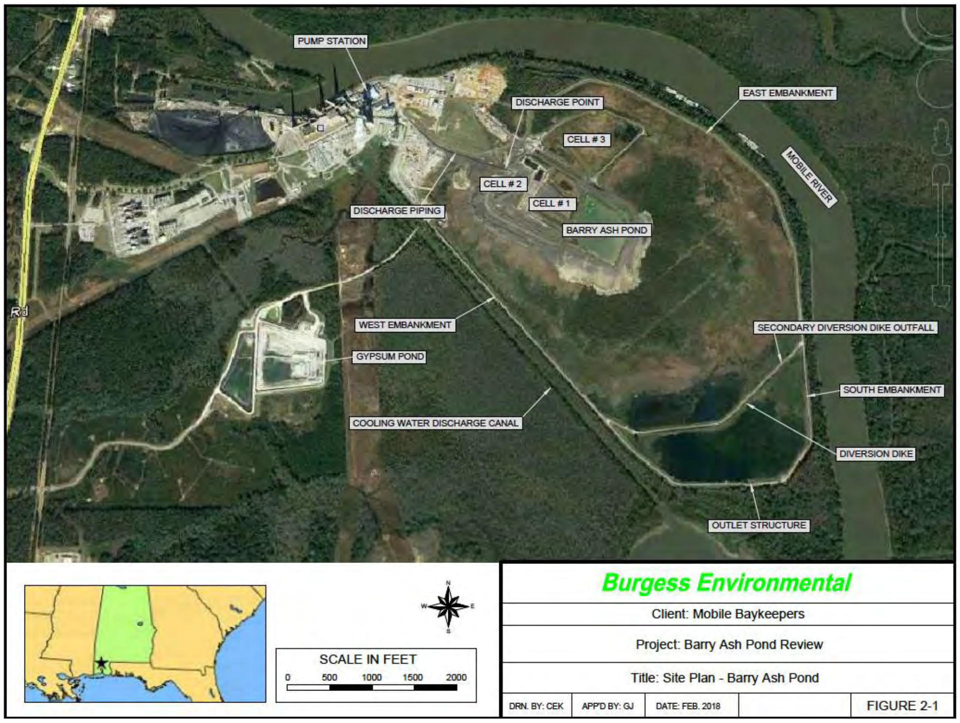


Figure 2-2

Surface Geology

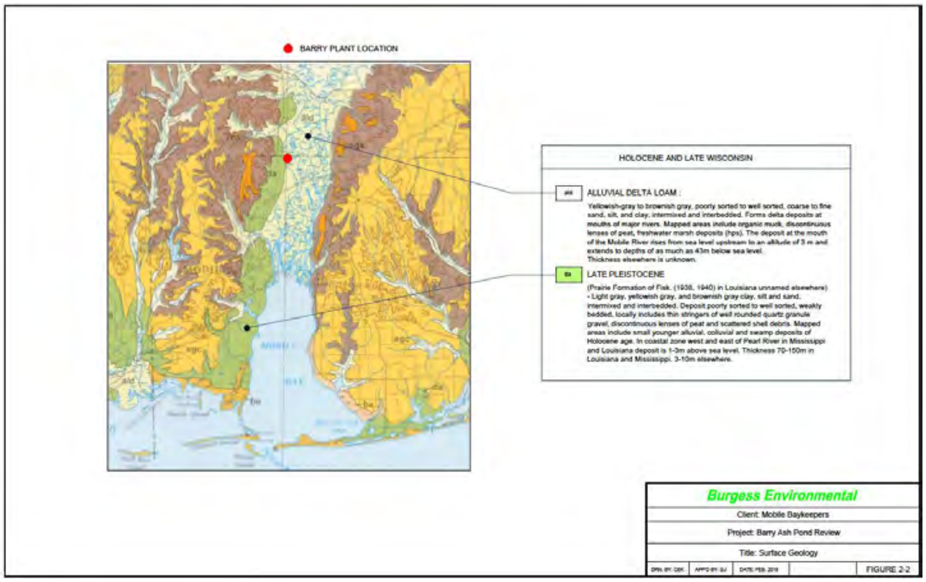
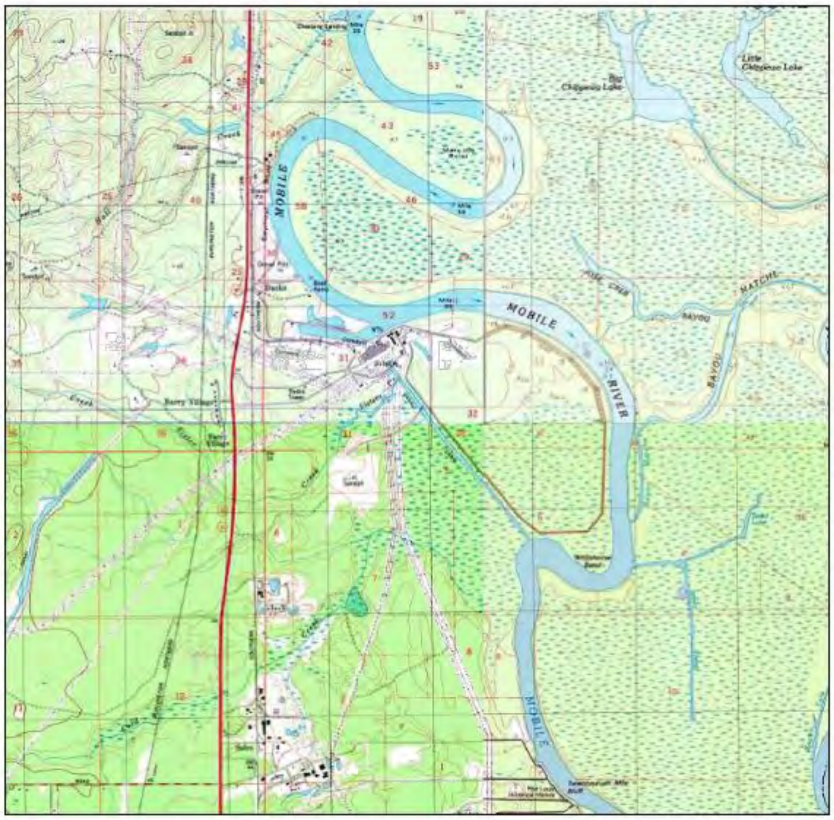


Figure 2-3

Topography and Drainage



Burgess Environmental	
Client: Mobile Baykeepers	
Project: Barry Ash Pond Review	
Title: Topography and Drainage	
DRN. BY: CEK	APP'D BY: GJ	DATE: FEB. 2018		FIGURE 2-3

3 LEGISLATION

3.1 40 CFR Part 257, Subpart D

General

40 CFR Part 257, Subpart D - Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments (the Standards) was promulgated by the U.S. EPA in response to failures of large CCR impoundments that impacted waters of the United Sates. This legislation is intended to complement existing federal, state and local legislation regarding CCR disposal facilities and environmental protection. This section highlights aspects of these Standards as they may apply to this review of the Barry Ash Pond. Its intent is not to evaluate compliance of the Barry Ash Pond with this legislation. Rather the intent of this section is to highlight technical aspects of the Standards to help guide this review and assessment of the Barry Ash Pond.

The operator of a CCR disposal facility is required to post most of the underlying information, plans and studies on an internet site that is made available to the public. Section 4 provides a summary of the requirements of these Standards together with the status of the Barry Ash Pond based on the reports and studies that have been posted for review.

Location Restrictions

Location restrictions for CCR impoundments apply to existing CCR surface impoundments. The following restrictions (paraphrased) are most relevant to this review, and the environmental and stability aspects of the Barry Ash Pond:

- Not in direct contact with an underlying aquifer or within 5 feet vertically of a zone that may be inundated by an underlying aquifer.
- Not in a wetland or adjacent to a wetland such that the CCR impoundment may harm that wetland. For existing CCR impoundments the owner must demonstrate a lack of harm to the wetland by October, 2018.
- Not in an area subject to recent faulting, high seismic activity or where the ground is unstable. Stability concerns that may affect the integrity of a CCR surface impoundment include erosion, differential settlement and ground movement.

Design

The following design standards and guidance apply to new or laterally expanding CCR impoundments (except as otherwise noted):

- a composite liner that comprises a 30 mil plastic and underlying clay-soil liner having a hydraulic conductivity no greater than 10^{-7} cm/sec

- a leachate collection system overlying the composite liner
- demonstrated structural integrity (all CCR impoundments above grade), which includes;
    - a hazard assessment
    - emergency action plan
    - assessment of the foundation, composition, contents and capacity of the CCR impoundment
    - stability assessment
    - flood assessment (1 in 1000 years event for impoundment judged to present a 'significant' hazard
    - instrumentation and monitoring programs

Operating Criteria

The following operating requirements are specified in the Standards:

- control and minimization of fugitive air emissions, with annual report
- run-on and run-off controls
- inflow flood controls
- inspection and repair/maintenance programs
- groundwater monitoring and corrective action (in place by October, 2017)

Closure and Post-Closure Care

The following requirements are included in Closure and Post-Closure Care section of the Standards:

- the impoundment must be stable and secure if the CCR is to be capped and closed in-place
- cap design and specifications are included
- standards for closure by removal
- retro-fitting or closure of the facility is required if groundwater exceedances are observed over a 6-month period
- requirements for planning, implementation and reporting

4 ASSESSMENTS

4.1 General

Publicly available assessments of the Barry Ash Pond were obtained by Mobile Baykeeper and from the Barry Plant website to assist in this review. These assessments have been grouped into the following subject areas, which are discussed further in underlying subsections:

- stability analyses
- flood and risk assessments
- water quality and environmental
- inspections and maintenance

Most of the assessments were completed by James Pegues a Professional Engineer with the Southern Company, the parent company of Alabama Power Company. A summary of the content and status of these assessments and reports in comparison with the requirements of the EPA Standards is presented in Section 4.9.

4.2 Construction

The history of construction of the Barry Ash Pond is summarized by Pegues[a] as required by Section 257.73. The Ash Pond was originally constructed in 1965. The pond was formed with the creation of dikes on the east, south, and west sides of the impoundment. The north side of the impoundment is natural ground that ties into the east and west dikes. The dikes were modified in 1972, 1992, 1998, and 2005. Design and construction information appears to be available for the 1998 and 2005 expansion programs but not for the previous construction programs. Selected drawings and construction specifications are included in the history of construction report (Pegues[a]) but no foundation information is included. No construction quality assurance and quality control data is presented or summarized in this report.

The outlet consists of a vertical pipe riser located in the south end of the Pond, behind a diversion dike that was installed in 1999 and expanded in 2004 to increase residence time and sedimentation within the Pond. Recent minor modifications to outlet structure have been put in place to aid in separation of water and solids, and to increase discharge capacity.

4.3 Stability Analyses

An Initial Factor of Safety of the Pond dikes was completed by Pegues[b] in accordance with the requirements of Section 257.73 of the Standards. The assessment utilized commercially available software to analyse slope stability and assumptions for soil conditions and properties that were obtained from previous reports. The stability analyses were completed for the ‘critical section’ along the northeast main dike, although the criteria used to establish the critical section was not explained. Liquefaction analysis was not completed because the dikes were determined by Pegues as not susceptible to liquefaction. It is standard practice to consider this potential mode and liquefaction analysis should have been completed for the Barry Pond. In particular, liquefaction analysis should have been completed for the dikes that are founded on ash and sand that could be susceptible liquefaction.

The dikes were constructed primarily on organic clay, which is in turn underlain by alluvial sands. The dikes are reported to be constructed using clay and clay sand, with some bottom and fly ash used in portions of the dike construction. Soil properties used in the analyses are summarized in Table 4.1. The Pond was assumed to be full of bottom and fly ash, and the water level was assumed to coincide with the elevation of the top of the dike. A schematic view of the dike cross-section used in the stability analysis is presented in Figure 4-1.

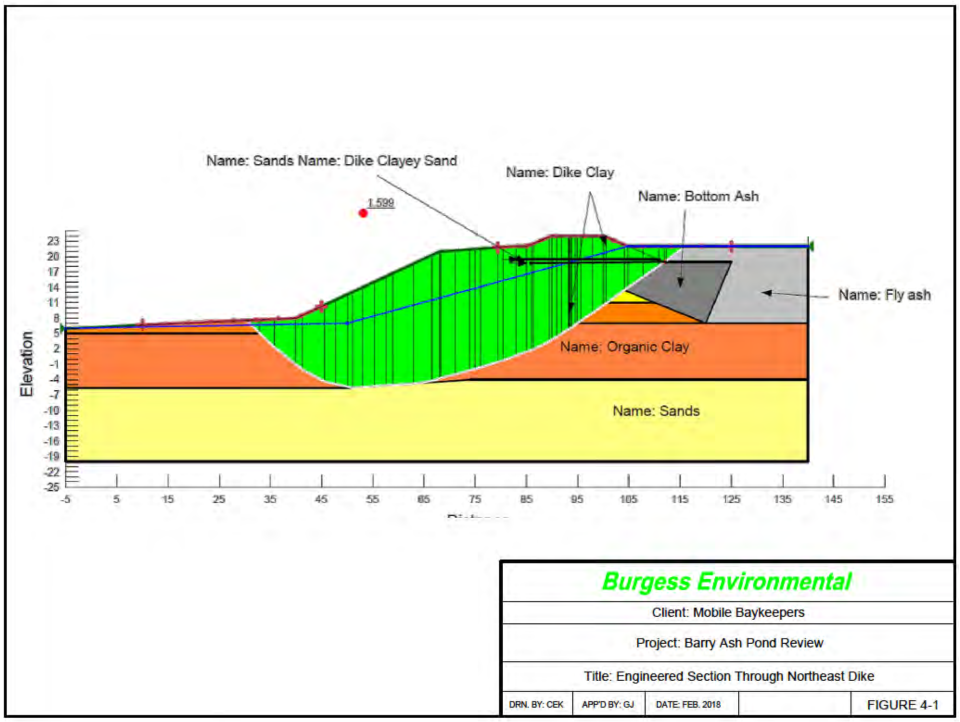
Table 4.1
Summary of Soil Properties Used in Stability Analyses

Soil Properties of North East Main Dike			
Layer	**Density (pcf)**	**Cohesion (psf)**	**Friction angle (degrees)**
Bottom Ash	95	0	35
Fly Ash	90	90	2
Dike (clayey sand)	102.9	0	30
Dike Clay	102	500	0
Organic Clay Foundation	90	444	0
Sand Foundation	107	0	35

The calculated factors of safety varied between 1.6 and 1.5 for the normal, maximum pool and seismic cases, which complies with the requirements of the Standards (1.5 to 1.0). The factor of safety calculation represents the ratio of stabilizing to destabilizing forces. The assessment did not include an analysis of settlement and differential settlement, which would appear to be warranted based on the presence of relatively thick organic clay underlying the northeast dike.

An Initial Stability Assessment of the Pond dikes was also completed by Pegues[c] as per Section 257.73 of the Standards. No new analyses were completed as part of this assessment. Mr. Pegues limited this assessment report to qualitative explanations as to why there were not stability concerns. No analysis was completed regarding the potential for settlement and differential settlement and no detailed analysis of the risk of erosion of the external dikes from the outside was provided. No analysis of potential piping failure was provided, even though there is evidence of potential for piping as discussed in Section 5.4 of this report. Further, Mr. Pegues concluded that there were no risks associated with the dikes because the perimeter dikes were properly compacted. It is not clear how this conclusion was derived given that the early construction activities do not appear to have been supported by proper engineering drawings, construction specifications or QA/QC data.

Figure 4-1
Engineering Section Through Northeast Dike



4.4 Risk and Flood Analyses

An Initial Hazard Potential Assessment of the Barry Ash Pond was completed by Pegues[d] in accordance with the requirements of Section 257.73 of the Standards. Mr. Pegues concluded that the Barry Ash Pond presented a Significant Hazard Potential, which means that failure of the impoundment would result in significant environmental harm but not risks to human life or critical infrastructure. This is the same hazard potential that was determined by O'Brien and Gere (2010).

An Inflow Design Flood Control System Plan for the Barry Ash Pond was completed by Pegues[d] in accordance with the requirements of Section 257.82 of the Standards. The report is not so much a plan but is an assessment of the ability of the Barry Ash Pond to safely convey flows associated with the 1 in 1,000 years, 24-hour rainfall event. Flows that are contained within the Pond and conveyed by the Pond outlet structure consist of rainfall and a minor amount of process water that is directed through the Pond. Calculations were made using the computer program Hydraflow for Hydrographs in Civil 3D.

The 1 in 1,000 years rainfall event was 21.7 inches and was calculated to result in an increase in pond level of 5.6 feet, which would reduce the available freeboard (the difference between the top of the pond water and the top of the dike) to 0.03 feet (a little over ¼ of an inch). The maximum inflows and outflows were calculated to be 5,407 and 223 cfs, respectively.

An inundation analysis and Emergency Action Plan were prepared by Alabama Power in accordance with the requirements of the Section 257.105. The Emergency Action Plan is generic in nature and primarily specifies organization and responsibilities. This Plan includes the inundation analysis, which shows that the entire down-stream portion of Mobile River and the surrounding wetlands will be inundated should the Barry Ash Pond fail. Mobile Bay and the Mobile River estuary are known to be important aquatic environments based on the richness and diversity of the species that inhabit these areas.

4.5 Water Quality and Environmental

An attestation was completed by Pegues[f] in accordance with the requirements of Section 257.71 of the Standards stating that the Barry Ash Pond design did not include a liner as is required for new facilities. This is an important consideration given that the location of the pond does not comply with 3 of the location restrictions specified in the Standards.

Groundwater investigation and monitoring was completed in 2016 and 2017, and included installation and sampling of 16 monitoring wells completed in the Miocene aquifer underlying the perimeter of the Barry Ash Pond. This report included statistical analysis of the groundwater data, but not any meaningful assessment of water quality and the related impacts to the surrounding environment. For example, not samples were collected from and no comparisons were made to the process water within the pond and the water in Mobile River immediately adjacent to the pond. These comparisons need to be made to determine the nature of the potential impacts to groundwater quality and the potential affects that this water may have on the surrounding environment. In addition, no assessment of potential regulatory standards and their basis was provided in the report. Finally, water quality results are compared to 'background' samples that were collected in 3 of the 16 monitoring wells that were collected from up-gradient wells. In my opinion, there are no well installations that are representative of background conditions because the water level within the Barry Ash Pond is significantly higher than the water levels measured in the all of the monitoring wells; hence, process water has the potential to seep into all of the monitoring wells.

In early 2018, ADEM fined Plant Barry and the Alabama Power Company $250,000.00 for polluting the groundwater underlying the Barry Ash Pond. This fine was presumably issued based on the results of the groundwater monitoring results recently posted by Plant Barry. It indicates that contamination from the Barry Ash Pond is seeping into the underlying regional aquifer.

4.6 Inspections and Maintenance

Richard Mickwee completed the annual inspection and report for the Barry Ash Pond in 2015, in accordance with Section 257.83 of the Standards, and Mr. Wilson performed the same inspection in 2016. These inspection reports are essentially a checklist that reports volumes and water levels. There is no volunteered information and there is no comment on the state of the perimeter dikes or discharge infrastructure. There is no description of maintenance or repair activities that may have occurred or why. A simple statement questioning if any issues that might affect the integrity of the impoundment was simply answered 'no'.

The O'Brien and Gere (2010) independent assessment of the Barry Ash Pond does go into considerably more detail regarding the inspection and maintenance program being implemented for the Barry Ash Pond and recommends that it be continued diligently.

4.7 Closure Planning

The Closure Plan submitted by Alabama Power as per Section 257.102 of the Standards (Pegues[g]) contemplates closure of the CCR in place by consolidating the CCR to form the desired grades and capping the area in accordance with the minimum requirements of the Standards (an 18-inch thick infiltration layer overlain by a 6-inch thick topsoil layer). The Closure Plan is very brief and satisfies the minimum reporting requirements of the Standards. No drawings or material specifications are included with the Plan. No discussion is provided regarding erosion protection along the Mobile River or the significant challenges associated with capping a CCR impoundment immediately adjacent to a major waterway and wetland. This report states that of the Barry Ash Pond is expected to be initiated in 2019.

4.8 Independent Assessments

Dam Safety Assessment of CCW Impoundments James M. Barry Electric Generating Plant was completed in 2010 by O'Brien and Gere, on behalf of the U.S. EPA, 2010. This assessment was reportedly commissioned by the U.S. EPA in response to significant failures that occurred in the U.S. The reported objective of this work was to provide a Dam Safety Assessment of the Barry Ash Pond, which included the following tasks:

- identify conditions that could adversely affect structural stability or functionality
- note the extent of deterioration, status of maintenance, and need for repair
- evaluate conformity with current design and construction practices
- determine the hazard potential classification

The scope of the O'Brien & Gere assessment that was reported to include the following tasks:

- review pertinent records (prior inspections, engineering reports, drawings, etc.)
- visit and inspect the Barry Ash Pond
- evaluate the adequacy of the outlet works, structural stability, quality and inspection, maintenance, and operations procedures
- identify critical infrastructure within 5 miles down gradient of management units
- evaluate the risks and effects of flood loading on the management units
- identify all leaks, spills, or releases within the last 5 years
- report the findings and conclusions regarding safety and structural integrity

No independent analyses were completed by O'Brien and Gere. The assessment primarily consisted of review of the various reports and studies that were made available to the review team. The assessment concluded that the risk associated with the Barry Ash Pond was significant as the facility is located immediately adjacent to the Mobile River.

