A REPORT TO THE
BOARD OF DIRECTORS
OF
THE TENNESSEE VALLEY AUTHORITY
REGARDING
KINGSTON FACTUAL FINDINGS

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On December 22, 2008, the Tennessee Valley Authority ("TVA") experienced an environmental spill at its Kingston Fossil Plant, releasing 5.4 million cubic yards of fly ash sludge onto adjacent property and into the Emory River (the "Kingston Spill" or the "Spill"). McKenna Long & Aldridge LLP ("MLA") was retained by the TVA Board of Directors (the "Board") after the Spill to advise the Board on its legal duties and potential litigation exposure and to provide other advice related to Board oversight. Since early January 2009, MLA has been so advising the Board. MLA also was asked by the Board to prepare a factual report on the Kingston Spill, separate from its legal advice and work product analysis involving Kingston facts. The following report is in response to the Board's request and is independent from work that MLA has undertaken in providing legal advice.

A. Scope of McKenna Long & Aldridge Kingston Fact Finding.

In our factual investigation, our charge was to provide the Board with the facts as to the Kingston Spill. Our investigation used best practices governance and management systems, controls, standards and culture as a screen against which to examine the TVA practices to determine if there were gaps of which the Board needed to be aware so that it could proactively address them, thereby mitigating existing or future risks. In other words, we looked back at the Kingston Spill to provide a basis for the Board to improve TVA's governance, systems and controls to reduce the likelihood of similar or other harmful incidents that could be prevented by improvements to systems and controls and by setting performance expectations.

B. Summary of Findings.

The engineering, siting, construction, operations and maintenance of retention ponds are factors that must be coordinated and monitored from a central source of accountability pursuant to universally understood health, safety and environmental processes, standards, controls and a culture of accountability. "Too high," "too wet," "Foundation, Geometry, Material, Load" and similar characterizations seeking to explain the Kingston Spill miss the fundamental question,[1] which is: did system and culture failures allow such conditions to occur and remain undetected or unaddressed. The following are MLA's findings regarding the Kingston Spill specifically and the fossil byproduct ponds (retaining ash and other residues) generally. These findings demonstrate that the necessary systems, controls, standards and culture were not in place.

- **Lack of Clarity and Accountability for Ultimate Responsibility**. The number of TVA groups involved with the byproduct[2] retention ponds coupled with frequent reorganizations led to a lack of accountability. Although the Fossil Engineering Division ("Fossil Engineering") was tasked with ultimate governance of the ponds regarding safety, the Coal Combustion Byproducts Division ("Byproducts") conceded that any order to stop dredging from Fossil Engineering would be viewed as merely a

[1] AECOM Technology Corporation ("AECOM") provided a technical analysis of the physics of the spill on June 25, 2009. See http://www.tva.gov/kingston/rca/index.htm.

[2] Byproducts are the materials resulting from the combustion of coal at coal-fired power plants, including fly ash, bottom ash and, if scrubbers are employed at the plant, gypsum.

recommendation. Further, members of Fossil Engineering voiced concerns over the arrangement, indicating that they lacked tools, such as a stop work order, to enforce their decisions. The engineers conducted annual inspections, but did not follow-up on the recommendations until the next annual inspection, often repeating the same recommendations year after year. In practice, there was no ultimate authority in charge of the byproducts ponds until remediation was commenced after the Kingston Spill.

- **Lack of Standardization, Training and Metrics**. Despite maintaining wet ash ponds at five of its Fossil Plants, TVA did not have any standard procedures regarding operations and maintenance of wet ash ponds, instead allowing the activities and regimens at each location to be dictated by local personnel. TVA did not conduct standardized training for the engineers performing the annual inspections or for the individuals performing the daily inspections. Although manuals for ash handling were created for each facility in 2006, the manuals were never updated and were difficult for a non-engineer to comprehend, much less implement.

- **Siloed Responsibilities and Poor Communication**. No fewer than four separate TVA divisions had responsibilities related to TVA's ash retention facilities. Although the various responsibilities necessarily overlapped and were interdependent, communication between the groups was strained and in some instances, non-existent. For example, the ash handlers at Kingston continued dredging in the fall and winter of 2008, despite stopping in mid-November of 2007 under engineers' orders because of danger from excessive water from rain in the winter.[3] They continued dredging in the fall of 2008 because the engineers had not instructed them to stop; however, the engineers noted that no one had asked about continuing the dredging into the fall and winter.