Erosion and deterioration of the slopes exposed to the Mobile River were noted, as were holes associated with burrowing and rooting animals. The assessment concluded that the work completed for the Barry Ash Pond was acceptable. Numerous recommendations were made regarding inspections and maintenance. It was noted that there is no instrumentation of the Barry Ash Pond and that it was not possible to identify dike seepage because the dike abuts the Mobile River.

4.9 Assessment of Alabama Power Reports

Table 4.2 summarizes the scope and content of the reports prepared by the Barry Plant relative to the requirements of the Standards and generally accepted practices for dam safety. Particular concerns include the following:

- The Initial Stability Assessment report does not consider erosion or differential settlement. These are stability concerns specifically referenced in the Standards. The variable nature of the foundation (soft organic clays inter-bedded with alluvial sands) suggests that differential settlement may be a particular concern for the Barry Ash Pond. Erosion is clearly a concern given that the Barry Pond is essentially in the Mobile River, a vast water course that is susceptible to flooding and is eroding the river bank adjacent to the Barry Ash Pond.
- The Initial Stability Assessment report and the Inspection reports do not make reference to potential piping even though this was a specific concern raised by the O'Brien & Gere report (2010). This is particularly important given the lack of records for initial dike construction.
- The Closure Plan assumes that closure by capping in place is feasible and appropriate even though no analysis is provided to support closure in place. The lack of technical support for this assumption is particularly troubling given that the Barry Pond site does not comply with three of the five location restrictions specified in the Standards.
- The groundwater monitoring report does not include a meaningful technical assessment of water quality and the potential for impact to Mobile River and associated wetland.

Table 4.2

Summary of Status of Standards Requirements

Requirement	Section of Standards	Status	Comment
Hazard Potential Classification	257.73	Completed	Hazard potential determined to be significant. I agree with this determination.
Emergency Action Plan	257.73	Completed	Quite generic in nature. No specific actions are noted or contemplated to assist responders.
History of Construction	257.73	Completed	No design or construction records are available for the early stages of construction.
Structural Stability Assessment	257.73	Completed	Erosion, differential settlement and potential for piping failure not considered.
Factor of Safety Assessment	257.73	Completed	Liquefaction failure not analyzed even though portions of the dikes are founded on ash.
Fugitive Dust Control Plan	257.80	Completed	Not relevant to dam safety, ash slurries are typically not prone to fugitive dust.
Flood Analysis	257.82	Completed	Very little margin predicted by the analysis. Partial blockage of the outlet would impede drainage.
Inspection Reports	257.83	Completed	Very brief. Reports don't describe maintenance, which we know was done on occasion.
Groundwater Monitoring & Corrective Action	257.90	Completed	2017 Groundwater Monitoring Report is in place. Plant Barry was fined by ADEM for groundwater contamination in 2018.
Closure Plan	257.102	Completed	It is presumed that closure in place will be allowed. No technical support provided.
Publicly Available Internet	257.107	Completed	The internet site is established. Many assessments are incomplete or overly simplistic.

5 EVALUATION

5.1 General

One of the very striking aspects of this review is the degree to which Alabama Power and the Southern Company have relied on their own people and assessments to review and validate the integrity of the Barry Ash Pond. While this is consistent with the Standard, it is more typical for an organization to contract out an independent third party to assess critical dam structures with such significant hazard risk, and to ensure that individuals possessing the requisite qualifications complete these assessments. The individuals within the Southern Company that completed the assessments may have the requisite qualifications; this is not clear from the reports that were made available by the Barry Plant.

The simplicity of the assessments is also striking, which may reflect the scope of information that the Southern Company decided to include in the reports or the rigor of the assessments. It is more typical to report more rigorous and comprehensive analyses when assessing the integrity of such an important structure.

It is also unusual for such a large impoundment, in such an environmentally important area, not to be supported by instrumentation. It is common for impoundments of this size to include instrumentation such as slope indicators, settlements gauges, monitoring wells and pressure transducers to confirm the performance predictions and design assumptions included in the stability and factor of safety assessments.

5.2 Barry Pond Location

The location of the Barry Ash Pond is a critical issue that needs to be evaluated. The Barry Ash Pond location does not comply with at three of five location restrictions specified in the Standards, as follows.

- It is located directly over permeable sands that are hydraulically connected to Mobile River and over regionally important aquifers: the alluvial coastal aquifer, which is of Holocene age; and, the Miocene and Pleistocene aquifer, which is reported to be up to 100 feet thick and extends throughout the area of the Mobile River estuary. These aquifers have been impacted by the pond.
- It was constructed within a regionally important wetland and adjacent to a regionally important river. The area is an important wildlife, wetland and aquatic habitat, and is susceptible to flooding. The downstream Mobile Bay is known to be one of the most biologically diverse aquatic ecosystems in the United States.

- The area and foundation are potentially unstable. The Barry Ash Pond is located adjacent to a meandering river and within its floodplain. The perimeter dikes are susceptible to both river and wave erosion during flooding events, and the foundation soils are susceptible to differential settlement.

Based on the above, it is not appropriate to continue to fill the Barry Ash Pond or to close it in-place without implementing measures that ensure the long-term integrity of the structure. Given the size of Mobile River and its tendency to meander it will be very difficult to guarantee the integrity of the closed ash pond in perpetuity. Further, monitoring and maintenance of the closure will be required long into the future and essentially in perpetuity should the pond be closed in place. These measures are critical given the ecological importance of the Mobile River estuary.

5.3 Facility Risk

The risk associated with the Barry Ash Pond is 'significant' in accordance with the criteria of the Standards. Failure of the Pond would result in very significant environmental impact to the adjacent Mobile River as well as downstream aquatic environs. There is not a significant risk of damage to critical municipal infrastructure, nor is there any significant risk of loss of human life were a dike to fail.

5.4 Stability

The stability assessment completed by Southern Company does not comply with the requirements of the Standards because it did not consider erosion, differential settlement or potential piping failure of the dikes. The following aspects are considered to be significant stability concerns for the Barry Ash Pond.

Differential Settlement
At least a portion of the dikes are founded on organic clay deposits associated with the wetlands that were filled over to construct the Barry Ash Pond. These materials are susceptible to settlement and differential settlement, particularly if they vary in thickness and are inter-bedded with sand deposits that are not susceptible to settlement. Settlement is an important consideration because it can cause cracking and piping failure of the dikes. The anticipated settlement and potential for differential settlement can only be determined by extensive investigations, laboratory testing and geotechnical analyses, which do not appear to have been completed for the Barry Ash Pond. The investigation data pertaining to the pond is not included in the information that has been made available by the Plant.

Piping Failure

Piping failure refers to the gradual erosion of an impoundment dike caused by seepage through that dike and does not appear to have been considered by the Southern Company in its assessments or in its inspection reports. This is a particularly important consideration given that there is little or no design and construction information pertaining to the initial stages of construction of the Barry Ash Pond. It is an important failure mechanism that needs to be considered when evaluating earth-filled dams and was specifically identified as a risk by the O'Brien & Gere (2010) assessment completed for the U.S. EPA.

Potential for piping was observed during the site visit completed on February 9, 2018, from a backwater that is located immediately upstream of the outlet structure. A bulge in the toe of the slope is evident at this location, as are slope repairs and accumulation of sand at the toe of the slope. These observations corroborate observations made and pictures taken by Baykeeper staff on February 4, 2016 (see Photos 1 and 2). Evidence of piping can be seen in the slope above and below areas of the slope where sod was placed as part of a slope repair. A short video taken that same day clearly shows seepage flowing out of the toe of the dike, resulting in erosion of the toe.

Liquefaction Failure

Some failure risks and modes were not considered or not reported in the assessments completed by Southern Company. For example, liquefaction failure was discounted as a potential failure mechanism in the Initial Factor of Safety Assessment (Pegues[b]). Liquefaction refers to the loss of strength and failure of an embankment that is caused by rising pore pressures induced by dike strain. This is a questionable assumption given that a large portion of the dike construction appears to lack design and construction information, and that at least portions of the dikes are founded on bottom ash, which may be in a loose state that is susceptible to liquefaction.

External Erosion

The stability assessment does not consider the potential for erosion to undermine the integrity of the dikes, even though this stability concern is specifically referenced in the Standards. This is a particularly important consideration given that the Barry Ash Pond is located immediately adjacent to the Mobile River.

Erosion can occur two ways, as erosion of the river embankment and dike foundation soils, and as wave erosion during periods of flooding. Both can result in failure of the dikes. River erosion, as shown in Figure 3, is an ongoing process that results in meandering of a river through its floodplain. Bank erosion is clearly evident along the west bank of Mobile River. Over time, this process and meandering of the river will infringe on the Barry Ash Pond unless significant measures are implemented to prevent this process from occurring.

Wave induced erosion can occur during flood events when the dikes surrounding the Barry Ash Pond are inundated by the flood-waters of the Mobile River. Figure 4 shows the Barry Ash Pond and river flood water near the pond outlet on February 3, 2016 and confirms that flood waters inundate the dikes during these periods (a typical but not an extreme flood event). Wave erosion can occur during these events and can erode the dikes of the Pond.

5.5 Flood Related Risks

The flood risk assessment that evaluated the 1 in 1,000 years, 24-hour rainfall event concluded that the resulting water level within the Barry Ash Pond would rise to less than half an inch of the top of the dike. This is a razor-thin margin of error, which can be easily affected by debris getting stuck in the outfall, damage to the outfall or internal wave erosion that is likely to accompany an extreme rainfall event.

The water level within the pond rose to within a few feet of the top of the dikes on February 3, 2016. This event occurred in response to approximately 4 inches of rainfall that occurred over the week prior to the photo being taken according to rainfall records published for Mobile airport that is located south of the Barry Plant. This is significantly less than the 1 in 1,000 years, 24 hour rainfall event (21.7 inches). Photo 4 in Appendix A shows how significant the potential for flooding is, even for events that are less significant than the 1 in 1,000 years design event.

5.6 Water Quality

Groundwater monitoring and the associated fine levied by ADEM (2018) indicate that the Barry Ash Pond has resulted in pollution of the underlying Miocene aquifer by arsenic. This monitoring program and associated report did not address or even mention the potential for direct seepage of these contaminants into Mobile River.

The Barry Ash Pond is constructed over an ‘aquifer’ as defined by Section 257.60 (ADEM, 2010). The Barry Ash Pond is also not lined. Given its location within an important and sensitive environment and the presence of sand zones at or near the surface, the rate of process water seepage into the ground and into the Mobile River is expected to be significant. Groundwater seepage through the ash pond and into Mobile River will continue even if the ash pond is capped and closed in place because precipitation will continue to seep through the cap and groundwater will continue to seep through the waste.

5.7 Pond Closure

The Closure Plan for the Barry Ash Pond contemplates capping the CCR in-place and in accordance with the minimum cap requirements included in the Standards. The wisdom of closing the Barry Ash Pond in its current location should be re-evaluated because the location does not comply with 3 of the 5 location restrictions included in the Standards. The Mobile River will eventually meander through the Barry Ash Pond unless significant erosion protection measures are implemented to prevent this from occurring. Such measures would alter the natural environment of the riparian and wetland habitat along this portion of the river. They would also require monitoring and maintenance essentially in perpetuity to ensure that erosion and river meandering does not erode the contents of the ash pond into the Mobile River. It will be very difficult to ensure that these measures are implemented and effective over such a long time frame.

6 REFERENCES

Alabama Department of Environmental Management, 1994. Hydrogeological Evaluation of the Barry Steam Plant Inert Waste Landfill. Internal memorandum issued May 17, 1994.

Alabama Department of Environmental Management, 2018. Enforcement in the amount of $250,000 issued by ADEM to Alabama Power Company regarding groundwater pollution emanating from the Plant Barry ash pond.

Richard Mickwee, 2015. Report of Annual Inspection of CCR Surface Impoundment. Report prepared for Alabama Power in accordance with Section 257.83 of the Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments. June 25, 2015.

National Park Service, 2016. A State of Knowledge of the Natural, Cultural, and Economic Resources of the Greater Mobile-Tensaw River Area. Report prepared for the U.S. Department of the Interior, Natural Resource Report NPS/NRSS/BRD/NRR—2016/1243.

O'Brien and Gere, 2010. Dam Safety Assessment of CCW Impoundments James M. Barry Electric Generating Plant. Report prepared for the U.S. EPA, 2010. December 8, 2010.

[a] James Pegues. History of Construction for Existing CCR Surface Impoundment Barry Ash Pond. Report prepared for Alabama Power in accordance with Section 257.73 of the Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments. Date not shown.

[b] James Pegues, 2016. Initial Safety Factor Assessment Barry Ash Pond. Report prepared for Alabama Power in accordance with Section 257.73 of the Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments. October 14, 2016.

[c] James Pegues, 2016. Initial Structural Stability Assessment Barry Ash Pond. Report prepared for Alabama Power in accordance with Section 257.73 of the Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments. October 17, 2016.

[d] James Pegues, 2016. Initial Hazard Potential Assessment Barry Ash Pond. Report prepared for Alabama Power in accordance with Section 257.73 of the Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments. October 13, 2016.

[e] James Pegues, 2016. Inflow Design Flood Control System Plan Barry Ash Pond. Report prepared for Alabama Power in accordance with Section 257.82 of the Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments. October 1, 2016.

[f] James Pegues, 2016. Liner Design Criteria 40 CFR Part 257.71 Barry Ash Pond. Report prepared for Alabama Power in accordance with Section 257.71 of the Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments. October 17, 2016.

[g] James Pegues, 2016. Closure Plan for Existing CCR Surface Impoundment Barry Ash Pond. (James Pegues, P.E.)

James Pegues, 2016. Initial Structural Stability Assessment Barry Gypsum Pond. Report prepared for Alabama Power in accordance with Section 257.73 of the Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments. October 17, 2016.

James Pegues, 2016. Initial Safety Factor Assessment Barry Gypsum Pond. Report prepared for Alabama Power in accordance with Section 257.73 of the Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments. October 17, 2016.

James Pegues, 2016. Initial Hazard Potential Assessment Barry Gypsum Pond. Report prepared for Alabama Power in accordance with Section 257.73 of the Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments. October 17, 2016.

Betty-Ann Pruner, 1991. Screening Site Inspection, Phase 2 Alabama Power Company Barry Steam Plant. Issued to U.S. EPA. April 3, 1991.

Southern Company Services, 2018. 2017 Annual Groundwater Monitoring and Corrective Action Report Alabama Power Company Plant Barry Ash Pond. Report prepared by the Earth Science and Environmental Engineering division of the Southern Company Services. January 31, 2018.

USGS, 2018. Evolution and History of Incised Valleys: The Mobile Bay Model. https://pubs.usgs.gov/fs/incised-valleys/ . Accessed January 2018.

University of Alabama, 2013. Southern Wonder Alabama's Surprising Biodiversity. Book published by the University of Alabama and the Nature Conservancy, which was funded in part by the World Wildlife Federation. 2013.

7 CLOSURE

This report has been prepared for Mobile Baykeeper. The text contained herein presents documentation of the review and site inspections of the Barry Ash Pond associated with the Barry Power Generating Facility that is located near Mobile, Alabama. This represents the opinion of Burgess Environmental Ltd. that is based on this work as well as information provided by the Mobile Baykeeper and publicly available information that has not been independently verified.

All information contained herein has been reviewed and interpreted by, or under the direct supervision of Gordon J. Johnson, P.Eng.

____

Gordon J. Johnson, M.Sc., P. Eng.
President
Burgess Environmental Ltd.

APPENDIX A
SITE PHOTOGRAPHS

Photo 1: Evidence of Piping North of Pond Outlet (Feb. 4, 2016)

Photo 2: Evidence of Piping North of Pond Outlet (Feb. 4, 2016)

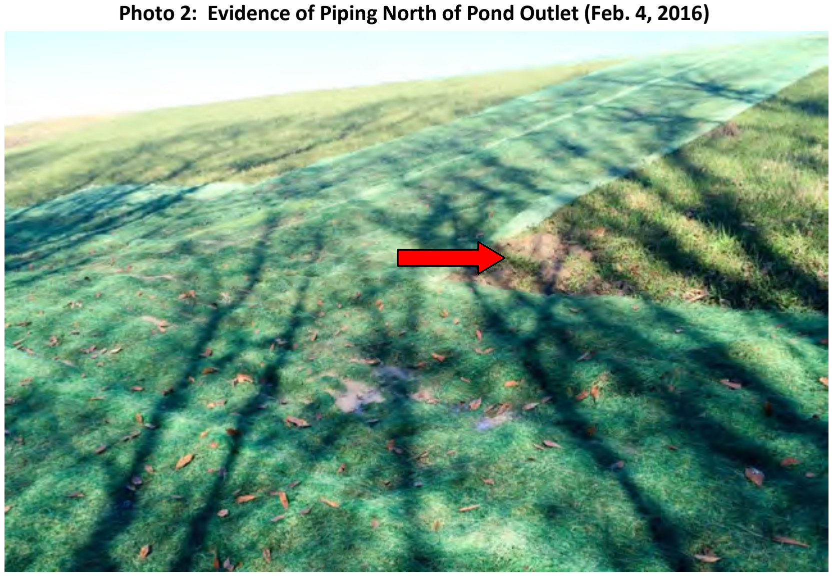


Photo 3: Evidence of River Bank Erosion (Feb. 9, 2017)

Photo 4: Flooding Adjacent to Barry Ash Pond (Jan. 3, 2016)

18. APPENDIX K – SEPT. 2, 2015 SAMPLE RESULTS

Plant Barry
9/2/2015

Parameter	Units	1-A	1-B	1-C	1-D	1-E	1-F
Aluminum	ug/L	700	2000	200	110	950	330
Arsenic	ug/L	78	15	7.9	41	4.3	20
Boron	ug/L	600	510	290	230	ND	890
Cadmium	ug/L	ND	0.12	ND	ND	ND	ND
Calcium	ug/L	40600	33200	26800	136000	24000	107000
Chromium	ug/L	1.7	3.8	ND	ND	1.9	ND
Cobalt	ug/L	1.5	1.4	ND	2	1.2	ND
Iron	ug/L	5100	5100	1400	46800	3000	2700
Lead	ug/L	ND	1.9	ND	ND	1.1	ND
Magnesium	ug/L	6400	5900	4600	18300	6600	21700
Manganese	ug/L	2100	250	380	5400	ND	760
Mercury	ug/L	ND	ND	ND	ND	ND	ND
Molybdenum	ug/L	42	59	35	3.9	1.5	1.2
Potassium	ug/L	3000	2500	1300	3600	2600	7200
Selenium	ug/L	8	11	10	ND	ND	ND
Sodium	ug/L	38600	37800	30100	12800	24000	29100
Thallium	ug/L	ND	ND	ND	ND	ND	ND
Vanadium	ug/L	9.2	11	5.2	ND	3.1	1.5
Conductivity	µS/cm	490	457	338	1242	312.0	NA
pH	s.u.	6.86	6.39	8.74	6.4	6.73	NA
TDS	ppm	241	228	170	615	156.0	NA
Temp.	ºF	82.7	81.9	99.7	84.5	91.9	NA


D
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2254 ft
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Google earth
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2

Pace Analytical Services, Inc.
2225 Riverside Dr.
Asheville, NC 28804
(828)254-7176

September 16, 2015

Mr. Pete Harrison
Waterkeeper Alliance
17 Battery Place Ste 1329
Suite 1329
New York, NY 10004

RE: Project: BAR 09/02/15
Pace Project No.: 92266415

Dear Mr. Harrison:

Enclosed are the analytical results for sample(s) received by the laboratory on September 04, 2015. The results relate only to the samples included in this report. Results reported herein conform to the most current TNI standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

Analyses were performed at the Pace Analytical Services location indicated on the sample analyte page for analysis unless otherwise footnoted.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Chris Derouen
christopher.derouen@pacelabs.com
Project Manager

Enclosures

cc: Larissa Liebmann, Waterkeeper Alliance

Pace Analytical Services, Inc.
2225 Riverside Dr.
Asheville, NC 28804
(828)254-7176

CERTIFICATIONS

Project:	BAR 09/02/15
Pace Project No.:	92266415

Ormond Beach Certification IDs

8 East Tower Circle, Ormond Beach, FL 32174
Alabama Certification #: 41320
Connecticut Certification #: PH-0216
Delaware Certification: FL NELAC Reciprocity
Florida Certification #: E83079
Georgia Certification #: 955
Guam Certification: FL NELAC Reciprocity
Hawaii Certification: FL NELAC Reciprocity
Illinois Certification #: 200068
Indiana Certification: FL NELAC Reciprocity
Kansas Certification #: E-10383
Kentucky Certification #: 90050
Louisiana Certification #: FL NELAC Reciprocity
Louisiana Environmental Certificate #: 05007
Maryland Certification: #346
Michigan Certification #: 9911
Mississippi Certification: FL NELAC Reciprocity
Missouri Certification #: 236
Montana Certification #: Cert 0074
Nebraska Certification: NE-OS-28-14
Nevada Certification: FL NELAC Reciprocity
New Hampshire Certification #: 2958
New York Certification #: 11608
North Carolina Environmental Certificate #: 667
North Carolina Certification #: 12710
North Dakota Certification #: R-216
Pennsylvania Certification #: 68-00547
Puerto Rico Certification #: FL01264
South Carolina Certification: #96042001
Tennessee Certification #: TN02974
Texas Certification: FL NELAC Reciprocity
US Virgin Islands Certification: FL NELAC Reciprocity
Virginia Environmental Certification #: 460165
West Virginia Certification #: 9962C
Wisconsin Certification #: 399079670
Wyoming (EPA Region 8): FL NELAC Reciprocity

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SAMPLE ANALYTE COUNT

Project: BAR 09/02/15
Pace Project No.: 92266415

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
92266415001	**BAR 1-A**	EPA 200.7	TAP	6	PASI-O
		EPA 200.8	CKJ	11	PASI-O
		EPA 245.1	MEW	1	PASI-O
92266415002	**BAR 1-B**	EPA 200.7	TAP	6	PASI-O
		EPA 200.8	CKJ	11	PASI-O
		EPA 245.1	MEW	1	PASI-O
92266415003	**BAR 1-C**	EPA 200.7	TAP	6	PASI-O
		EPA 200.8	CKJ	11	PASI-O
		EPA 245.1	MEW	1	PASI-O
92266415004	**BAR 1-D**	EPA 200.7	TAP	6	PASI-O
		EPA 200.8	CKJ	11	PASI-O
		EPA 245.1	MEW	1	PASI-O
92266415005	**BAR 1-E**	EPA 200.7	TAP	6	PASI-O
		EPA 200.8	CKJ	11	PASI-O
		EPA 245.1	MEW	1	PASI-O
92266415006	**BAR 1-F**	EPA 200.7	TAP	6	PASI-O
		EPA 200.8	CKJ	11	PASI-O
		EPA 245.1	MEW	1	PASI-O

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ANALYTICAL RESULTS

Project: BAR 09/02/15
Pace Project No.: 92266415

Sample: BAR 1-A | **Lab ID: 92266415001** | Collected: 09/02/15 11:22 | Received: 09/04/15 10:30 | Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
200.7 MET ICP	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7							
Boron	**0.60**	mg/L	0.050	1	09/10/15 17:23	09/14/15 19:53	7440-42-8	
Calcium	**40.6**	mg/L	0.50	1	09/10/15 17:23	09/14/15 19:53	7440-70-2	
Iron	**5.1**	mg/L	0.040	1	09/10/15 17:23	09/14/15 19:53	7439-89-6	
Magnesium	**6.4**	mg/L	0.50	1	09/10/15 17:23	09/14/15 19:53	7439-95-4	
Potassium	**3.0**	mg/L	1.0	1	09/10/15 17:23	09/14/15 19:53	7440-09-7	
Sodium	**38.6**	mg/L	1.0	1	09/10/15 17:23	09/14/15 19:53	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8							
Aluminum	**0.70**	mg/L	0.010	1	09/10/15 17:23	09/15/15 12:27	7429-90-5	M1
Arsenic	**0.078**	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:27	7440-38-2	
Cadmium	ND	mg/L	0.00010	1	09/10/15 17:23	09/15/15 12:27	7440-43-9	
Chromium	**0.0017**	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:27	7440-47-3	
Cobalt	**0.0015**	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:27	7440-48-4	
Lead	ND	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:27	7439-92-1	
Manganese	**2.1**	mg/L	0.010	10	09/10/15 17:23	09/15/15 16:36	7439-96-5	D4,M1
Molybdenum	**0.042**	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:27	7439-98-7	
Selenium	**0.0080**	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:27	7782-49-2	
Thallium	ND	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:27	7440-28-0	
Vanadium	**0.0092**	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:27	7440-62-2	
245.1 Mercury	Analytical Method: EPA 245.1 Preparation Method: EPA 245.1							
Mercury	ND	mg/L	0.00020	1	09/15/15 04:29	09/15/15 12:33	7439-97-6	

Sample: BAR 1-B | **Lab ID: 92266415002** | Collected: 09/02/15 12:05 | Received: 09/04/15 10:30 | Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
200.7 MET ICP	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7							
Boron	**0.51**	mg/L	0.050	1	09/10/15 17:23	09/14/15 19:58	7440-42-8	
Calcium	**33.2**	mg/L	0.50	1	09/10/15 17:23	09/14/15 19:58	7440-70-2	
Iron	**5.1**	mg/L	0.040	1	09/10/15 17:23	09/14/15 19:58	7439-89-6	
Magnesium	**5.9**	mg/L	0.50	1	09/10/15 17:23	09/14/15 19:58	7439-95-4	
Potassium	**2.5**	mg/L	1.0	1	09/10/15 17:23	09/14/15 19:58	7440-09-7	
Sodium	**37.8**	mg/L	1.0	1	09/10/15 17:23	09/14/15 19:58	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8							
Aluminum	**2.0**	mg/L	0.010	1	09/10/15 17:23	09/15/15 12:35	7429-90-5	
Arsenic	**0.015**	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:35	7440-38-2	
Cadmium	**0.00012**	mg/L	0.00010	1	09/10/15 17:23	09/15/15 12:35	7440-43-9	
Chromium	**0.0038**	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:35	7440-47-3	
Cobalt	**0.0014**	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:35	7440-48-4	
Lead	**0.0019**	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:35	7439-92-1	
Manganese	**0.25**	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:35	7439-96-5	
Molybdenum	**0.059**	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:35	7439-98-7	
Selenium	**0.011**	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:35	7782-49-2	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: BAR 09/02/15
Pace Project No.: 92266415

Sample: BAR 1-B **Lab ID: 92266415002** Collected: 09/02/15 12:05 Received: 09/04/15 10:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8							
Thallium	ND	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:35	7440-28-0	
Vanadium	**0.011**	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:35	7440-62-2	
245.1 Mercury	Analytical Method: EPA 245.1 Preparation Method: EPA 245.1							
Mercury	ND	mg/L	0.00020	1	09/15/15 04:29	09/15/15 12:36	7439-97-6	

Sample: BAR 1-C **Lab ID: 92266415003** Collected: 09/02/15 12:40 Received: 09/04/15 10:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
200.7 MET ICP	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7							
Boron	**0.29**	mg/L	0.050	1	09/10/15 17:23	09/14/15 20:02	7440-42-8	
Calcium	**26.8**	mg/L	0.50	1	09/10/15 17:23	09/14/15 20:02	7440-70-2	
Iron	**1.4**	mg/L	0.040	1	09/10/15 17:23	09/14/15 20:02	7439-89-6	
Magnesium	**4.6**	mg/L	0.50	1	09/10/15 17:23	09/14/15 20:02	7439-95-4	
Potassium	**1.3**	mg/L	1.0	1	09/10/15 17:23	09/14/15 20:02	7440-09-7	
Sodium	**30.1**	mg/L	1.0	1	09/10/15 17:23	09/14/15 20:02	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8							
Aluminum	**0.20**	mg/L	0.010	1	09/10/15 17:23	09/15/15 12:37	7429-90-5	
Arsenic	**0.0079**	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:37	7440-38-2	
Cadmium	ND	mg/L	0.00010	1	09/10/15 17:23	09/15/15 12:37	7440-43-9	
Chromium	ND	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:37	7440-47-3	
Cobalt	ND	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:37	7440-48-4	
Lead	ND	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:37	7439-92-1	
Manganese	**0.38**	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:37	7439-96-5	
Molybdenum	**0.035**	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:37	7439-98-7	
Selenium	**0.010**	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:37	7782-49-2	
Thallium	ND	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:37	7440-28-0	
Vanadium	**0.0052**	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:37	7440-62-2	
245.1 Mercury	Analytical Method: EPA 245.1 Preparation Method: EPA 245.1							
Mercury	ND	mg/L	0.00020	1	09/15/15 04:29	09/15/15 12:38	7439-97-6	

Sample: BAR 1-D **Lab ID: 92266415004** Collected: 09/02/15 13:48 Received: 09/04/15 10:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
200.7 MET ICP	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7							
Boron	**0.23**	mg/L	0.050	1	09/10/15 17:23	09/14/15 20:06	7440-42-8	
Calcium	**136**	mg/L	0.50	1	09/10/15 17:23	09/14/15 20:06	7440-70-2	
Iron	**46.8**	mg/L	0.040	1	09/10/15 17:23	09/14/15 20:06	7439-89-6	
Magnesium	**18.3**	mg/L	0.50	1	09/10/15 17:23	09/14/15 20:06	7439-95-4	
Potassium	**3.6**	mg/L	1.0	1	09/10/15 17:23	09/14/15 20:06	7440-09-7	

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ANALYTICAL RESULTS

Project: BAR 09/02/15
Pace Project No.: 92266415

Sample: BAR 1-D | **Lab ID: 92266415004** | Collected: 09/02/15 13:48 | Received: 09/04/15 10:30 | Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
200.7 MET ICP	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7							
Sodium	**12.8**	mg/L	1.0	1	09/10/15 17:23	09/14/15 20:06	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8							
Aluminum	**0.11**	mg/L	0.010	1	09/10/15 17:23	09/15/15 12:45	7429-90-5	
Arsenic	**0.041**	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:45	7440-38-2	
Cadmium	ND	mg/L	0.00010	1	09/10/15 17:23	09/15/15 12:45	7440-43-9	
Chromium	ND	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:45	7440-47-3	
Cobalt	**0.0020**	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:45	7440-48-4	
Lead	ND	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:45	7439-92-1	
Manganese	**5.4**	mg/L	0.020	20	09/10/15 17:23	09/15/15 16:38	7439-96-5	D4
Molybdenum	**0.0039**	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:45	7439-98-7	
Selenium	ND	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:45	7782-49-2	
Thallium	ND	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:45	7440-28-0	
Vanadium	ND	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:45	7440-62-2	
245.1 Mercury	Analytical Method: EPA 245.1 Preparation Method: EPA 245.1							
Mercury	ND	mg/L	0.00020	1	09/15/15 04:29	09/15/15 12:40	7439-97-6	

Sample: BAR 1-E | **Lab ID: 92266415005** | Collected: 09/02/15 15:26 | Received: 09/04/15 10:30 | Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
200.7 MET ICP	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7							
Boron	ND	mg/L	0.050	1	09/10/15 17:23	09/14/15 20:11	7440-42-8	
Calcium	**24.0**	mg/L	0.50	1	09/10/15 17:23	09/14/15 20:11	7440-70-2	
Iron	**3.0**	mg/L	0.040	1	09/10/15 17:23	09/14/15 20:11	7439-89-6	
Magnesium	**6.6**	mg/L	0.50	1	09/10/15 17:23	09/14/15 20:11	7439-95-4	
Potassium	**2.6**	mg/L	1.0	1	09/10/15 17:23	09/14/15 20:11	7440-09-7	
Sodium	**24.0**	mg/L	1.0	1	09/10/15 17:23	09/14/15 20:11	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8							
Aluminum	**0.95**	mg/L	0.010	1	09/10/15 17:23	09/15/15 12:48	7429-90-5	
Arsenic	**0.0043**	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:48	7440-38-2	
Cadmium	ND	mg/L	0.00010	1	09/10/15 17:23	09/15/15 12:48	7440-43-9	
Chromium	**0.0019**	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:48	7440-47-3	
Cobalt	**0.0012**	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:48	7440-48-4	
Lead	**0.0011**	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:48	7439-92-1	
Manganese	ND	mg/L	0.0050	5	09/10/15 17:23	09/15/15 16:41	7439-96-5	D4
Molybdenum	**0.0015**	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:48	7439-98-7	
Selenium	ND	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:48	7782-49-2	
Thallium	ND	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:48	7440-28-0	
Vanadium	**0.0031**	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:48	7440-62-2	
245.1 Mercury	Analytical Method: EPA 245.1 Preparation Method: EPA 245.1							
Mercury	ND	mg/L	0.00020	1	09/15/15 04:29	09/15/15 12:46	7439-97-6	

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ANALYTICAL RESULTS

Project: BAR 09/02/15
Pace Project No.: 92266415

Sample: BAR 1-F **Lab ID: 92266415006** Collected: 09/02/15 16:24 Received: 09/04/15 10:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
200.7 MET ICP	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7							
Boron	**0.89**	mg/L	0.050	1	09/10/15 17:23	09/14/15 20:15	7440-42-8	
Calcium	**107**	mg/L	0.50	1	09/10/15 17:23	09/14/15 20:15	7440-70-2	
Iron	**2.7**	mg/L	0.040	1	09/10/15 17:23	09/14/15 20:15	7439-89-6	
Magnesium	**21.7**	mg/L	0.50	1	09/10/15 17:23	09/14/15 20:15	7439-95-4	
Potassium	**7.2**	mg/L	1.0	1	09/10/15 17:23	09/14/15 20:15	7440-09-7	
Sodium	**29.1**	mg/L	1.0	1	09/10/15 17:23	09/14/15 20:15	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8							
Aluminum	**0.33**	mg/L	0.010	1	09/10/15 17:23	09/15/15 12:50	7429-90-5	
Arsenic	**0.020**	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:50	7440-38-2	
Cadmium	ND	mg/L	0.00010	1	09/10/15 17:23	09/15/15 12:50	7440-43-9	
Chromium	ND	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:50	7440-47-3	
Cobalt	ND	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:50	7440-48-4	
Lead	ND	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:50	7439-92-1	
Manganese	**0.76**	mg/L	0.0050	5	09/10/15 17:23	09/15/15 16:44	7439-96-5	D4
Molybdenum	**0.0012**	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:50	7439-98-7	
Selenium	ND	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:50	7782-49-2	
Thallium	ND	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:50	7440-28-0	
Vanadium	**0.0015**	mg/L	0.0010	1	09/10/15 17:23	09/15/15 12:50	7440-62-2	
245.1 Mercury	Analytical Method: EPA 245.1 Preparation Method: EPA 245.1							
Mercury	ND	mg/L	0.00020	1	09/15/15 04:29	09/15/15 12:49	7439-97-6	

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QUALITY CONTROL DATA

Project: BAR 09/02/15
Pace Project No.: 92266415

QC Batch: MERP/6153 Analysis Method: EPA 245.1
QC Batch Method: EPA 245.1 Analysis Description: 245.1 Mercury
Associated Lab Samples: 92266415001, 92266415002, 92266415003, 92266415004, 92266415005, 92266415006

METHOD BLANK: 1330651 Matrix: Water
Associated Lab Samples: 92266415001, 92266415002, 92266415003, 92266415004, 92266415005, 92266415006

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Mercury	mg/L	ND	0.00020	09/15/15 12:21	

LABORATORY CONTROL SAMPLE: 1330652

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	mg/L	.002	0.0021	106	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1330653 1330654

Parameter	Units	92266460001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Mercury	mg/L	ND	.002	.002	0.0020	0.0021	102	104	70-130	1	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

Pace Analytical Services, Inc.
2225 Riverside Dr.
Asheville, NC 28804
(828)254-7176

QUALITY CONTROL DATA

Project: BAR 09/02/15
Pace Project No.: 92266415

QC Batch: MPRP/26247 | Analysis Method: EPA 200.7
QC Batch Method: EPA 200.7 | Analysis Description: 200.7 MET
Associated Lab Samples: 92266415001, 92266415002, 92266415003, 92266415004, 92266415005, 92266415006

METHOD BLANK: 1327250 | Matrix: Water
Associated Lab Samples: 92266415001, 92266415002, 92266415003, 92266415004, 92266415005, 92266415006

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Boron	mg/L	ND	0.050	09/14/15 19:19	
Calcium	mg/L	ND	0.50	09/14/15 19:19	
Iron	mg/L	ND	0.040	09/14/15 19:19	
Magnesium	mg/L	ND	0.50	09/14/15 19:19	
Potassium	mg/L	ND	1.0	09/14/15 19:19	
Sodium	mg/L	ND	1.0	09/14/15 19:19	

LABORATORY CONTROL SAMPLE: 1327252

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Boron	mg/L	2.5	2.3	94	85-115	
Calcium	mg/L	12.5	12.0	96	85-115	
Iron	mg/L	2.5	2.4	95	85-115	
Magnesium	mg/L	12.5	11.8	94	85-115	
Potassium	mg/L	12.5	11.9	95	85-115	
Sodium	mg/L	12.5	11.9	95	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1327253 1327254

Parameter	Units	35206087001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Boron	mg/L	0.088	2.5	2.5	2.6	2.5	99	95	70-130	5	
Calcium	mg/L	24.4	12.5	12.5	37.2	36.5	102	96	70-130	2	
Iron	mg/L	<0.020	2.5	2.5	2.4	2.4	97	95	70-130	2	
Magnesium	mg/L	6.0	12.5	12.5	18.4	18.0	99	96	70-130	2	
Potassium	mg/L	4.7	12.5	12.5	17.1	17.0	99	98	70-130	1	
Sodium	mg/L	40.6	12.5	12.5	53.9	52.7	107	97	70-130	2	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1327255 1327256

Parameter	Units	35206442001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Boron	mg/L	42.2J ug/L	2.5	2.5	2.5	2.6	99	102	70-130	3	
Calcium	mg/L	60200 ug/L	12.5	12.5	72.3	74.2	96	112	70-130	3	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

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QUALITY CONTROL DATA

Project: BAR 09/02/15
Pace Project No.: 92266415

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1327255 1327256

Parameter	Units	35206442001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Iron	mg/L	60.3 ug/L	2.5	2.5	2.5	2.5	97	98	70-130	1	
Magnesium	mg/L	15600 ug/L	12.5	12.5	27.5	28.1	95	100	70-130	2	
Potassium	mg/L	3870 ug/L	12.5	12.5	16.3	16.6	100	101	70-130	1	
Sodium	mg/L	111000 ug/L	12.5	12.5	124	128	105	134	70-130	3	M1

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QUALITY CONTROL DATA

Project: BAR 09/02/15
Pace Project No.: 92266415

QC Batch: MPRP/26248 Analysis Method: EPA 200.8
QC Batch Method: EPA 200.8 Analysis Description: 200.8 MET
Associated Lab Samples: 92266415001, 92266415002, 92266415003, 92266415004, 92266415005, 92266415006

METHOD BLANK: 1327259 Matrix: Water
Associated Lab Samples: 92266415001, 92266415002, 92266415003, 92266415004, 92266415005, 92266415006

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Aluminum	mg/L	ND	0.010	09/15/15 16:33	
Arsenic	mg/L	ND	0.0010	09/15/15 16:33	
Cadmium	mg/L	ND	0.00010	09/15/15 16:33	
Chromium	mg/L	ND	0.0010	09/15/15 16:33	
Cobalt	mg/L	ND	0.0010	09/15/15 16:33	
Lead	mg/L	ND	0.0010	09/15/15 16:33	
Manganese	mg/L	ND	0.0010	09/15/15 16:33	
Molybdenum	mg/L	ND	0.0010	09/15/15 16:33	
Selenium	mg/L	ND	0.0010	09/15/15 16:33	
Thallium	mg/L	ND	0.0010	09/15/15 16:33	
Vanadium	mg/L	ND	0.0010	09/15/15 16:33	

LABORATORY CONTROL SAMPLE: 1327260

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Aluminum	mg/L	.5	0.51	102	85-115	
Arsenic	mg/L	.05	0.051	103	85-115	
Cadmium	mg/L	.005	0.0049	97	85-115	
Chromium	mg/L	.05	0.050	100	85-115	
Cobalt	mg/L	.05	0.050	100	85-115	
Lead	mg/L	.05	0.048	97	85-115	
Manganese	mg/L	.05	0.050	100	85-115	
Molybdenum	mg/L	.05	0.049	97	85-115	
Selenium	mg/L	.05	0.052	103	85-115	
Thallium	mg/L	.05	0.049	98	85-115	
Vanadium	mg/L	.05	0.050	100	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1327261 1327262

Parameter	Units	92266415001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Aluminum	mg/L	0.70	.5	.5	1.4	1.5	136	168	70-130	11	M1
Arsenic	mg/L	0.078	.05	.05	0.13	0.13	103	102	70-130	0	
Cadmium	mg/L	ND	.005	.005	0.0048	0.0049	94	96	70-130	2	
Chromium	mg/L	0.0017	.05	.05	0.050	0.050	97	97	70-130	0	
Cobalt	mg/L	0.0015	.05	.05	0.050	0.049	96	95	70-130	1	
Lead	mg/L	ND	.05	.05	0.051	0.051	101	100	70-130	0	
Manganese	mg/L	2.1	.05	.05	2.2	2.2	216	170	70-130	1	E,M1

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

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QUALITY CONTROL DATA

Project: BAR 09/02/15
Pace Project No.: 92266415

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1327261 1327262

Parameter	Units	92266415001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Molybdenum	mg/L	0.042	.05	.05	0.092	0.093	99	102	70-130	2	
Selenium	mg/L	0.0080	.05	.05	0.056	0.056	97	97	70-130	0	
Thallium	mg/L	ND	.05	.05	0.051	0.051	102	102	70-130	0	
Vanadium	mg/L	0.0092	.05	.05	0.059	0.059	100	100	70-130	0	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1327263 1327264

Parameter	Units	35206492001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Aluminum	mg/L	92.8 ug/L	.5	.5	0.58	0.57	97	96	70-130	1	
Arsenic	mg/L	0.57J ug/L	.05	.05	0.048	0.049	95	96	70-130	1	
Cadmium	mg/L	0.086J ug/L	.005	.005	0.0046	0.0047	90	92	70-130	2	
Chromium	mg/L	0.50U ug/L	.05	.05	0.047	0.047	93	94	70-130	1	
Cobalt	mg/L	0.50U ug/L	.05	.05	0.046	0.046	91	91	70-130	0	
Lead	mg/L	0.50U ug/L	.05	.05	0.049	0.050	98	99	70-130	1	
Manganese	mg/L	1.8 ug/L	.05	.05	0.049	0.049	94	95	70-130	1	
Molybdenum	mg/L	0.79J ug/L	.05	.05	0.048	0.049	95	96	70-130	1	
Selenium	mg/L	0.50U ug/L	.05	.05	0.047	0.047	93	93	70-130	0	
Thallium	mg/L	0.50U ug/L	.05	.05	0.050	0.050	100	101	70-130	1	
Vanadium	mg/L	1.7 ug/L	.05	.05	0.050	0.050	96	96	70-130	0	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

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QUALIFIERS

Project: BAR 09/02/15
Pace Project No.: 92266415

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

Acid preservation may not be appropriate for 2 Chloroethylvinyl ether, Styrene, and Vinyl chloride.