- **Lack of Checks and Balances**. After the completion of the "starter" dikes for a new byproduct retention pond, TVA did not perform routine inspections to ensure that the pond was constructed pursuant to the engineered specifications. Because TVA lacked a robust Quality Assurance/Quality Control plan, when a deviation was uncovered, there was significant disagreement over the appropriate response resulting in a failure to act on a proper corrective action. The lack of Quality Assurance/Quality Control created an environment where employees felt empowered to ignore engineers and "build it better" than the drawings.

- **Lack of Prevention Priority and Resources**. The budget for routine maintenance of byproduct retention ponds was the responsibility of the individual plants. This included regular mowing and installing any "fixes" outlined in the annual inspection reports. The TVA budget process was an impediment to the upkeep of the ponds because the budget

[3]The 2009 Annual Inspection Report for Kingston, which was based on the physical inspection performed on October 20, 2008, contained the following: "Dredging to these cells was stopped in mid-November 2007 based on recommendations from EDS and Geosyntec Consultants, Inc. This preventative measure was taken to reduce water levels in the dredge cell through the winter months. Dredging restarted in March 2008 and was still in operation at the time of the inspection [October 2008]."

process was not formalized and tended to prioritize regulated assets over unregulated assets and then generating assets over non-generating assets. Under the historic budget process, plants received their "fair share" of the money coming to the Fossil Power Group, but this did not necessarily relate to the needs of the plant and certainly not the priorities of the Fossil Fleet.[4] The funds allocated by this ad hoc approach were inadequate for routine maintenance, creating a situation in which adequate inspections were impossible because the sides of the dikes were overgrown and maintenance needs compounded over time. During the remediation efforts following the Kingston Spill, seventeen dump trucks of material were removed from dikes at the Paradise Fossil Plant, which does not include the relatively large trees growing on the dikes, the removal of which had been recommended sporadically in the annual inspection reports since at least 1995. When Byproducts was reorganized after the Kingston Spill, two retention ponds were identified where, under current operating conditions, the capacity to take additional byproduct could be exhausted within two years, but there were no plans in place for addressing those situations.

- **Reactive Instead of Proactive**. In 2003 and 2006, seeps along the west side of the Kingston dredge cells were discovered. The "fixes" put in place to remedy these seeps were limited to patching the specific leaks. Investigating the cause of incidents beyond the specific physical occurrences into the functioning of systems is fundamental to a robust safety program. The system failings discussed herein were not detected in conjunction with these seeps, and no effort was made to leverage the lessons learned across the Fossil Fleet. Moreover, in 2000, Widows Creek experienced an incident very similar to its highly publicized gypsum spill that occurred in January 2009, less than three weeks after the Kingston Spill. The plant's staff determined that the 2000 incident was caused by the failure of a sealed abandoned weir. The fix was to remove the failed weir without addressing the other abandoned weirs at Widows Creek (such as the abandoned weir that gave way in 2009), or any other TVA facility. Additionally, an August 2005 incident in Pennsylvania during which 100 million gallons of fly ash spilled into the Delaware River through a breached plug in an ash settling pond did not prompt any response or study within TVA of TVA's own potential ash pond risks.

C. Construction of the Ash Retention Facility at the Kingston Fossil Plant—Storage Needs Drove Risk Decisions.

At the time of the Kingston Spill, the management of the byproduct retention ponds was fragmented, and the pieces were assigned to various groups within TVA without a clear designated owner. To fully understand the shortcomings that resulted from the lack of an ultimately accountable group, it is important to understand how the disposal ponds functioned prior to the Spill. Because the Spill occurred at Kingston, the activities detailed below are tailored to the Kingston Fossil Plant, but also are indicative of how the disposal facilities were managed at the other TVA fossil plants. The activities described below are the procedures that

[4] As used in this report, "Fossil Fleet" means TVA's eleven coal-fired steam plants: Johnsonville, Widows Creek, Shawnee, Kingston, Colbert, John Sevier, Gallatin, Paradise, Bull Run, Cumberland and Allen.

were in place at the time of the Kingston Spill; notably, the procedures have changed frequently over the last few decades and have been revised again since the Kingston Spill.[5]

1. Construction of Ash Retention Facilities.

Some of TVA's ash retention facilities, including the one at the Kingston Fossil Plant, consist of raised dikes that are continually elevated as byproduct is deposited inside. Therefore, the construction of the dikes is divided into two phases—initial construction and ongoing construction. Initial construction, which includes the planning phase, starts with a request from Byproducts to Fossil Engineering that explains the need and outlines the solution that the group would prefer to use. Fossil Engineering is then responsible for producing a detailed drawing of the new facility, including how the dikes will be constructed and how the byproduct will be stacked inside. In the past, Fossil Engineering generally designed TVA's Byproduct Facilities[6] in-house; recently, however, due in part to a smaller workforce, this work tends to be outsourced by Fossil Engineering to third-party engineers.