A separate vial preserved to a pH of 4-5 is recommended in SW846 Chapter 4 for the analysis of Acrolein and Acrylonitrile by EPA Method 8260.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-O Pace Analytical Services - Ormond Beach

ANALYTE QUALIFIERS

D4	Sample was diluted due to the presence of high levels of target analytes.
E	Analyte concentration exceeded the calibration range. The reported result is estimated.
M1	Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: BAR 09/02/15
Pace Project No.: 92266415

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
92266415001	**BAR 1-A**	EPA 200.7	MPRP/26247	EPA 200.7	ICP/15872
92266415002	**BAR 1-B**	EPA 200.7	MPRP/26247	EPA 200.7	ICP/15872
92266415003	**BAR 1-C**	EPA 200.7	MPRP/26247	EPA 200.7	ICP/15872
92266415004	**BAR 1-D**	EPA 200.7	MPRP/26247	EPA 200.7	ICP/15872
92266415005	**BAR 1-E**	EPA 200.7	MPRP/26247	EPA 200.7	ICP/15872
92266415006	**BAR 1-F**	EPA 200.7	MPRP/26247	EPA 200.7	ICP/15872
92266415001	**BAR 1-A**	EPA 200.8	MPRP/26248	EPA 200.8	ICPM/10686
92266415002	**BAR 1-B**	EPA 200.8	MPRP/26248	EPA 200.8	ICPM/10686
92266415003	**BAR 1-C**	EPA 200.8	MPRP/26248	EPA 200.8	ICPM/10686
92266415004	**BAR 1-D**	EPA 200.8	MPRP/26248	EPA 200.8	ICPM/10686
92266415005	**BAR 1-E**	EPA 200.8	MPRP/26248	EPA 200.8	ICPM/10686
92266415006	**BAR 1-F**	EPA 200.8	MPRP/26248	EPA 200.8	ICPM/10686
92266415001	**BAR 1-A**	EPA 245.1	MERP/6153	EPA 245.1	MERC/6136
92266415002	**BAR 1-B**	EPA 245.1	MERP/6153	EPA 245.1	MERC/6136
92266415003	**BAR 1-C**	EPA 245.1	MERP/6153	EPA 245.1	MERC/6136
92266415004	**BAR 1-D**	EPA 245.1	MERP/6153	EPA 245.1	MERC/6136
92266415005	**BAR 1-E**	EPA 245.1	MERP/6153	EPA 245.1	MERC/6136
92266415006	**BAR 1-F**	EPA 245.1	MERP/6153	EPA 245.1	MERC/6136

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CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page: 1 of 1

Section A — **Required** Client Information:

Company:	Waterkeeper Alliance
Address:	17 Battery Place, Suite 1329
	New York, NY 10004
Email To:	pharrison@waterkeeper.org
Phone:	828-582-0422 — Fax: 212-747-0622
Requested Due Date/TAT:	

Section B — **Required** Project Information:

Report To:	Peter Harrison, pharrison@waterkeeper.org
Copy To:	Larissa Liebmann, lliebmann@waterkeeper.org
Purchase Order No.:	
Project Name:	BAR - 09/02/2015
Project Number:	

Section C — Invoice Information:

Attention:	Peter Harrison, pharrison@waterkeeper.org
Company Name:	Waterkeeper Alliance
Address:	1415 Ruffin St., Durham, NC 27701
Pace Quote Reference:	
Pace Project Manager:	Chris Derouen (Asheville, NC)
Pace Profile #:	

REGULATORY AGENCY

- [x] NPDES
- [ ] GROUND WATER
- [ ] DRINKING WATER
- [ ] UST
- [ ] RCRA
- [ ] OTHER ______

Site Location STATE: AL

Section D — Required Client Information

SAMPLE ID (A-Z, 0-9 / ,-) Sample IDs MUST BE UNIQUE

Valid Matrix Codes

MATRIX	CODE
DRINKING WATER	DW
WATER	WT
WASTE WATER	WW
PRODUCT	P
SOIL/SOLID	SL
OIL	OL
WIPE	WP
AIR	AR
OTHER	OT
TISSUE	TS

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED: COMPOSITE START DATE	COMPOSITE START TIME	COMPOSITE END/GRAB DATE	COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test (Y/N)	As, Cd, Cr, Pb, Mn, Mb, Se, Tl	B, Co, Fe, V	Al, Ca, Mg, K, Na	Hg	Residual Chlorine (Y/N)	9226641S Pace Project No./Lab I.D.
1	BAR 1-A	WT	G			9/2/2015	11:22		1		✓								✓	✓	✓	✓		001
2	BAR 1-B	WT	G			9/2/2015	12:05		1		✓								✓	✓	✓	✓		002
3	BAR 1-C	WT	G			9/2/2015	12:40		1		✓								✓	✓	✓	✓		003
4	BAR 1-D	WT	G			9/2/2015	13:48		1		✓								✓	✓	✓	✓		004
5	BAR 1-E	WT	G			9/2/2015	15:26		1		✓								✓	✓	✓	✓		005
6	BAR 1-F	WT	G			9/2/2015	16:24		1		✓								✓	✓	✓	✓		006
7																								
8																								
9																								
10																								
11																								
12																								

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
Use EPA 200.8 where possible.	CK/MBK	9/2/15	17:45	PA/WKA	9/2/15	17:45				
				Matt Stewart A/L	9/4/15	1030	2.2	Y	N	Y

SAMPLE CONDITIONS

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Cade Kistler

SIGNATURE of SAMPLER: [signature]

DATE Signed (MM/DD/YY): 09/03/15

*Important Note: By signing this form you are accepting Pace's Net 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days.

F-ALL-Q-020rev.08, 12-Oct-2007

Pace Analytical® www.pacelabs.com	Document Name: **Sample Condition Upon Receipt (SCUR)**	Document Revised: May 15, 2015 Page 1 of 2*
	Document No.: F-ASV-CS-003-rev.14	Issuing Authorities: Pace Asheville Quality Office

Client Name: Water Keeper Alliance

* Page 2 of 2 is for Internal Use Only

Courier (Circle): Fed Ex UPS USPS Client Commercial Pace Other________

Custody Seal on Cooler/Box Present: ☐ yes ☑ no Seals intact: ☑ yes ☐ no

Packing Material: ☐ Bubble Wrap ☑ Bubble Bags ☐ None ☐ Other________

Thermometer Used: IR Gun#3 -130265963 **Type of Ice:** Wet Blue None ☑ Samples on ice, cooling process has begun

IR Gun #4 SN:140290365 Other:________

Temp Correction Factor: Add / Subtract 0 C

Corrected Cooler Temp.: 2.2 C **Biological Tissue is Frozen:** Yes No N/A

Temp should be above freezing to 6°C

Date and Initials of person examining contents: 9/4 MS

		Comments:
Chain of Custody Present:	☑Yes ☐No ☐N/A	1.
Chain of Custody Filled Out:	☑Yes ☐No ☐N/A	2.
Chain of Custody Relinquished:	☑Yes ☐No ☐N/A	3.
Sampler Name & Signature on COC:	☑Yes ☐No ☐N/A	4.
Samples Arrived within Hold Time:	☑Yes ☐No ☐N/A	5.
Short Hold Time Analysis (<72hr):	☐Yes ☑No ☐N/A	6.
Rush Turn Around Time Requested:	☐Yes ☑No ☐N/A	7.
Sufficient Volume:	☑Yes ☐No ☐N/A	8.
Correct Containers Used:	☑Yes ☐No ☐N/A	9.
-Pace Containers Used:	☑Yes ☐No ☐N/A	
Containers Intact:	☑Yes ☐No ☐N/A	~~10.~~
Filtered volume received for Dissolved tests	☐Yes ☐No ☑N/A	11.
Sample Labels match COC:	☑Yes ☐No ☐N/A	12.
-Includes date/time/ID/Analysis Matrix: WT		
All containers needing preservation have been checked.	☑Yes ☐No ☐N/A	13.
All containers needing preservation are found to be in compliance with EPA recommendation.	☑Yes ☐No ☐N/A	
exceptions: VOA, coliform, TOC, O&G, WI-DRO (water)	☐Yes ☑No	
Samples checked for dechlorination:	☐Yes ☐No ☑N/A	14.
Headspace in VOA Vials (>6mm):	☐Yes ☐No ☑N/A	15.
Trip Blank Present:	☐Yes ☐No ☑N/A	16.
Trip Blank Custody Seals Present	☐Yes ☐No ☑N/A	
Pace Trip Blank Lot # (if purchased):________		

Client Notification/ Resolution: Field Data Required? Y / N

Person Contacted: ________________ Date/Time: ________

Comments/ Resolution: ________________

SCURF Review: L **Date:** 9/4/15

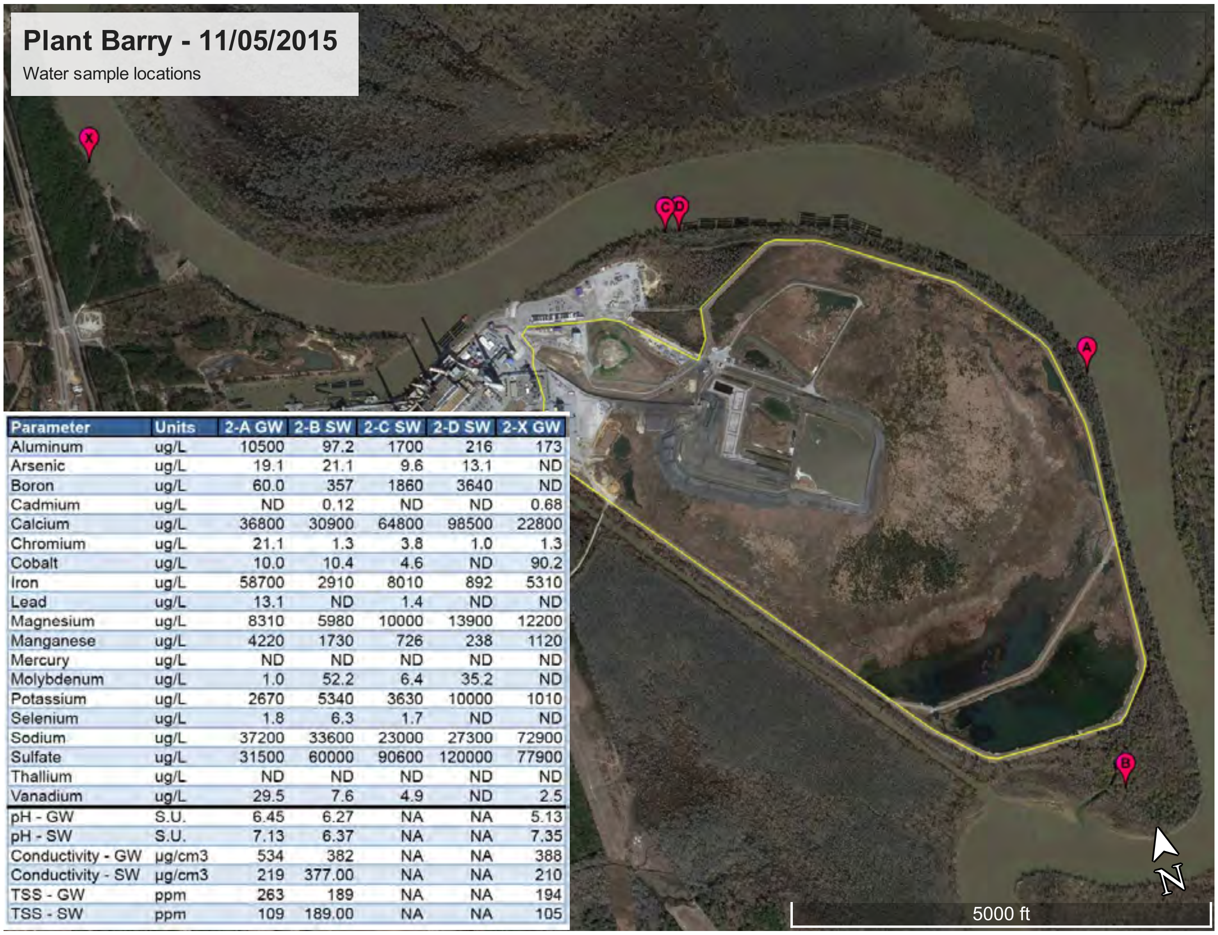
SRF Review: L **Date:** 9/4/15

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e out of hold, incorrect preservative, out of temp, incorrect containers)

WO# : 92266415

92266415

19. APPENDIX L – NOV. 5, 2015 SAMPLE RESULTS



Parameter	Units	2-A GW	2-B SW	2-C SW	2-D SW	2-X GW
Aluminum	ug/L	10500	97.2	1700	216	173
Arsenic	ug/L	19.1	21.1	9.6	13.1	ND
Boron	ug/L	60.0	357	1860	3640	ND
Cadmium	ug/L	ND	0.12	ND	ND	0.68
Calcium	ug/L	36800	30900	64800	98500	22800
Chromium	ug/L	21.1	1.3	3.8	1.0	1.3
Cobalt	ug/L	10.0	10.4	4.6	ND	90.2
Iron	ug/L	58700	2910	8010	892	5310
Lead	ug/L	13.1	ND	1.4	ND	ND
Magnesium	ug/L	8310	5980	10000	13900	12200
Manganese	ug/L	4220	1730	726	238	1120
Mercury	ug/L	ND	ND	ND	ND	ND
Molybdenum	ug/L	1.0	52.2	6.4	35.2	ND
Potassium	ug/L	2670	5340	3630	10000	1010
Selenium	ug/L	1.8	6.3	1.7	ND	ND
Sodium	ug/L	37200	33600	23000	27300	72900
Sulfate	ug/L	31500	60000	90600	120000	77900
Thallium	ug/L	ND	ND	ND	ND	ND
Vanadium	ug/L	29.5	7.6	4.9	ND	2.5
pH - GW	S.U.	6.45	6.27	NA	NA	5.13
pH - SW	S.U.	7.13	6.37	NA	NA	7.35
Conductivity - GW	µg/cm3	534	382	NA	NA	388
Conductivity - SW	µg/cm3	219	377.00	NA	NA	210
TSS - GW	ppm	263	189	NA	NA	194
TSS - SW	ppm	109	189.00	NA	NA	105

Pace Analytical Services, Inc.
2225 Riverside Dr.
Asheville, NC 28804
(828)254-7176

November 23, 2015

Mr. Pete Harrison
Waterkeeper Alliance
17 Battery Place Ste 1329
Suite 1329
New York, NY 10004

RE: Project: BAR 11/5/2015
Pace Project No.: 92275909

Dear Mr. Harrison:

Enclosed are the analytical results for sample(s) received by the laboratory on November 12, 2015. The results relate only to the samples included in this report. Results reported herein conform to the most current TNI standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

Analyses were performed at the Pace Analytical Services location indicated on the sample analyte page for analysis unless otherwise footnoted.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Chris Derouen
christopher.derouen@pacelabs.com
Project Manager

Enclosures

cc: Larissa Liebmann, Waterkeeper Alliance

CERTIFICATIONS

Project:	BAR 11/5/2015
Pace Project No.:	92275909

Ormond Beach Certification IDs

8 East Tower Circle, Ormond Beach, FL 32174
Alabama Certification #: 41320
Connecticut Certification #: PH-0216
Delaware Certification: FL NELAC Reciprocity
Florida Certification #: E83079
Georgia Certification #: 955
Guam Certification: FL NELAC Reciprocity
Hawaii Certification: FL NELAC Reciprocity
Illinois Certification #: 200068
Indiana Certification: FL NELAC Reciprocity
Kansas Certification #: E-10383
Kentucky Certification #: 90050
Louisiana Certification #: FL NELAC Reciprocity
Louisiana Environmental Certificate #: 05007
Maryland Certification: #346
Michigan Certification #: 9911
Mississippi Certification: FL NELAC Reciprocity
Missouri Certification #: 236
Montana Certification #: Cert 0074
Nebraska Certification: NE-OS-28-14
Nevada Certification: FL NELAC Reciprocity
New Hampshire Certification #: 2958
New York Certification #: 11608
North Carolina Environmental Certificate #: 667
North Carolina Certification #: 12710
North Dakota Certification #: R-216
Oklahoma Certification #: D9947
Pennsylvania Certification #: 68-00547
Puerto Rico Certification #: FL01264
South Carolina Certification: #96042001
Tennessee Certification #: TN02974
Texas Certification: FL NELAC Reciprocity
US Virgin Islands Certification: FL NELAC Reciprocity
Virginia Environmental Certification #: 460165
West Virginia Certification #: 9962C
Wisconsin Certification #: 399079670
Wyoming (EPA Region 8): FL NELAC Reciprocity

Asheville Certification IDs

2225 Riverside Drive, Asheville, NC 28804
Florida/NELAP Certification #: E87648
Massachusetts Certification #: M-NC030
North Carolina Drinking Water Certification #: 37712
North Carolina Wastewater Certification #: 40
South Carolina Certification #: 99030001
West Virginia Certification #: 356
Virginia/VELAP Certification #: 460222

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SAMPLE ANALYTE COUNT

Project: BAR 11/5/2015
Pace Project No.: 92275909

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
92275909001	**BAR 2-X GW**	EPA 200.7	TAP	6	PASI-O
		EPA 200.8	CKJ	11	PASI-O
		EPA 245.1	MEW	1	PASI-O
		EPA 300.0	MDW	1	PASI-A
92275909002	**BAR 2-A GW**	EPA 200.7	TAP	6	PASI-O
		EPA 200.8	CKJ	11	PASI-O
		EPA 245.1	MEW	1	PASI-O
		EPA 300.0	MDW	1	PASI-A
92275909003	**BAR 2-B SW**	EPA 200.7	TAP	6	PASI-O
		EPA 200.8	CKJ	11	PASI-O
		EPA 245.1	MEW	1	PASI-O
		EPA 300.0	MDW	1	PASI-A
92275909004	**BAR 2-C SW**	EPA 200.7	TAP	6	PASI-O
		EPA 200.8	CKJ, DRS	11	PASI-O
		EPA 245.1	MEW	1	PASI-O
		EPA 300.0	MDW	1	PASI-A
92275909005	**BAR 2-D SW**	EPA 200.7	TAP	6	PASI-O
		EPA 200.8	CKJ	11	PASI-O
		EPA 245.1	MEW	1	PASI-O
		EPA 300.0	MDW	1	PASI-A

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ANALYTICAL RESULTS

Project: BAR 11/5/2015
Pace Project No.: 92275909

Sample: BAR 2-X GW | **Lab ID: 92275909001** | Collected: 11/05/15 00:00 | Received: 11/12/15 10:30 | Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
200.7 MET ICP	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7							
Boron	ND	ug/L	50.0	1	11/18/15 12:27	11/21/15 19:59	7440-42-8	
Calcium	**22800**	ug/L	500	1	11/18/15 12:27	11/21/15 19:59	7440-70-2	
Iron	**5310**	ug/L	40.0	1	11/18/15 12:27	11/21/15 19:59	7439-89-6	
Magnesium	**12200**	ug/L	500	1	11/18/15 12:27	11/21/15 19:59	7439-95-4	
Potassium	**1010**	ug/L	1000	1	11/18/15 12:27	11/21/15 19:59	7440-09-7	
Sodium	**72900**	ug/L	1000	1	11/18/15 12:27	11/21/15 19:59	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8							
Aluminum	**173**	ug/L	10.0	1	11/18/15 12:27	11/20/15 11:50	7429-90-5	
Arsenic	ND	ug/L	1.0	1	11/18/15 12:27	11/20/15 11:50	7440-38-2	
Cadmium	**0.68**	ug/L	0.10	1	11/18/15 12:27	11/20/15 11:50	7440-43-9	
Chromium	**1.3**	ug/L	1.0	1	11/18/15 12:27	11/20/15 11:50	7440-47-3	
Cobalt	**90.2**	ug/L	1.0	1	11/18/15 12:27	11/20/15 11:50	7440-48-4	
Lead	ND	ug/L	1.0	1	11/18/15 12:27	11/20/15 11:50	7439-92-1	
Manganese	**1120**	ug/L	10.0	10	11/18/15 12:27	11/20/15 13:22	7439-96-5	
Molybdenum	ND	ug/L	1.0	1	11/18/15 12:27	11/20/15 11:50	7439-98-7	
Selenium	ND	ug/L	1.0	1	11/18/15 12:27	11/20/15 11:50	7782-49-2	
Thallium	ND	ug/L	1.0	1	11/18/15 12:27	11/20/15 11:50	7440-28-0	
Vanadium	**2.5**	ug/L	1.0	1	11/18/15 12:27	11/20/15 11:50	7440-62-2	
245.1 Mercury	Analytical Method: EPA 245.1 Preparation Method: EPA 245.1							
Mercury	ND	ug/L	0.20	1	11/18/15 13:03	11/19/15 12:43	7439-97-6	
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0							
Sulfate	**77.9**	mg/L	10.0	5		11/17/15 17:24	14808-79-8	

Sample: BAR 2-A GW | **Lab ID: 92275909002** | Collected: 11/05/15 00:00 | Received: 11/12/15 10:30 | Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
200.7 MET ICP	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7							
Boron	**60.0**	ug/L	50.0	1	11/18/15 12:27	11/21/15 20:03	7440-42-8	
Calcium	**36800**	ug/L	500	1	11/18/15 12:27	11/21/15 20:03	7440-70-2	
Iron	**58700**	ug/L	40.0	1	11/18/15 12:27	11/21/15 20:03	7439-89-6	
Magnesium	**8310**	ug/L	500	1	11/18/15 12:27	11/21/15 20:03	7439-95-4	
Potassium	**2670**	ug/L	1000	1	11/18/15 12:27	11/21/15 20:03	7440-09-7	
Sodium	**37200**	ug/L	1000	1	11/18/15 12:27	11/21/15 20:03	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8							
Aluminum	**10500**	ug/L	50.0	5	11/18/15 12:27	11/20/15 11:53	7429-90-5	D3
Arsenic	**19.1**	ug/L	1.0	1	11/18/15 12:27	11/20/15 11:56	7440-38-2	
Cadmium	ND	ug/L	0.50	5	11/18/15 12:27	11/20/15 11:53	7440-43-9	D3
Chromium	**21.1**	ug/L	5.0	5	11/18/15 12:27	11/20/15 11:53	7440-47-3	D3
Cobalt	**10.0**	ug/L	5.0	5	11/18/15 12:27	11/20/15 11:53	7440-48-4	D3
Lead	**13.1**	ug/L	1.0	1	11/18/15 12:27	11/20/15 11:56	7439-92-1	

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ANALYTICAL RESULTS

Project: BAR 11/5/2015
Pace Project No.: 92275909

Sample: BAR 2-A GW **Lab ID: 92275909002** Collected: 11/05/15 00:00 Received: 11/12/15 10:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8							
Manganese	**4220**	ug/L	10.0	10	11/18/15 12:27	11/20/15 13:25	7439-96-5	D4
Molybdenum	**1.0**	ug/L	1.0	1	11/18/15 12:27	11/20/15 11:56	7439-98-7	
Selenium	**1.8**	ug/L	1.0	1	11/18/15 12:27	11/20/15 11:56	7782-49-2	
Thallium	ND	ug/L	1.0	1	11/18/15 12:27	11/20/15 11:56	7440-28-0	
Vanadium	**29.5**	ug/L	5.0	5	11/18/15 12:27	11/20/15 11:53	7440-62-2	D3
245.1 Mercury	Analytical Method: EPA 245.1 Preparation Method: EPA 245.1							
Mercury	ND	ug/L	0.20	1	11/18/15 13:03	11/19/15 12:54	7439-97-6	
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0							
Sulfate	**31.5**	mg/L	2.0	1		11/17/15 17:38	14808-79-8	

Sample: BAR 2-B SW **Lab ID: 92275909003** Collected: 11/05/15 00:00 Received: 11/12/15 10:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
200.7 MET ICP	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7							
Boron	**357**	ug/L	50.0	1	11/18/15 12:27	11/21/15 20:07	7440-42-8	
Calcium	**30900**	ug/L	500	1	11/18/15 12:27	11/21/15 20:07	7440-70-2	
Iron	**2910**	ug/L	40.0	1	11/18/15 12:27	11/21/15 20:07	7439-89-6	
Magnesium	**5980**	ug/L	500	1	11/18/15 12:27	11/21/15 20:07	7439-95-4	
Potassium	**5340**	ug/L	1000	1	11/18/15 12:27	11/21/15 20:07	7440-09-7	
Sodium	**33600**	ug/L	1000	1	11/18/15 12:27	11/21/15 20:07	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8							
Aluminum	**97.2**	ug/L	10.0	1	11/18/15 12:27	11/20/15 12:03	7429-90-5	
Arsenic	**21.1**	ug/L	1.0	1	11/18/15 12:27	11/20/15 12:03	7440-38-2	
Cadmium	**0.12**	ug/L	0.10	1	11/18/15 12:27	11/20/15 12:03	7440-43-9	
Chromium	**1.3**	ug/L	1.0	1	11/18/15 12:27	11/20/15 12:03	7440-47-3	
Cobalt	**10.4**	ug/L	1.0	1	11/18/15 12:27	11/20/15 12:03	7440-48-4	
Lead	ND	ug/L	1.0	1	11/18/15 12:27	11/20/15 12:03	7439-92-1	
Manganese	**1730**	ug/L	5.0	5	11/18/15 12:27	11/20/15 12:00	7439-96-5	D4
Molybdenum	**52.2**	ug/L	1.0	1	11/18/15 12:27	11/20/15 12:03	7439-98-7	
Selenium	**6.3**	ug/L	1.0	1	11/18/15 12:27	11/20/15 12:03	7782-49-2	
Thallium	ND	ug/L	1.0	1	11/18/15 12:27	11/20/15 12:03	7440-28-0	
Vanadium	**7.6**	ug/L	1.0	1	11/18/15 12:27	11/20/15 12:03	7440-62-2	
245.1 Mercury	Analytical Method: EPA 245.1 Preparation Method: EPA 245.1							
Mercury	ND	ug/L	0.20	1	11/18/15 13:03	11/19/15 12:56	7439-97-6	
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0							
Sulfate	**60.0**	mg/L	4.0	2		11/17/15 17:52	14808-79-8	

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ANALYTICAL RESULTS

Project: BAR 11/5/2015
Pace Project No.: 92275909

Sample: BAR 2-C SW | **Lab ID: 92275909004** | Collected: 11/05/15 00:00 | Received: 11/12/15 10:30 | Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
200.7 MET ICP	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7							
Boron	**1860**	ug/L	50.0	1	11/18/15 12:27	11/21/15 20:11	7440-42-8	
Calcium	**64800**	ug/L	500	1	11/18/15 12:27	11/21/15 20:11	7440-70-2	
Iron	**8010**	ug/L	40.0	1	11/18/15 12:27	11/21/15 20:11	7439-89-6	
Magnesium	**10000**	ug/L	500	1	11/18/15 12:27	11/21/15 20:11	7439-95-4	
Potassium	**3630**	ug/L	1000	1	11/18/15 12:27	11/21/15 20:11	7440-09-7	
Sodium	**23000**	ug/L	1000	1	11/18/15 12:27	11/21/15 20:11	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8							
Aluminum	**1700**	ug/L	10.0	1	11/18/15 12:27	11/19/15 18:43	7429-90-5	
Arsenic	**9.6**	ug/L	1.0	1	11/18/15 12:27	11/19/15 18:43	7440-38-2	
Cadmium	ND	ug/L	0.20	2	11/18/15 12:27	11/20/15 12:17	7440-43-9	D3
Chromium	**3.8**	ug/L	2.0	2	11/18/15 12:27	11/20/15 12:17	7440-47-3	D3
Cobalt	**4.6**	ug/L	2.0	2	11/18/15 12:27	11/20/15 12:17	7440-48-4	D3
Lead	**1.4**	ug/L	1.0	1	11/18/15 12:27	11/19/15 18:43	7439-92-1	
Manganese	**726**	ug/L	2.0	2	11/18/15 12:27	11/20/15 12:17	7439-96-5	D4
Molybdenum	**6.4**	ug/L	2.0	2	11/18/15 12:27	11/20/15 12:17	7439-98-7	D3
Selenium	**1.7**	ug/L	1.0	1	11/18/15 12:27	11/19/15 18:43	7782-49-2	
Thallium	ND	ug/L	1.0	1	11/18/15 12:27	11/19/15 18:43	7440-28-0	
Vanadium	**4.9**	ug/L	2.0	2	11/18/15 12:27	11/20/15 12:17	7440-62-2	D3
245.1 Mercury	Analytical Method: EPA 245.1 Preparation Method: EPA 245.1							
Mercury	ND	ug/L	0.20	1	11/18/15 13:03	11/19/15 12:58	7439-97-6	
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0							
Sulfate	**90.6**	mg/L	10.0	5		11/17/15 18:05	14808-79-8	

Sample: BAR 2-D SW | **Lab ID: 92275909005** | Collected: 11/05/15 00:00 | Received: 11/12/15 10:30 | Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
200.7 MET ICP	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7							
Boron	**3640**	ug/L	50.0	1	11/18/15 12:27	11/21/15 20:15	7440-42-8	
Calcium	**98500**	ug/L	500	1	11/18/15 12:27	11/21/15 20:15	7440-70-2	
Iron	**892**	ug/L	40.0	1	11/18/15 12:27	11/21/15 20:15	7439-89-6	
Magnesium	**13900**	ug/L	500	1	11/18/15 12:27	11/21/15 20:15	7439-95-4	
Potassium	**10000**	ug/L	1000	1	11/18/15 12:27	11/21/15 20:15	7440-09-7	
Sodium	**27300**	ug/L	1000	1	11/18/15 12:27	11/21/15 20:15	7440-23-5	
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8							
Aluminum	**216**	ug/L	10.0	1	11/18/15 12:27	11/20/15 12:20	7429-90-5	
Arsenic	**13.1**	ug/L	1.0	1	11/18/15 12:27	11/20/15 12:20	7440-38-2	
Cadmium	ND	ug/L	0.10	1	11/18/15 12:27	11/20/15 12:20	7440-43-9	
Chromium	**1.0**	ug/L	1.0	1	11/18/15 12:27	11/20/15 12:20	7440-47-3	
Cobalt	ND	ug/L	1.0	1	11/18/15 12:27	11/20/15 12:20	7440-48-4	
Lead	ND	ug/L	1.0	1	11/18/15 12:27	11/20/15 12:20	7439-92-1	

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ANALYTICAL RESULTS

Project: BAR 11/5/2015
Pace Project No.: 92275909

Sample: BAR 2-D SW **Lab ID: 92275909005** Collected: 11/05/15 00:00 Received: 11/12/15 10:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
200.8 MET ICPMS	Analytical Method: EPA 200.8 Preparation Method: EPA 200.8							
Manganese	**238**	ug/L	1.0	1	11/18/15 12:27	11/20/15 12:20	7439-96-5	M1
Molybdenum	**35.2**	ug/L	1.0	1	11/18/15 12:27	11/20/15 12:20	7439-98-7	
Selenium	ND	ug/L	1.0	1	11/18/15 12:27	11/20/15 12:20	7782-49-2	
Thallium	ND	ug/L	1.0	1	11/18/15 12:27	11/20/15 12:20	7440-28-0	
Vanadium	ND	ug/L	1.0	1	11/18/15 12:27	11/20/15 12:20	7440-62-2	CL
245.1 Mercury	Analytical Method: EPA 245.1 Preparation Method: EPA 245.1							
Mercury	ND	ug/L	0.20	1	11/18/15 13:03	11/19/15 13:00	7439-97-6	
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0							
Sulfate	**120**	mg/L	20.0	10		11/17/15 18:19	14808-79-8	

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QUALITY CONTROL DATA

Project: BAR 11/5/2015
Pace Project No.: 92275909

QC Batch: MERP/6369 Analysis Method: EPA 245.1
QC Batch Method: EPA 245.1 Analysis Description: 245.1 Mercury
Associated Lab Samples: 92275909001, 92275909002, 92275909003, 92275909004, 92275909005

METHOD BLANK: 1396131 Matrix: Water
Associated Lab Samples: 92275909001, 92275909002, 92275909003, 92275909004, 92275909005

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Mercury	ug/L	ND	0.20	11/19/15 12:23	

LABORATORY CONTROL SAMPLE: 1396132

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	ug/L	2	2.0	100	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1396133 1396134

Parameter	Units	30164731001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Mercury	ug/L	ND	2	2	1.7	1.8	79	83	70-130	5	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1396340 1396341

Parameter	Units	92275909001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Mercury	ug/L	ND	2	2	2.0	1.8	98	92	70-130	6	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

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QUALITY CONTROL DATA

Project: BAR 11/5/2015
Pace Project No.: 92275909

QC Batch: MPRP/27436 Analysis Method: EPA 200.7
QC Batch Method: EPA 200.7 Analysis Description: 200.7 MET
Associated Lab Samples: 92275909001, 92275909002, 92275909003, 92275909004, 92275909005

METHOD BLANK: 1396145 Matrix: Water
Associated Lab Samples: 92275909001, 92275909002, 92275909003, 92275909004, 92275909005

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Boron	ug/L	ND	50.0	11/21/15 19:18	
Calcium	ug/L	ND	500	11/21/15 19:18	
Iron	ug/L	ND	40.0	11/21/15 19:18	
Magnesium	ug/L	ND	500	11/21/15 19:18	
Potassium	ug/L	ND	1000	11/21/15 19:18	
Sodium	ug/L	ND	1000	11/21/15 19:18	

LABORATORY CONTROL SAMPLE: 1396146

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Boron	ug/L	2500	2520	101	85-115	
Calcium	ug/L	12500	12700	101	85-115	
Iron	ug/L	2500	2430	97	85-115	
Magnesium	ug/L	12500	12600	100	85-115	
Potassium	ug/L	12500	13000	104	85-115	
Sodium	ug/L	12500	13400	107	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1396375 1396376

Parameter	Units	92275908001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Boron	ug/L	1220	2500	2500	3600	3610	95	95	70-130	0	
Calcium	ug/L	47600	12500	12500	55100	55800	60	66	70-130	1	M1
Iron	ug/L	1750	2500	2500	2680	3440	37	68	70-130	25	M1,R1
Magnesium	ug/L	63900	12500	12500	70700	71500	54	61	70-130	1	M1
Potassium	ug/L	43800	12500	12500	53500	54100	77	82	70-130	1	
Sodium	ug/L	748000	12500	12500	705000	711000	-346	-301	70-130	1	M1

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1396377 1396378

Parameter	Units	92275923001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Boron	ug/L	ND	2500	2500	2470	2500	98	99	70-130	1	
Calcium	ug/L	1510	12500	12500	14600	14200	105	102	70-130	3	
Iron	ug/L	10900	2500	2500	14400	15100	142	168	70-130	4	M1
Magnesium	ug/L	777	12500	12500	12900	13400	97	101	70-130	4	
Potassium	ug/L	2200	12500	12500	15300	15700	105	108	70-130	3	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, Inc.
2225 Riverside Dr.
Asheville, NC 28804
(828)254-7176

QUALITY CONTROL DATA

Project: BAR 11/5/2015
Pace Project No.: 92275909

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1396377 1396378

Parameter	Units	92275923001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Sodium	ug/L	5240	12500	12500	18800	19100	108	111	70-130	2	

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(828)254-7176

QUALITY CONTROL DATA

Project: BAR 11/5/2015
Pace Project No.: 92275909

QC Batch: MPRP/27437 Analysis Method: EPA 200.8
QC Batch Method: EPA 200.8 Analysis Description: 200.8 MET
Associated Lab Samples: 92275909001, 92275909002, 92275909003, 92275909004, 92275909005

METHOD BLANK: 1396162 Matrix: Water
Associated Lab Samples: 92275909001, 92275909002, 92275909003, 92275909004, 92275909005

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Aluminum	ug/L	ND	10.0	11/19/15 18:01	
Arsenic	ug/L	ND	1.0	11/19/15 18:01	
Cadmium	ug/L	ND	0.10	11/19/15 18:01	
Chromium	ug/L	ND	1.0	11/19/15 18:01	
Cobalt	ug/L	ND	1.0	11/19/15 18:01	
Lead	ug/L	ND	1.0	11/19/15 18:01	
Manganese	ug/L	ND	1.0	11/19/15 18:01	
Molybdenum	ug/L	ND	1.0	11/19/15 18:01	
Selenium	ug/L	ND	1.0	11/19/15 18:01	
Thallium	ug/L	ND	1.0	11/19/15 18:01	
Vanadium	ug/L	ND	1.0	11/19/15 18:01	

LABORATORY CONTROL SAMPLE: 1396163

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Aluminum	ug/L	500	491	98	85-115	
Arsenic	ug/L	50	47.4	95	85-115	
Cadmium	ug/L	5	4.8	96	85-115	
Chromium	ug/L	50	49.0	98	85-115	
Cobalt	ug/L	50	48.7	97	85-115	
Lead	ug/L	50	48.3	97	85-115	
Manganese	ug/L	50	47.4	95	85-115	
Molybdenum	ug/L	50	47.4	95	85-115	
Selenium	ug/L	50	48.2	96	85-115	
Thallium	ug/L	50	48.2	96	85-115	
Vanadium	ug/L	50	47.8	96	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1396164 1396165

Parameter	Units	35216904001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Aluminum	ug/L	0.043 mg/L	500	500	469	469	85	85	70-130	0	
Arsenic	ug/L	0.00050 U mg/L	50	50	42.4	42.3	84	84	70-130	0	
Cadmium	ug/L	0.000050U mg/L	5	5	4.0	4.2	80	83	70-130	4	

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REPORT OF LABORATORY ANALYSIS

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Asheville, NC 28804
(828)254-7176

QUALITY CONTROL DATA

Project: BAR 11/5/2015
Pace Project No.: 92275909

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1396164 1396165

Parameter	Units	35216904001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Chromium	ug/L	0.00050 U mg/L	50	50	42.0	41.1	83	82	70-130	2	
Cobalt	ug/L	0.00050 U mg/L	50	50	40.9	40.2	82	80	70-130	2	
Lead	ug/L	0.00050 U mg/L	50	50	45.8	46.7	91	93	70-130	2	
Manganese	ug/L	0.013 mg/L	50	50	53.6	52.6	81	79	70-130	2	
Molybdenum	ug/L	0.00050 U mg/L	50	50	45.6	44.9	90	89	70-130	2	
Selenium	ug/L	0.00050 U mg/L	50	50	42.8	42.3	85	84	70-130	1	
Thallium	ug/L	0.00050 U mg/L	50	50	46.4	48.1	93	96	70-130	4	
Vanadium	ug/L	0.00050 U mg/L	50	50	42.9	42.0	86	84	70-130	2	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1396393 1396394

Parameter	Units	92275909005 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Aluminum	ug/L	216	500	500	606	613	78	79	70-130	1	
Arsenic	ug/L	13.1	50	50	69.1	69.8	112	113	70-130	1	
Cadmium	ug/L	ND	5	5	4.9	5.1	98	102	70-130	4	
Chromium	ug/L	1.0	50	50	49.8	50.2	98	98	70-130	1	
Cobalt	ug/L	ND	50	50	47.3	48.6	94	96	70-130	3	
Lead	ug/L	ND	50	50	46.9	48.7	93	97	70-130	4	
Manganese	ug/L	238	50	50	299	307	123	139	70-130	3	M1
Molybdenum	ug/L	35.2	50	50	70.1	73.2	70	76	70-130	4	
Selenium	ug/L	ND	50	50	48.8	49.5	97	98	70-130	1	
Thallium	ug/L	ND	50	50	47.1	48.7	94	97	70-130	3	
Vanadium	ug/L	ND	50	50	50.5	51.1	100	101	70-130	1	CL

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

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Asheville, NC 28804
(828)254-7176

QUALITY CONTROL DATA

Project: BAR 11/5/2015
Pace Project No.: 92275909

QC Batch: WETA/25411 — Analysis Method: EPA 300.0
QC Batch Method: EPA 300.0 — Analysis Description: 300.0 IC Anions
Associated Lab Samples: 92275909001, 92275909002, 92275909003, 92275909004, 92275909005

METHOD BLANK: 1607385 — Matrix: Water
Associated Lab Samples: 92275909001, 92275909002, 92275909003, 92275909004, 92275909005

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Sulfate	mg/L	ND	2.0	11/17/15 15:07	

LABORATORY CONTROL SAMPLE: 1607386

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Sulfate	mg/L	20	18.3	92	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1607387 1607388

Parameter	Units	92275827002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Sulfate	mg/L	8.5	20	20	28.0	27.9	97	97	90-110	0	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1607389 1607390

Parameter	Units	92275827005 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Sulfate	mg/L	8.6	20	20	27.4	27.4	94	94	90-110	0	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

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Asheville, NC 28804
(828)254-7176

QUALIFIERS

Project:	BAR 11/5/2015
Pace Project No.:	92275909

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

Acid preservation may not be appropriate for 2 Chloroethylvinyl ether, Styrene, and Vinyl chloride.

A separate vial preserved to a pH of 4-5 is recommended in SW846 Chapter 4 for the analysis of Acrolein and Acrylonitrile by EPA Method 8260.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-A	Pace Analytical Services - Asheville
PASI-O	Pace Analytical Services - Ormond Beach

ANALYTE QUALIFIERS

CL	The continuing calibration for this compound is outside of Pace Analytical acceptance limits. The results may be biased low.
D3	Sample was diluted due to the presence of high levels of non-target analytes or other matrix interference.
D4	Sample was diluted due to the presence of high levels of target analytes.
M1	Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.
R1	RPD value was outside control limits.