In conjunction with the design phase, TVA must procure a permit or a permit modification for the facility from the Solid Waste Division of the Tennessee Department of Environment and Conservation ("TDEC").[7] The permit application process requires TVA to submit the proposed drawings and certain supporting documentation, including compaction testing schedules and boring schedules. Due to the amount of information required, the permit application process generally takes at least two years to complete.[8] TDEC did not start permitting ash disposal facilities until the 1980s. Therefore, when the Kingston ash facility was constructed in the 1950s, and for thirty years thereafter, a permit from TDEC was not required for the Kingston ash facilities. In fact, TVA did not file its first application for a landfill permit for Kingston until the mid-1990s.[9] When the permit was finally issued in 2000, the Kingston dredge cells were already at an elevation of 800 feet, towering approximately sixty feet above the surface of the Emory River. By the time of the Spill, TVA had raised the dikes another twenty

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[5] For a description of the current operations, see Section F(2), Page 28.

[6] As used in this report, "Byproducts Facilities" means the ponds and other on-site storage facilities used by TVA to store the byproducts resulting from its coal-fired steam plants, including fly ash, bottom ash and gypsum.

[7] Some of TVA's facilities do not have Solid Waste Permits from TDEC because the facility is located outside of the state of Tennessee, or because the facility does not require a permit pursuant to TDEC's rules.

[8] The issued permit from TDEC dictates the allowed footprint of the disposal facility and the ultimate height of the facility.

[9] TVA initially applied for a Class IV landfill permit. During the application process, TDEC determined that Kingston was in fact a Class II landfill since "the facility is being constructed by raising dikes above grade and placing dredged material there." (Registration Authorizing Solid Waste Disposal Activities in Tennessee, Registrations Number: IDL 73-0094, dated September 26, 2000, issued to the Tennessee Valley Authority, Kingston Fossil Plant, Subsection 11(i).) In 2000, TVA received its Class II landfill permit, which has more restrictions than a Class IV landfill permit.

feet; the dredge cells were at an elevation 820 feet, at least forty feet above the adjacent Swan Pond Road, a road traveled often by both cars and school buses.

Following the design completion and permit approval, TVA contracted with a third-party contractor to construct the initial starter dikes[10] based on the drawings. Throughout the construction of the starter dikes, Fossil Engineering or the third party engineers, if applicable, would oversee the construction to ensure that the dike was built in accordance with the drawings. After the starter dike was completed, the ongoing raising of the dikes transitioned from a capital project to an operations and maintenance project, and construction became the responsibility of the ash handling group on site. At Kingston, the ash foreman was a TVA employee assigned to the Heavy Equipment Division ("HED").

For the life of the disposal facility, despite HED's handling responsibilities, Byproducts had authority over the movement of the ash. Based on freeboard requirements,[11] capacity issues and other factors, Byproducts decided when the ash settling pond would be dredged to a dredge cell. Because the stilling pond at Kingston has a small capacity, frequent dredging is required to maintain adequate capacity.[12] After Byproducts elected to dredge the material to the top of the ash stacks, HED performed the actual dredging, deciding into which dredge cell the ash would be dredged. As each dredge cell neared capacity, HED raised the dikes to increase the cell's capacity; the plans for each such dike lift were included in the original drawings, and the ash foreman was tasked with following such drawings as TVA built up the dikes to increase storage capacity. The dikes surrounding the dredge cells were raised using compacted byproduct. Originally, most of the dikes were constructed of heavier bottom ash. As the market for bottom ash grew,[13] however, the dikes were built increasingly with a fly ash and bottom ash mixture. In 2002, Fossil Engineering approved the ongoing construction of the dikes with fly ash alone, concluding "the factor of safety went up slightly after substituting the apparently weaker material in the dikes