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(828)254-7176

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: BAR 11/5/2015
Pace Project No.: 92275909

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
92275909001	**BAR 2-X GW**	EPA 200.7	MPRP/27436	EPA 200.7	ICP/16523
92275909002	**BAR 2-A GW**	EPA 200.7	MPRP/27436	EPA 200.7	ICP/16523
92275909003	**BAR 2-B SW**	EPA 200.7	MPRP/27436	EPA 200.7	ICP/16523
92275909004	**BAR 2-C SW**	EPA 200.7	MPRP/27436	EPA 200.7	ICP/16523
92275909005	**BAR 2-D SW**	EPA 200.7	MPRP/27436	EPA 200.7	ICP/16523
92275909001	**BAR 2-X GW**	EPA 200.8	MPRP/27437	EPA 200.8	ICPM/11187
92275909002	**BAR 2-A GW**	EPA 200.8	MPRP/27437	EPA 200.8	ICPM/11187
92275909003	**BAR 2-B SW**	EPA 200.8	MPRP/27437	EPA 200.8	ICPM/11187
92275909004	**BAR 2-C SW**	EPA 200.8	MPRP/27437	EPA 200.8	ICPM/11187
92275909005	**BAR 2-D SW**	EPA 200.8	MPRP/27437	EPA 200.8	ICPM/11187
92275909001	**BAR 2-X GW**	EPA 245.1	MERP/6369	EPA 245.1	MERC/6349
92275909002	**BAR 2-A GW**	EPA 245.1	MERP/6369	EPA 245.1	MERC/6349
92275909003	**BAR 2-B SW**	EPA 245.1	MERP/6369	EPA 245.1	MERC/6349
92275909004	**BAR 2-C SW**	EPA 245.1	MERP/6369	EPA 245.1	MERC/6349
92275909005	**BAR 2-D SW**	EPA 245.1	MERP/6369	EPA 245.1	MERC/6349
92275909001	**BAR 2-X GW**	EPA 300.0	WETA/25411		
92275909002	**BAR 2-A GW**	EPA 300.0	WETA/25411		
92275909003	**BAR 2-B SW**	EPA 300.0	WETA/25411		
92275909004	**BAR 2-C SW**	EPA 300.0	WETA/25411		
92275909005	**BAR 2-D SW**	EPA 300.0	WETA/25411		

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CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page: 1 of 1

Section A Required Client Information:

Company:	WATERKEEPER ALLIANCE
Address:	17 BATTERY PL STE 1329 NEWYORK, NY 10004
Email To:	PHARRISON@WATERKEEPER.ORG
Phone:	212-747-0622
Fax:	
Requested Due Date/TAT:	

Section B Required Project Information:

Report To:	PHARRISON@WATERKEEPER.ORG
Copy To:	LLIEBMANN@WATERKEEPER.ORG
Purchase Order No.:	
Project Name:	BAR 11/5/2015
Project Number:	

Section C Invoice Information:

Attention:	RACHEL COOK
Company Name:	← SAME
Address:	
Pace Quote Reference:	
Pace Project Manager:	CHRIS DEROUEN (NC)
Pace Profile #:	

REGULATORY AGENCY

☒ NPDES ☒ GROUND WATER ☐ DRINKING WATER
☐ UST ☐ RCRA ☐ OTHER

Site Location STATE: AL

Section D Required Client Information

Valid Matrix Codes: MATRIX / CODE — DRINKING WATER DW; WATER WT; WASTE WATER WW; PRODUCT P; SOIL/SOLID SL; OIL OL; WIPE WP; AIR AR; OTHER OT; TISSUE TS

SAMPLE ID (A-Z, 0-9 / ,-) Sample IDs MUST BE UNIQUE

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID	MATRIX CODE	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED COMPOSITE START DATE	TIME	COMPOSITE END/GRAB DATE	TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test Y/N	As, Cd, Cr, Pb, Mn	Mb, Se, Tl	B, Co, Fe, V	Al, Ca, Mg, K, Na	Hg	Sulfate				Residual Chlorine (Y/N)	Pace Project No./ Lab I.D. 92275909
1	BAR 2-X	GW	WT	G			11/5/15			2	X		X							X	X	X	X		X					001
2	BAR 2-A	GW	"	G			"			2	X		X							X	X	X	X		X					002
3	BAR 2-B	SW	"	G			"			2	X		X							X	X	X	X		X					003
4	BAR 2-C	SW	"	G			"			2	X		X							X	X	X	X		X					004
5	BAR 2-D	SW	"	G			"			2	X		X							X	X	X	X		X					005
6																													
7																													
8																													
9																													
10																													
11																													
12																													

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS			
Use EPA 200.7 where avail.	[signature]	11/05/15	6:38PM	[signature] / WKA	11/5/15	8:58				
	PH / WKA	11/11/15	15:25	Matt Stewart PAC	11/12/15	1030	17.5	N	N	Y
							Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Cade Kistler

SIGNATURE of SAMPLER: [signature] DATE Signed (MM/DD/YY): 11/05/15

*Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days.

F-ALL-Q-020rev.08, 12-Oct-2007

Pace Analytical® www.pacelabs.com	Document Name: **Sample Condition Upon Receipt (SCUR)**	Document Revised: November 06, 2015 Page 1 of 2*
	Document No.: F-ASV-CS-003-rev.15	Issuing Authorities: Pace Asheville Quality Office

Client Name: Water Keeper Alliance

* Page 2 of 2 is for Internal Use Only

Courier (Circle): Fed Ex UPS USPS Client Commercial Pace Other________

Custody Seal on Cooler/Box Present: ☐ yes ☑ no Seals intact: ☑ yes ☐ no

Packing Material: ☐ Bubble Wrap ☐ Bubble Bags ☑ None ☐ Other________

Thermometer Used: IR Gun#5 - 155271998 IR Gun #4 SN:140290365 Other:________ **Type of Ice:** Wet Blue None ☑ Samples on ice, cooling process has begun

Temp Correction Factor: Add / Subtract 0 **C**

Corrected Cooler Temp.: 17.5 **C** **Biological Tissue is Frozen:** Yes No N/A

Temp should be above freezing to 6°C

Date and Initials of person examining contents: 11/12 MS

				Comments:
Chain of Custody Present:	☑Yes	☐No	☐N/A	1.
Chain of Custody Filled Out:	☑Yes	☐No	☐N/A	2.
Chain of Custody Relinquished:	☑Yes	☐No	☐N/A	3.
Sampler Name & Signature on COC:	☑Yes	☐No	☐N/A	4.
Samples Arrived within Hold Time:	☑Yes	☐No	☐N/A	5.
Short Hold Time Analysis (<72hr):	☐Yes	☑No	☐N/A	6.
Rush Turn Around Time Requested:	☐Yes	☑No	☐N/A	7.
Sufficient Volume:	☑Yes	☐No	☐N/A	8.
Correct Containers Used:	☑Yes	☐No	☐N/A	9.
-Pace Containers Used:	☑Yes	☐No	☐N/A	
Containers Intact:	☑Yes	☐No	☐N/A	10.
Filtered volume received for Dissolved tests	☐Yes	☐No	☑N/A	11.
Sample Labels match COC:	☑Yes	☐No	☐N/A	12.
-Includes date/time/ID/Analysis Matrix: WT				
All containers needing preservation have been checked.	☑Yes	☐No	☐N/A	13.
All containers needing preservation are found to be in compliance with EPA recommendation.	☑Yes	☐No	☐N/A	
exceptions: VOA, coliform, TOC, O&G, WI-DRO (water)	☐Yes	☑No		
Samples checked for dechlorination:	☐Yes	☐No	☑N/A	14.
Headspace in VOA Vials (>6mm):	☐Yes	☐No	☑N/A	15.
Trip Blank Present:	☐Yes	☐No	☑N/A	16.
Trip Blank Custody Seals Present	☐Yes	☐No	☑N/A	
Pace Trip Blank Lot # (if purchased):________				

Client Notification/ Resolution: Field Data Required? Y / N

Person Contacted:________________ Date/Time:________

Comments/ Resolution: Received with no Ice.

SCURF Review: ✓ Date: 11/13/15

SRF Review: ✓ Date: 11/13/15

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e out of hold, incorrect preservative, out of temp, incorrect containers)

WO#: 92275909

92275909

20. APPENDIX M – FEB. 4, 2016 SAMPLE RESULTS

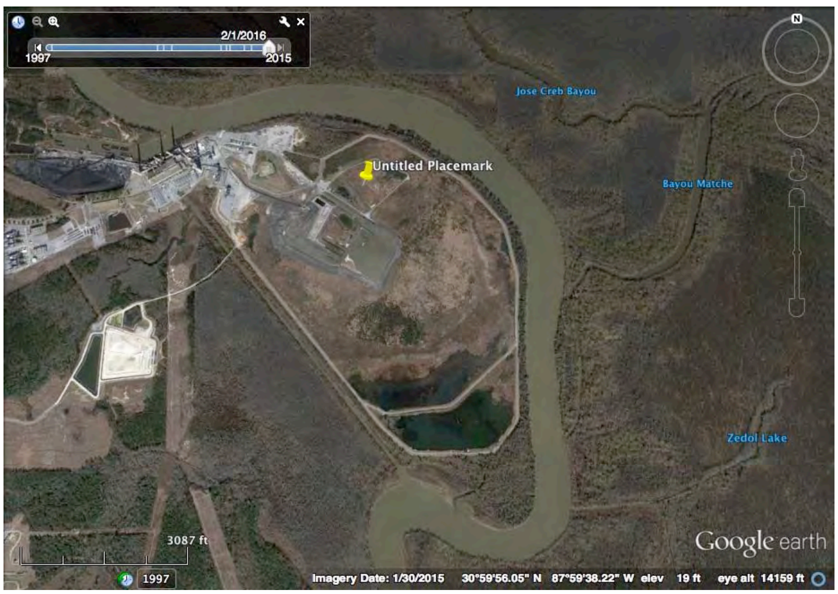
Global Environmental, LLC
Environmental Consulting

Barry Plant Sampling Evaluation of Results

Southern Environmental Law Center and Waterkeeper

Summary

Sampling was completed on February 4, 2016 using a boat supplied by the Mobile BayKeeper organization. Water samples were collected from areas that exhibited high field probe indicator conductivity concentrations, from areas of reddish brown stained areas, and / or areas with suspicious flow. Solid samples were collected as a comparison.



The February 2016 sampling event included relatively high water compared to the 2015 sampling events. Wetland / marsh areas were submerged, and there was standing water up to the impoundment dike in most areas. According to Waterkeeper staff, water levels were so much higher than the 2015 sampling events that some of those previous locations were submerged.

PO Box 58302, Nashville, Tennessee 37205
615-646-0969

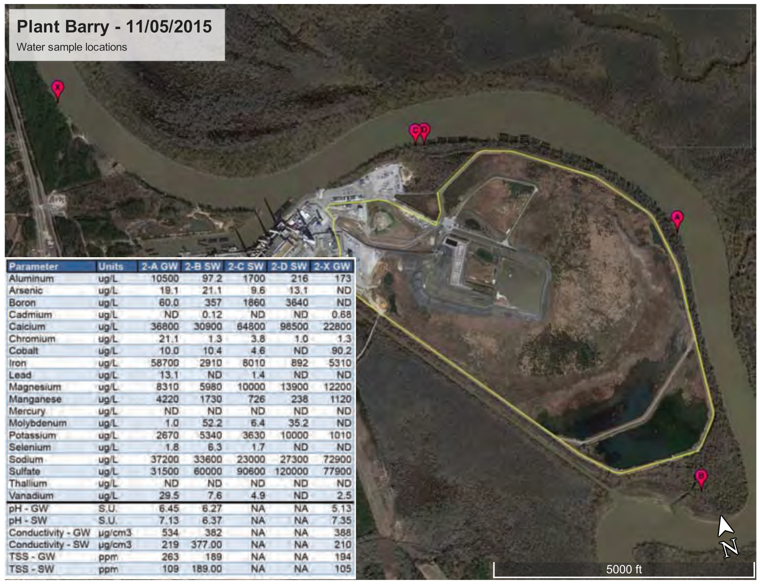
Water analytical results were compared to ADEM ecological (chronic and acute toxicity), EPA Region IV ecological, and EPA maximum contaminant levels (MCLs) and secondary MCLs. ADEM human health consumption of fish / ingestion and consumption of fish values were not evaluated – assuming the sampling locations were not human recreational areas.

Solids sample results were compared to EPA Region IV ecological soil screening levels and freshwater sediment criteria.

In short, main observations and conclusions include:

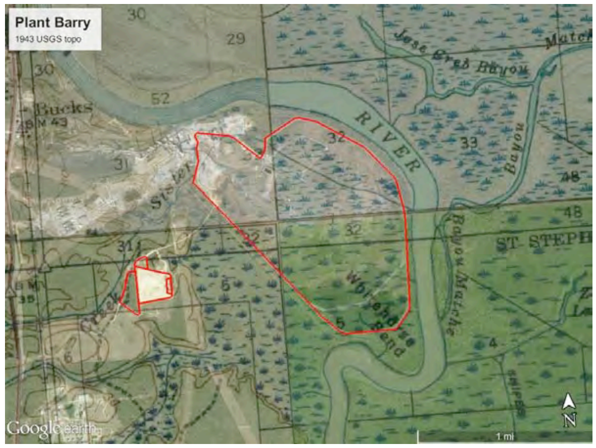
1. There is plenty of visual and field probe device (conductivity) evidence that the surface impoundment is leaking below and / or through the dikes. That leakage becomes surface water flow on the exterior sides of the dike. Flow is especially significant to the east and northeast. Those areas had considerable surface water flow going *away from* the toe of the dike.

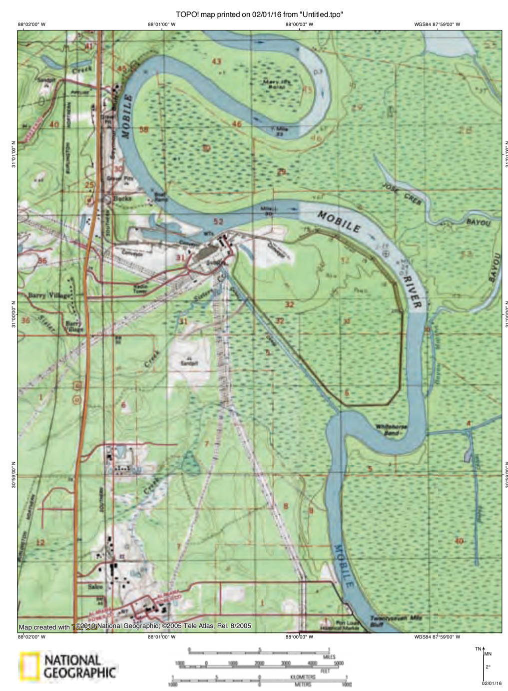
2. Water sampling results of February 2016 and September / November 2015 results offer similarity in terms of what was detected and concentrations detected. Signature coal combustion signature parameters were present. As a result, the data indicate leakage of impoundment liquids through and beneath the dikes to groundwater, and that groundwater emerges to the surface and becomes surface water flow. Comparative sample location diagrams for the 3 events are as follows:



Parameter	Units	2-A GW	2-B SW	2-C SW	2-D SW	2-X GW
Aluminum	ug/L	10500	97.2	1700	216	173
Arsenic	ug/L	19.1	21.1	9.6	13.1	ND
Boron	ug/L	60.0	357	1860	3640	ND
Cadmium	ug/L	ND	0.12	ND	ND	0.68
Calcium	ug/L	36800	30900	64800	98500	22800
Chromium	ug/L	21.1	1.3	3.8	1.0	1.3
Cobalt	ug/L	10.0	10.4	4.6	ND	90.2
Iron	ug/L	58700	2910	8010	892	5310
Lead	ug/L	13.1	ND	1.4	ND	ND
Magnesium	ug/L	8310	5980	10000	13900	12200
Manganese	ug/L	4220	1730	726	238	1120
Mercury	ug/L	ND	ND	ND	ND	ND
Molybdenum	ug/L	1.0	52.2	6.4	35.2	ND
Potassium	ug/L	2670	5340	3630	10000	1010
Selenium	ug/L	1.8	6.3	1.7	ND	ND
Sodium	ug/L	37200	33600	23000	27300	72900
Sulfate	ug/L	31500	60000	90600	120000	77900
Thallium	ug/L	ND	ND	ND	ND	ND
Vanadium	ug/L	29.5	7.6	4.9	ND	2.5
pH - GW	S.U.	6.45	6.27	NA	NA	5.13
pH - SW	S.U.	7.13	6.37	NA	NA	7.35
Conductivity - GW	µg/cm3	534	382	NA	NA	388
Conductivity - SW	µg/cm3	219	377.00	NA	NA	210
TSS - GW	ppm	263	189	NA	NA	194
TSS - SW	ppm	109	189.00	NA	NA	105

3. Key question is at what points do the discharges flow into a regulated waterway.
4. Topographic maps show that the surface impoundment was built over a marsh / wetland.



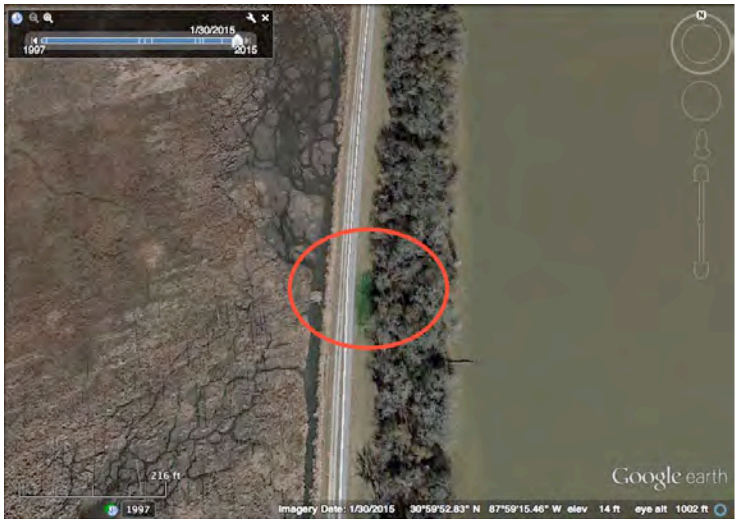


5. Water from the impoundment dike perimeters flowed into the Mobile River where there was a direct access channel (e.g. East Toe -1 sample locations, see photos below looking towards the impoundment and then towards the river) or complete backwater connection to the River. Other flows went to wetland / marsh areas with

no obvious channel connection to the Mobile River, while others are indirectly connected through unidentified surface water flow courses.

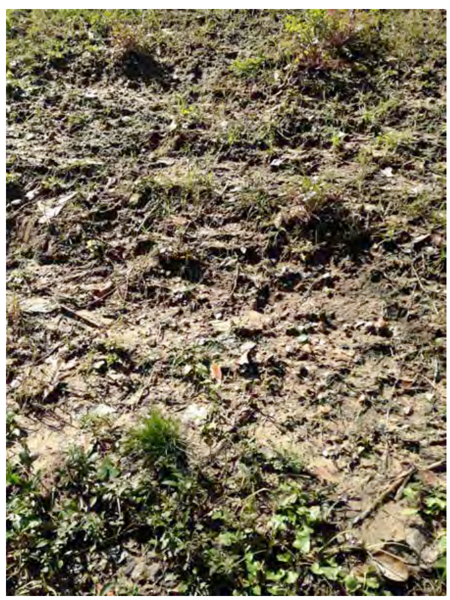
	

6. Samples collected by Waterkeeper of groundwater seeps along the exposed bank of the Mobile River and emergence points where water flows from the ground are all indicative of “groundwater”.
7. Aerial photos show areas of suspect dike leakage or repair areas where grass is especially green (from nutrients) or from repairs with green mats. These are most prominent on the eastern and northern dikes.



8. Groundwater ("GW") samples and Surface Water ("SW") sample results can be skewed high if the results have high suspended solids due to shallow water and human agitation during collection. Water samples Toe South-1 and Toe South-2 had high turbidity.
9. Dike repairs to the south were considerable and were recent, as evidenced by erosion control mats. Beneath the mats, one could see channelized flow – which is a sign that usually initiates more repairs are needed because such flows can result in "piping" of the dike and higher likelihood for failure.

10. Exterior dike surfaces commonly had what seems to be bottom ash in their construction materials. Bottom ash is porous (leaks) and is not very cohesive (erodes easily.



11. Floating fly ash was present in the backwater of the Mobile River approximately 10 feet south of the southern dike. A pocket of approximately 2 feet by 3 feet of

floating debris was observed. Samples analyzed microscopically confirmed 60 to 80% fly ash – mostly hollow floating cenospheres.

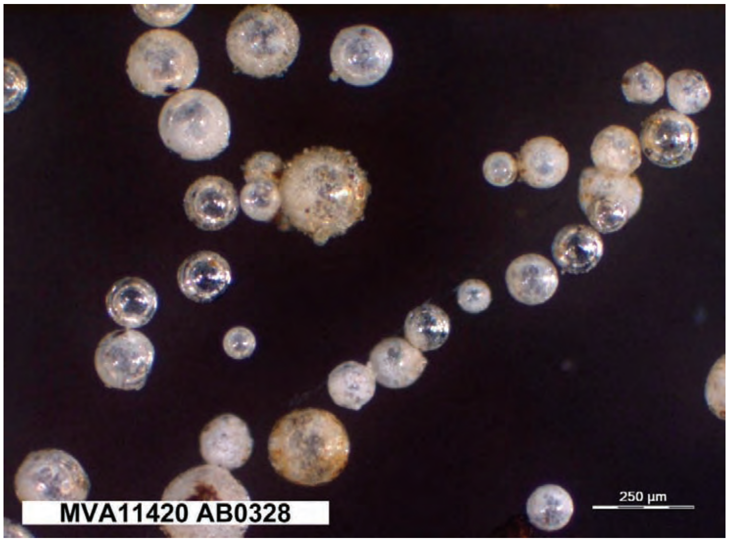


Figure 2. PLM image of fly ash cenospheres observed in sample AB0328.

12. Arsenic was present above drinking water standards but not ADEM or EPA ecological chronic or acute standards. Arsenic concentrations correlated moderately well with sulfate for February 2016 sampling event. The presence of high concentrations of arsenic in non-turbid Northeast 1 and Northeast 2 (2016) samples are indicative of leakage from the impoundment given the locations, clear non-turbid flow, and correlation to other constituents. See below table.
13. Water results for boron, calcium, strontium, TDS, and barium all correlated very well with sulfate - meaning, the concentrations of those constituents would rise and fall with sulfate. See below table.
14. ADEM ecological water standards for selenium (south locations) and lead (south and east) were exceeded. See below table.
15. Numerous EPA ecological water standards were exceeded. Those constituents were aluminum, calcium, iron, manganese, barium, cadmium, cobalt, copper, lead, selenium, and vanadium. See below table.
16. MCLs or SMCLs were exceeded for aluminum, iron, manganese, arsenic, lead, total dissolved solids, and sulfate. See below table.
17. Some constituents were reported in a groundwater sample collected upstream from the plant for comparison. See sample “2X” in the attached table.

18. Soil and sediment results show exceedences for barium, manganese, vanadium, and sulfide when compared to EPA ecological soil and / or sediment criteria. See attached table. The results were not compared to EPA Regional Screening Levels for human industrial or residential toxicity due to their locations.

Regulatory exceedences and / or notable concentrations and trends are included below and are highlighted in YELLOW on the associated (attached) spreadsheet.

Constituent	ADEM ecological	EPA ecological	EPA MCL / SMCL	Location(s)
Aluminum		✓	✓	East, Northeast, South, *Upgradient*, Northwest
Boron				Highest Northeast (>1 mg/L)
Calcium		✓		South but elevated on dike and turbid. Northeast discharge near dike.
Iron		✓	✓	East, Northeast, South, *Upgradient*, Northwest
Manganese		✓	✓	East, Northeast, South, *Upgradient*, Northwest
Sulfur				Highest Northeast
Arsenic			✓	East, Northeast, South, Northwest
Barium		✓		South but elevated on dike and turbid. Northeast
Cadmium		✓		South but elevated on dike and turbid. *Upgradient too.*
Cobalt		✓		*Upgradient*
Copper		✓		South but seep elevated on dike and turbid
Lead	✓	✓	✓	South but elevated on dike and turbid. East.
Selenium	✓	✓		South
Strontium				Highest northeast
Vanadium		✓		South but elevated on dike and turbid. East.
Total Dissolved Solids			✓	Northeast.
Sulfate			✓	Northeast

Barry Plant SELC Water Testing Results

Barry Plant SELC Analyte	Alabama ecological Acute (mg/L)	Alabama ecological Chronic (mg/L)	EPA ecolog. Acute (mg/L)	EPA ecolog. Chronic (mg/L)	EPL MCL or SMCL (mg/L)	TOE SOUTH-1 Dike Seep 2/4/16 (mg/L)	Qual	TOE SOUTH-2 Dike Seep 2/4/16 (mg/L)	Qual	EAST TOE-1 SW East Toe Discharge 2/4/16 (mg/L)	Qual	NORTHEAST-1 SW Discharge in Wetland 02/04/2016 (mg/L)	Qual	NORTHEAST-2 SW Discharge Nearest NE Dike 02/04/2016 (mg/L)	Qual
Hardness	-	-	-	-	-	319		400		261		247		471	
pH					6.5 - 8.5	-		-		6.6		8.23		7.76	
ALUMINUM	-	-	0.75	0.087	0.05 - 0.2	**13.5**		**4.18**		**0.556**		**0.225**		**0.0332**	J
BORON	-	-	34	7.2	-	0.0605	J	0.256		0.0748	J	2.81		5.82	
CALCIUM	-	-	-	116	-	59.9		**128**		79		78.3		**155**	
IRON	-	-	-	1	0.3	**10.9**		**15.2**		**21.3**		**0.847**		0.124	
LITHIUM	-	-	0.91	0.44	-	0.00608	J	<0.006		<0.006		0.14		0.26	
MAGNESIUM	-	-	-	82	-	22.3		10		10.3		10.1		20.9	
MANGANESE	-	-	1.68	0.093	0.05 - 0.2	**10.7**		**3.84**		**6.76**		**0.238**		**0.0845**	
SILICON	-	-	-	-	-	7.51		7.09		5.45		4.68		8.07	
SODIUM	-	-	-	680	-	3.59		7.61		5.78		17.7		36	
SULFUR	-	-	-	-	-	7.07		16.6		14.9		33.8		87.2	
ANTIMONY	-	-	0.9	0.19	0.006	0.000648	J	<0.00027		<0.00027		<0.00027		<0.00027	
ARSENIC	0.34	0.15	0.34	0.15	0.01	0.00837		0.00531		0.00584		**0.0139**		**0.0158**	
BARIUM	-	-	2	0.22	2	**0.289**		**0.246**		0.132		0.158		**0.26**	
BERYLLIUM	-	-	0.093	0.011	0.004	0.000609	J	<0.00028		<0.00028		<0.00028		<0.00028	
CADMIUM	*See below*	*See below*	0.002	0.00025	0.005	**0.000505**	J	<0.00022		<0.00022		<0.00022		<0.00022	
CHROMIUM (results total; std +3)	*See below*	*See below*	0.57	0.074	0.1	0.0107		0.00866		0.00104		0.000688	J	<0.00032	
CHROMIUM (+6)	0.016	0.011	0.016	0.011	-	-		-		-		-		-	
COBALT	-	-	0.12	0.019	-	0.0134		0.00596		0.00982		<0.00027		<0.00027	
COPPER	*See below*	*See below*	0.013	0.009	1.3	**0.0192**		0.00585		0.00158		0.000465	J	<0.00027	
LEAD	*See below*	*See below*	0.065	0.0025	0.015	**0.0604**		**0.0131**		0.00134		<0.00026		<0.00026	
MOLYBDENUM	-	-	7.2	0.8	-	0.00258	J	0.000674	J	0.000567	J	0.0336		0.0857	
NICKEL	*See below*	*See below*	0.47	0.052	-	0.00677		0.00385		0.00347		<0.00032		<0.00032	
SELENIUM	0.02	0.005	0.02	0.005	0.05	0.00266		0.0013	J	0.000455	J	<0.00032		<0.00032	
STRONTIUM	-	-	48	5.3	-	0.156		0.393		0.316		1.11		2.05	
THALLIUM	-	-	0.054	0.006	0.002	<0.00028		<0.00028		<0.00028		<0.00028		<0.00028	
VANADIUM	-	-	0.079	0.027	-	**0.0317**		0.0214		0.0021	J	0.000742	J	<0.00062	
ZINC	*See below*	*See below*	0.12	0.12	5	0.0816		0.0232		0.00879	J	0.00651	J	<0.00191	
MERCURY	0.0024	0.000012	0.0014	0.00077	0.002	**0.000218**		<0.000049		<0.000049		<0.000049		<0.000049	
TOTAL DISSOLVED SOLIDS	-	-	-	-	500	275		394		281		339		**637**	
CHLORIDE	-	-	860	230	250	13.6		29.7		49		24.9		39.2	
SULFATE	-	-	-	-	250	18.5		45.7		43.3		92.9		**264**	
AMMONIA NITROGEN	-	-	-	-	-	0.637		1.26		0.393		<0.038		<0.0380	
SULFIDE	-	-	-	-	-	0.024	J	<0.0065		<0.0065		<0.0065		<0.0065	

Qualifiers:J: The identification of the analyte is acceptable; the reported value is an estimate.

ITALICIZED requires hardness-based ADEM ecological toxicity evaluation. See below. ***See Below.***

Barry Plant SELC Water Testing Results

ADEM Hardness-Based Water Criteria Chronic / Acute

Hardness 247 as CaCO3

Northeast-1	Acute	Chronic
Cadmium	0.0048	0.00046
Chromium +3	1.194	0.155
Copper	0.031	0.019
Lead	0.17	0.0066
Nickel	1.006	0.111
Silver	0.015	-
Zinc	0.252	0.254

Hardness 400 as CaCO3

Toe South 2	Acute	Chronic
Cadmium	0.0078	0.00064
Chromium +3	1.773	0.23
Copper	0.05	0.029
Lead	0.28	**0.011**
Nickel	1.512	0.168
Silver	0.035	-
Zinc	0.379	0.382

Hardness 471 as CaCO3

Northeast-2	Acute	Chronic
Cadmium	0.0091	0.00072
Chromium +3	2.027	0.263
Copper	0.058	0.034
Lead	0.332	0.013
Nickel	1.737	0.193
Silver	0.046	-
Zinc	0.436	0.439

Hardness 261 as CaCO3

East Toe 1	Acute	Chronic
Cadmium	0.005	0.00048
Chromium +3	1.25	0.162
Copper	0.033	0.02
Lead	0.18	0.007
Nickel	1.054	0.117
Silver	0.017	-
Zinc	0.264	0.266

Hardness 319 as CaCO3

Toe South 1	Acute	Chronic
Cadmium	0.006	0.00055
Chromium +3	1.473	0.192
Copper	0.04	0.024
Lead	0.222	**0.0087**
Nickel	1.249	0.139
Silver	0.024	-
Zinc	0.313	0.315

Barry Plant SELC Water Testing Results

2A (east) GW near bank? 11/5/15 (mg/L)	2B (South) SW Channel Down stream of Toe 11/5/15 (mg/L)	2C (NE) SW river bank seep 11/5/15 (mg/L)	2D (NE) SW river bank seep 11/5/15 (mg/L)	2X (upgrd) GW near bank 11/5/15 (mg/L)	1-A (South) SW dry channel Toe (2B) 9/2/15 (mg/L)	1-B (South) emerging GW near toe 9/2/15 (mg/L)	1-C (South) SW channel at river 9/2/15 (mg/L)	1-D (NE) SW river bank seep 9/2/15 (mg/L)	1-E (East) SW river bank seep 9/2/15 (mg/L)	1-F (NW) Sisters Creek Cooling Channel 9/2/15 (mg/L)
-	-	-	-	-	-	-	-	-	-	-
6.45	6.27	-	-	-	6.86	6.39	8.74	6.4	6.73	-
10.5	0.097	1.7	0.216	0.173	0.7	2	0.2	0.11	0.95	0.33
0.06	0.357	1.86	3.64	ND	0.6	0.51	0.29	0.23	ND	0.89
36.8	30.9	64.8	98.5	22.8	40.6	33.2	26.8	136	24	107
58.7	**2.9**	**8.01**	**0.892**	**5.31**	**5.1**	**5.1**	**1.4**	**46.8**	**3**	**2.7**
-	-	-	-	-	-	-	-	-	-	-
8.31	5.98	10	13.9	12.2	6.4	5.9	4.6	18.3	6.6	21.7
4.22	**1.73**	**0.726**	**0.238**	**1.12**	**2.1**	**0.25**	**0.38**	**5.4**	ND	**0.76**
-	-	-	-	-	-	-	-	-	-	-
37.2	33.6	23	27.3	72.9	38.6	37.8	30.1	12.8	24	29.1
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
0.019	**0.0211**	0.0096	**0.0131**	ND	**0.078**	**0.015**	0.0079	**0.041**	0.0043	**0.02**
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
ND	0.00012	ND	ND	**0.00068**	ND	0.00012	ND	ND	ND	ND
0.0211	0.0013	0.0038	0.001	0.0013	0.0017	0.0038	ND	ND	0.0019	ND
-	-	-	-	-	-	-	-	-	-	-
-	0.0104	0.0046	ND	**0.0902**	0.0015	0.0014	ND	0.002	0.0012	ND
-	-	-	-	-	-	-	-	-	-	-
0.013	ND	0.0014	ND	ND	ND	0.0019	ND	ND	0.0011	ND
0.001	0.0522	0.0064	0.0352	ND	0.042	0.059	0.035	0.0039	0.0015	0.0012
-	-	-	-	-	-	-	-	-	-	-
0.0018	**0.0063**	0.0017	ND	ND	**0.008**	**0.011**	**0.01**	ND	ND	ND
-	-	-	-	-	-	-	-	-	-	-
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0.0295	0.0076	0.0049	ND	0.0025	0.0092	0.011	0.0052	ND	0.0031	0.0015
-	-	-	-	-	-	-	-	-	-	-
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
263	189	-	-	194	241	228	170	**615**	156	-
-	-	-	-	-	-	-	-	-	-	-
31.5	60	90.6	120	77.9	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-

Barry Plant SELC Soil
and
Sediment Sampling Results

Barry Plant SELC Date Collected Analyte	**Most Stringent** **EPA Region IV** ***Soil* Screening Level** **Ecological** (mg/kg)	**EPA Region IV** **Freshwater** ***Sediment*** **Ecological** (mg/kg)	**BP-3 TOE SOUTH-2** 02/04/2016 Result **Soil** (mg/kg)	 Qualifier	**BP-3 EAST TOE-1** 02/04/2016 Result **Sediment / Soil** (mg/kg)	 Qualifier
TOTAL SOLIDS	-		70.80%		67.20%	
AMMONIA NITROGEN	-		2.68	J		
ALUMINUM	narrative	25,000	14,500		10,400	
ANTIMONY	0.27	2	<2.83		<2.98	
ARSENIC	18	9.8	3.13		2.04	J
BARIUM	110	20	**52.9**		**49.6**	
BERYLLIUM	10	-	0.239	J	0.365	
BORON	7.5	-	4.22	J	2.95	J
CADMIUM	0.36	1	<0.706		<0.744	
CALCIUM	-	-	1,360		1,810	
CHROMIUM (total)	28	43.4	11.6		9.7	
CHROMIUM +6	0.35	-	-		-	
COBALT	13	50	2.39		2.05	
COPPER	28	31.6	4.67		6.29	
IRON	narrative	20,000	**21,300**		8,700	
LEAD	11	35.8	10.1		8.73	
LITHIUM	2	-	**6.21**	J	**6.3**	J
MAGNESIUM	-	-	426		592	
MANGANESE	220	460	208		**278**	
MOLYBDENUM	2	-	<0.706		0.239	J
NICKEL	38	22.7	6.51		5.63	
SELENIUM	0.52	11	<2.83		<2.98	
SILICON	-	-	312		304	
SODIUM	-	-	35.4	J	44.9	J
STRONTIUM	96	-	7.48		12	
SULFUR	-	-	106	J	181	
THALLIUM	0.22	-	<2.83		<2.98	
VANADIUM	7.8	-	**23.9**		**16.9**	
ZINC	46	121	14.5		21.7	
MERCURY	0.1	0.18	0.0198	J	0.0198	J
SULFIDE	-	39	**116**		**141**	
CHLORIDE	-	-	90.4		127	
SULFATE	-	-	25.5	J	22.5	J

21. APPENDIX N – AUG. 08, 2017 SAMPLE RESULTS

Pace Analytical Services, LLC
2225 Riverside Dr.
Asheville, NC 28804
(828)254-7176

September 06, 2017

Mr. Pete Harrison
Waterkeeper Alliance
17 Battery Place Ste 1329
Suite 1329
New York, NY 10004

RE: Project: BAR-08-07-17
Pace Project No.: 92350831

Dear Mr. Harrison:

Enclosed are the analytical results for sample(s) received by the laboratory on August 09, 2017. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

Revised Report: Report revised to add Se result

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Chris Derouen
christopher.derouen@pacelabs.com
(828)254-7176
Project Manager

Enclosures

cc: Larissa Liebmann, Waterkeeper Alliance

Pace Analytical Services, LLC
2225 Riverside Dr.
Asheville, NC 28804
(828)254-7176

CERTIFICATIONS

Project:	BAR-08-07-17
Pace Project No.:	92350831

Charlotte Certification IDs

9800 Kincey Ave. Ste 100, Huntersville, NC 28078
North Carolina Drinking Water Certification #: 37706
North Carolina Field Services Certification #: 5342
North Carolina Wastewater Certification #: 12
South Carolina Certification #: 99006001
Florida/NELAP Certification #: E87627
Kentucky UST Certification #: 84
Virginia/VELAP Certification #: 460221

Asheville Certification IDs

2225 Riverside Drive, Asheville, NC 28804
Florida/NELAP Certification #: E87648
Massachusetts Certification #: M-NC030
North Carolina Drinking Water Certification #: 37712
North Carolina Wastewater Certification #: 40
South Carolina Certification #: 99030001
Virginia/VELAP Certification #: 460222

Pace Analytical Services, LLC
2225 Riverside Dr.
Asheville, NC 28804
(828)254-7176

SAMPLE ANALYTE COUNT

Project: BAR-08-07-17
Pace Project No.: 92350831

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
92350831001	**BAR 4-X**	EPA 6010	SER	8	PASI-A
		EPA 7471	KAL	1	PASI-A
		ASTM D2974-87	CLW	1	PASI-C
92350831002	**BAR 4-A**	EPA 6010	SER	8	PASI-A
		EPA 7471	KAL	1	PASI-A
		ASTM D2974-87	CLW	1	PASI-C

Pace Analytical Services, LLC
2225 Riverside Dr.
Asheville, NC 28804
(828)254-7176

ANALYTICAL RESULTS

Project: BAR-08-07-17
Pace Project No.: 92350831

Sample: BAR 4-X **Lab ID: 92350831001** Collected: 08/07/17 10:50 Received: 08/09/17 10:10 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3050							
Antimony	ND	mg/kg	0.78	1	08/11/17 22:35	08/14/17 01:35	7440-36-0	
Arsenic	**5.1**	mg/kg	1.6	1	08/11/17 22:35	08/14/17 01:35	7440-38-2	
Cadmium	ND	mg/kg	0.16	1	08/11/17 22:35	08/14/17 01:35	7440-43-9	
Chromium	**15.2**	mg/kg	0.78	1	08/11/17 22:35	08/14/17 01:35	7440-47-3	
Cobalt	**9.0**	mg/kg	0.78	1	08/11/17 22:35	08/14/17 01:35	7440-48-4	
Lead	**10.1**	mg/kg	0.78	1	08/11/17 22:35	08/14/17 01:35	7439-92-1	
Selenium	ND	mg/kg	1.6	1	08/11/17 22:35	08/14/17 01:35	7782-49-2	
Thallium	ND	mg/kg	1.6	1	08/11/17 22:35	08/14/17 01:35	7440-28-0	
7471 Mercury	Analytical Method: EPA 7471 Preparation Method: EPA 7471							
Mercury	**0.021**	mg/kg	0.0059	1	08/15/17 23:45	08/16/17 04:39	7439-97-6	
Percent Moisture	Analytical Method: ASTM D2974-87							
Percent Moisture	**62.7**	%	0.10	1		08/11/17 07:36		

Sample: BAR 4-A **Lab ID: 92350831002** Collected: 08/07/17 11:34 Received: 08/09/17 10:10 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP	Analytical Method: EPA 6010 Preparation Method: EPA 3050							
Antimony	**4.4**	mg/kg	1.0	1	08/11/17 22:35	08/14/17 01:38	7440-36-0	
Arsenic	**64.9**	mg/kg	2.1	1	08/11/17 22:35	08/14/17 01:38	7440-38-2	
Cadmium	**2.5**	mg/kg	0.21	1	08/11/17 22:35	08/14/17 01:38	7440-43-9	
Chromium	**23.9**	mg/kg	1.0	1	08/11/17 22:35	08/14/17 01:38	7440-47-3	
Cobalt	**8.7**	mg/kg	1.0	1	08/11/17 22:35	08/14/17 01:38	7440-48-4	
Lead	**8.4**	mg/kg	1.0	1	08/11/17 22:35	08/14/17 01:38	7439-92-1	
Selenium	**43.0**	mg/kg	2.1	1	08/11/17 22:35	08/14/17 01:38	7782-49-2	
Thallium	ND	mg/kg	2.1	1	08/11/17 22:35	08/14/17 01:38	7440-28-0	
7471 Mercury	Analytical Method: EPA 7471 Preparation Method: EPA 7471							
Mercury	**0.020**	mg/kg	0.0083	1	08/15/17 23:45	08/16/17 04:46	7439-97-6	
Percent Moisture	Analytical Method: ASTM D2974-87							
Percent Moisture	**63.7**	%	0.10	1		08/11/17 07:36		

Pace Analytical Services, LLC
2225 Riverside Dr.
Asheville, NC 28804
(828)254-7176

QUALITY CONTROL DATA

Project: BAR-08-07-17
Pace Project No.: 92350831

QC Batch: 373526 Analysis Method: EPA 7471
QC Batch Method: EPA 7471 Analysis Description: 7471 Mercury
Associated Lab Samples: 92350831001, 92350831002

METHOD BLANK: 2069769 Matrix: Solid
Associated Lab Samples: 92350831001, 92350831002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Mercury	mg/kg	ND	0.0060	08/16/17 04:35	

LABORATORY CONTROL SAMPLE: 2069770

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Mercury	mg/kg	.083	0.083	99	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2069771 2069772

Parameter	Units	92350831001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Mercury	mg/kg	0.021	.1	.14	0.11	0.13	89	78	75-125	17	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

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QUALITY CONTROL DATA

Project: BAR-08-07-17
Pace Project No.: 92350831

QC Batch: 372826 Analysis Method: EPA 6010
QC Batch Method: EPA 3050 Analysis Description: 6010 MET
Associated Lab Samples: 92350831001, 92350831002

METHOD BLANK: 2065699 Matrix: Solid
Associated Lab Samples: 92350831001, 92350831002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Antimony	mg/kg	ND	0.50	08/14/17 00:55	
Arsenic	mg/kg	ND	1.0	08/14/17 00:55	
Cadmium	mg/kg	ND	0.10	08/14/17 00:55	
Chromium	mg/kg	ND	0.50	08/14/17 00:55	
Cobalt	mg/kg	ND	0.50	08/14/17 00:55	
Lead	mg/kg	ND	0.50	08/14/17 00:55	
Selenium	mg/kg	ND	1.0	08/14/17 00:55	
Thallium	mg/kg	ND	1.0	08/14/17 00:55	

LABORATORY CONTROL SAMPLE: 2065700

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Antimony	mg/kg	50	46.6	93	80-120	
Arsenic	mg/kg	50	46.8	94	80-120	
Cadmium	mg/kg	50	46.6	93	80-120	
Chromium	mg/kg	50	47.1	94	80-120	
Cobalt	mg/kg	50	47.6	95	80-120	
Lead	mg/kg	50	46.9	94	80-120	
Selenium	mg/kg	50	47.7	95	80-120	
Thallium	mg/kg	50	47.2	94	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2065701 2065702

Parameter	Units	92350295003 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Antimony	mg/kg	ND	39.1	37.9	15.0	14.7	38	38	75-125	2	M1
Arsenic	mg/kg	6.2	39.1	37.9	36.0	45.6	76	104	75-125	24	R1
Cadmium	mg/kg	ND	39.1	37.9	34.6	33.6	88	89	75-125	3	
Chromium	mg/kg	12.3	39.1	37.9	46.0	52.3	86	106	75-125	13	
Cobalt	mg/kg	ND	39.1	37.9	34.6	33.0	89	87	75-125	5	
Lead	mg/kg	6.0	39.1	37.9	42.2	40.3	93	91	75-125	5	
Selenium	mg/kg	ND	39.1	37.9	32.8	26.5	84	70	75-125	21	M1,R1
Thallium	mg/kg	ND	39.1	37.9	33.5	31.9	86	84	75-125	5	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

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2225 Riverside Dr.
Asheville, NC 28804
(828)254-7176

QUALITY CONTROL DATA

Project: BAR-08-07-17
Pace Project No.: 92350831

QC Batch:	372749	Analysis Method:	ASTM D2974-87
QC Batch Method:	ASTM D2974-87	Analysis Description:	Dry Weight/Percent Moisture

Associated Lab Samples: 92350831001, 92350831002

SAMPLE DUPLICATE: 2065178

Parameter	Units	92350898001 Result	Dup Result	RPD	Qualifiers
Percent Moisture	%	12.9	12.5	4	

SAMPLE DUPLICATE: 2065179

Parameter	Units	92350967008 Result	Dup Result	RPD	Qualifiers
Percent Moisture	%	13.7	13.9	1	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

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2225 Riverside Dr.
Asheville, NC 28804
(828)254-7176

QUALIFIERS

Project: BAR-08-07-17
Pace Project No.: 92350831

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

Acid preservation may not be appropriate for 2 Chloroethylvinyl ether.

A separate vial preserved to a pH of 4-5 is recommended in SW846 Chapter 4 for the analysis of Acrolein and Acrylonitrile by EPA Method 8260.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-A	Pace Analytical Services - Asheville
PASI-C	Pace Analytical Services - Charlotte

ANALYTE QUALIFIERS

M1	Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.
R1	RPD value was outside control limits.

Pace Analytical Services, LLC
2225 Riverside Dr.
Asheville, NC 28804
(828)254-7176

QUALIFIERS

Project: BAR-08-07-17
Pace Project No.: 92350831

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

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MS(D) - Matrix Spike (Duplicate)

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N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-A	Pace Analytical Services - Asheville
PASI-C	Pace Analytical Services - Charlotte

ANALYTE QUALIFIERS

M1	Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.
R1	RPD value was outside control limits.

Pace Analytical Services, LLC
2225 Riverside Dr.
Asheville, NC 28804
(828)254-7176

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: BAR-08-07-17
Pace Project No.: 92350831

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
92350831001	**BAR 4-X**	EPA 3050	372826	EPA 6010	373123
92350831002	**BAR 4-A**	EPA 3050	372826	EPA 6010	373123
92350831001	**BAR 4-X**	EPA 7471	373526	EPA 7471	373528
92350831002	**BAR 4-A**	EPA 7471	373526	EPA 7471	373528
92350831001	**BAR 4-X**	ASTM D2974-87	372749		
92350831002	**BAR 4-A**	ASTM D2974-87	372749		

Pace Analytical	Document Name: **Sample Condition Upon Receipt(SCUR)**	Document Revised: July 25, 2017 Page 1 of 2
	Document No.: **F-CAR-CS-033-Rev.03**	Issuing Authority: Pace Quality Office

Laboratory receiving samples:
Asheville ☑ **Eden** ☐ **Greenwood** ☐ **Huntersville** ☐ **Raleigh** ☐ **Mechanicsville** ☐

Sample Condition Upon Receipt **Client Name:** WATER KEEPER **Project #:** **WO#: 92350831**

92350831

Courier: ☑ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace ☐ Other:

Custody Seal Present? ☐ Yes ☑ No **Seals Intact?** ☐ Yes ☐ No

Date/Initials Person Examining Contents: LDT 8/9/17

Packing Material: ☐ Bubble Wrap ☐ Bubble Bags ☑ None ☐ Other

Biological Tissue Frozen? ☐ Yes ☐ No ☐ N/A

Thermometer: ☐ IR Gun ID: 5

Type of Ice: ☐ Wet ☐ Blue ☑ None

Correction Factor: 0 **Cooler Temp Corrected (°C):** N/A

Temp should be above freezing to 6°C
☐ Samples out of temp criteria. Samples on ice, cooling process has begun

USDA Regulated Soil (☑ N/A, water sample)
Did samples originate in a quarantine zone within the United States: CA, NY, or SC (check maps)? ☐ Yes ☐ No

Did samples originate from a foreign source (internationally, including Hawaii and Puerto Rico)? ☐ Yes ☐ No

				Comments/Discrepancy:
Chain of Custody Present?	☑ Yes	☐ No	☐ N/A	1.
Samples Arrived within Hold Time?	☑ Yes	☐ No	☐ N/A	2.
Short Hold Time Analysis (<72 hr.)?	☐ Yes	☑ No	☐ N/A	3.
Rush Turn Around Time Requested?	☐ Yes	☑ No	☐ N/A	4.
Sufficient Volume?	☑ Yes	☐ No	☐ N/A	5.
Correct Containers Used?	☑ Yes	☐ No	☐ N/A	6.
-Pace Containers Used?	☑ Yes	☐ No	☐ N/A	
Containers Intact?	☑ Yes	☐ No	☐ N/A	7.
Dissolved analysis: Samples Field Filtered?	☐ Yes	☐ No	☑ N/A	8.
Sample Labels Match COC?	☑ Yes	☐ No	☐ N/A	9.
-Includes Date/Time/ID/Analysis Matrix: SOIL				
Headspace in VOA Vials (>5-6mm)?	☐ Yes	☐ No	☑ N/A	10.
Trip Blank Present?	☐ Yes	☐ No	☑ N/A	11.
Trip Blank Custody Seals Present?	☐ Yes	☐ No	☑ N/A	

Field Data Required? ☐ Yes ☐ No

CLIENT NOTIFICATION/RESOLUTION

Person Contacted: Date/Time:

Comments/Sample Discrepancy:

Project Manager SCURF Review: Date: 8/10/17

Project Manager SRF Review: Date: 8/10/17

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. Out of hold, incorrect preservative, out of temp, incorrect containers)

Pace Analytical	Document Name: **Sample Condition Upon Receipt(SCUR)** Document No.: **F-CAR-CS-033-Rev.03**	Document Revised: July 25, 2017 Page 2 of 2 Issuing Authority: Pace Quality Office

***Check mark top half of box if pH and/or dechlorination is verified and within the acceptance range for preservation samples.**

****Bottom half of box is to list number of bottles**

Project # **WO#:92350831**

PM: CD1 Due Date: 08/16/17

CLIENT: 93-Waterkeep

Item#	BP4U-125 mL Plastic Unpreserved (N/A) (Cl-)	BP3U-250 mL Plastic Unpreserved (N/A)	BP2U-500 mL Plastic Unpreserved (N/A)	BP1U-1 liter Plastic Unpreserved (N/A)	BP4S-125 mL Plastic H2SO4 (pH < 2) (Cl-)	BP3N-250 mL plastic HNO3 (pH < 2)	BP3Z-250 mL Plastic ZN Acetate & NaOH (>9)	BP3C-250 mL Plastic NaOH (pH > 12) (Cl-)	WGFU-Wide-mouthed Glass jar Unpreserved	AG1U-1 liter Amber Unpreserved (N/A) (Cl-)	AG1H-1 liter Amber HCl (pH < 2)	AG3U-250 mL Amber Unpreserved (N/A) (Cl-)	AG1S-1 liter Amber H2SO4 (pH < 2)	AG3S-250 mL Amber H2SO4 (pH < 2)	AG3A(DG3A)-250 mL Amber NH4Cl (N/A)(Cl-)	DG9H-40 mL VOA HCl (N/A)	VG9T-40 mL VOA Na2S2O3 (N/A)	VG9U-40 mL VOA Unp (N/A)	DG9P-40 mL VOA H3PO4 (N/A)	VOAK (6 vials per kit)-5035 kit (N/A)	V/GK (3 vials per kit)-VPH/Gas kit (N/A)	SP5T-125 mL Sterile Plastic (N/A – lab)	SP2T-250 mL Sterile Plastic (N/A – lab)		BP3A-250 mL Plastic (NH2)2SO4 (9.3-9.7)	Cubitainer	VSGU-20 mL Scintillation vials (N/A)	GN
1									1																			
2									1																			
3																												
4																												
5																												
6																												
7																												
8																												
9																												
10																												
11																												
12																												

pH Adjustment Log for Preserved Samples

Sample ID	Type of Preservative	pH upon receipt	Date preservation adjusted	Time preservation adjusted	Amount of Preservative added	Lot #

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. ᴗocument
ₛ must be completed accurately.

Section A Required Client Information:	Section B Required Project Information:	Section C Invoice Information:
Company: Waterkeeper Alliance	Report To: Peter Harrison, pharrison@waterkeeper.org	Attention: Rachel Cook, rcook@waterkeeper.org
Address: 180 Maiden Lane, Ste 603	Copy To:	Company Name: Waterkeeper Alliance
New York, NY 10038		Address: 180 Maiden Ln, Ste 603, New York, NY 10038
Email To: pharrison@waterkeeper.org	Purchase Order No.:	Pace Quote Reference:
Phone: 828-582-0422 Fax: 212-747-0611	Project Name: BAR 08-07-17	Pace Project Manager: Chris Derouen (Asheville, NC)
Requested Due Date/TAT:	Project Number:	Pace Profile #:

REGULATORY AGENCY

NPDES ☐ GROUND WATER ☐ DRINKING WATER ☐ UST ☐ RCRA ☒ OTHER ☐ ______

Site Location STATE: AL

Section D Required Client Information

SAMPLE ID (A-Z, 0-9 / ,-) Sample IDs MUST BE UNIQUE

Matrix Codes	
DRINKING WATER	DW
WATER	WT
WASTE WATER	WW
PRODUCT	P
SOIL/SOLID	SL
OIL	OL
WIPE	WP
AIR	AR
OTHER	OT
TISSUE	TS

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED: COMPOSITE START DATE	COMPOSITE START TIME	COMPOSITE END/GRAB DATE	COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	↓Analysis Test↓ Y/N	Sb, As, Cd, Cr, Co, Pb, [illegible], TL	Hg	Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.
1	BAR 4-X	SL	G			8/7/17	10:50		1	✓									✓	✓		92350831-001
2	BAR 4-A	SL	G			8/7/17	11:34		1	✓									✓	✓		002
3																						
4																						
5																						
6																						
7																						
8																						
9																						
10																						
11																						
12																						

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS: Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
	Cade Kistler [illegible]	8/7/17	16:00	Pete Harris	8/7/17	16:00				
	Pete Harris	8/8/17	15:00	[illegible]	8/8/17	10:10	NA	N	N	Y

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Cade Kistler

SIGNATURE of SAMPLER: Cade Kistler DATE Signed (MM/DD/YY): 8/7/17

*Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days.

22. APPENDIX O – FEB. 09, 2018 SAMPLE RESULTS

MVA SCIENTIFIC CONSULTANTS
Full Service Analytical Microscopy Laboratory

3300 Breckinridge Blvd
Suite 400
Duluth, GA 30096

770.662.8509
FAX 770.662.8532
www.mvainc.com

Environmental Forensics Services

Particle Characterization

Dust Characterization

Carbon Black Analysis

Fly Ash Characterization

Darkening Agents Identification

Soot Analysis

Asbestos Analysis & Exposure Evaluation

Unknown Material Analysis

Contamination Analysis

Source Determination

Expert Witness Services

Techniques

Light Microscopy

Scanning Electron Microscopy

Transmission Electron Microscopy

Fourier Transform Infrared Spectroscopy

Confocal Raman Microscopy

White Light Interference Microscopy

Energy Dispersive X-ray Spectrometry

Fluorescence Microscopy

Ion Milling & Ultramicrotomy

Accreditations

cGMP Compliant

ISO/IEC 17025
A2LA Certificate #2096.01

FDA Registered

Report of Results: MVA12534

Examination of Water Sample for Coal Combustion Waste

Prepared for:

Mobile Baykeeper
450-C Government Street
Mobile, AL 36602

Respectfully Submitted by: Randy Boltin EXECUTED BY ELECTRONIC SIGNATURE

Randy Boltin for

Steven P. Compton, Ph.D.
Executive Director

16 March 2018

Report of Results: MVA12534

Examination of Water Sample for Coal Combustion Waste

Introduction

This report includes the results of analysis of one water sample containing sediment collected on 9 February 2018. The sample was received from Cade Kistler of Mobile Baykeeper on 2 March 2018 via UPS. It was requested that the sediment be characterized for the presence of coal combustion particulate. Upon receipt the sample was assigned a unique MVA sample number as provided in the following table. The analysis was conducted on 14 March 2018.

MVA Sample ID	Client Sample ID
12534AD0281	OCPB-020918-01C 02-09-18 collection Site: OCPB

Methods

Representative portions of the fine sample material were collected and dried on a clean microscope slide. The dried material was initially examined under a WILD M5 stereomicroscope at magnifications from 6X to 50X. Forceps and a tungsten needle were used to collect representative portions of the particulate found in the sample. The particulate was then transferred via forceps onto another microscope slide and mounted in Cargille refractive index liquids for analysis by polarized light microscopy (PLM) using an aus Jena Jenapol polarized light microscope with a magnification range from 32X to 500X.

Results and Discussion

The sediment sample consists primarily of solid material both floating on top of and resting at the bottom of a water-filled jar. This material was determined to be approximately 55% to 75% (by volume) fly ash, mostly floating cenospheres (Figures 1 through 4). Organic debris consisting primarily of wood and cellulose particles was determined to be approximately 20% to 40% (by volume) of the sample. Minor amounts of insect parts (≤5% by volume) were also detected.

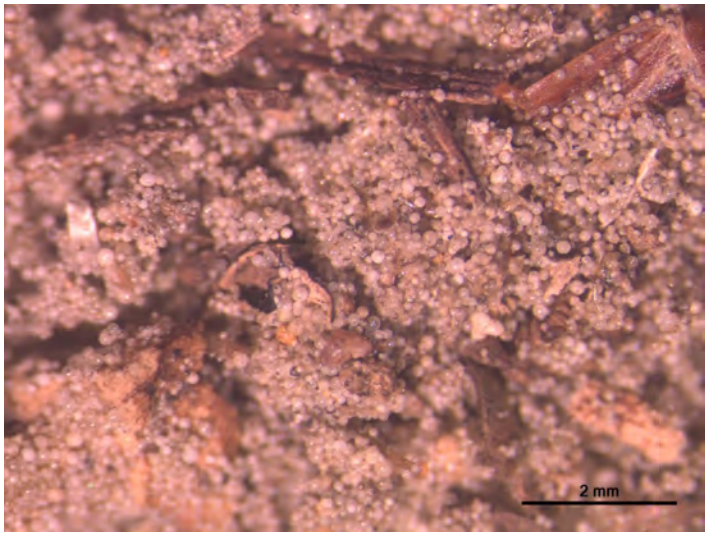

Figure 1. Stereoscope image of fly ash and plant material observed floating at the top of sample 12534AD0281.

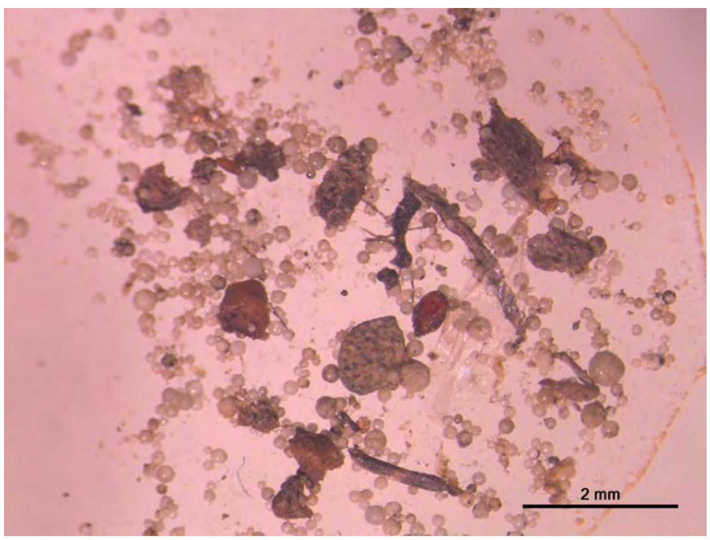

Figure 2. Stereoscope image of fly ash and plant material observed at the bottom of sample 12534AD0281.

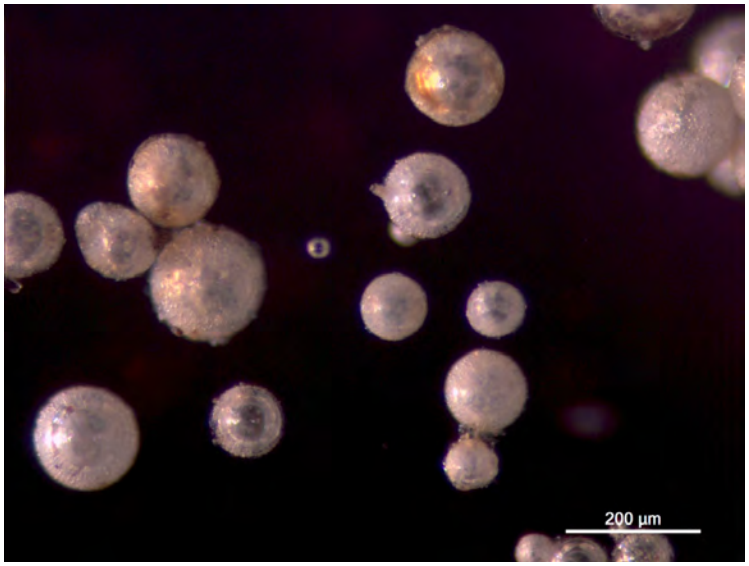

Figure 3. PLM image of fly ash cenospheres observed in sample 12534AD0281. Reflected (top) light illumination.

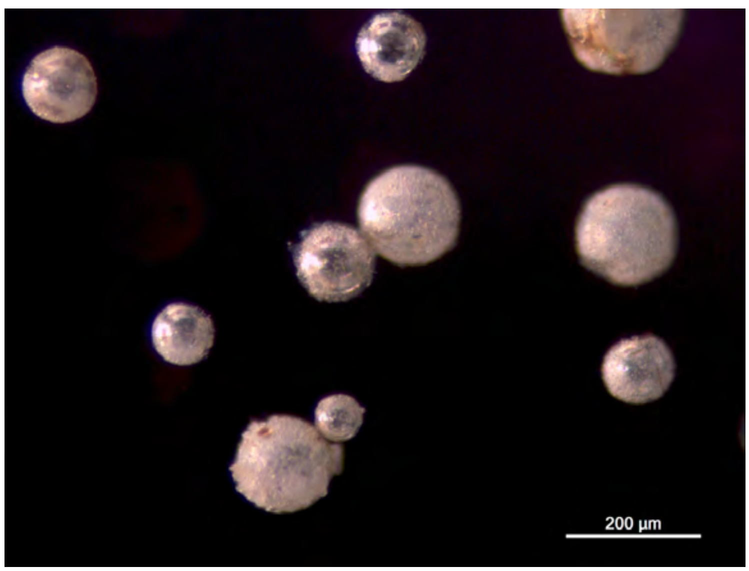

Figure 4. PLM image of fly ash cenospheres observed in sample 12534AD0281. Reflected (top) light illumination.

MVA SCIENTIFIC CONSULTANTS
Full Service Analytical Microscopy Laboratory

CHAIN OF CUSTODY

Project No. or Identification MVA12534

Client Sample ID	MVA ID*	Comments / Analytical Requests
OCPB-020918-CC	AD0281	Coal Combustion Waste microscopic +
02-09-18 collection		general characterization
Site: OCPB		

Relinquished by (sign): [signature]	Relinquished by (sign):
Via: Hand Delivery to UPS	Via:
Date: 02/28/18 Printed Name: Cade Kistler	Date: Printed Name:
Company: Mobile Baykeeper	Company:

Received by (sign): Kathy Jennings	Received by (sign):
Date: 3/2/18 Printed Name: KATHY JENNINGS	Date: Printed Name:
Company: MVA Scientific Consultants	Company: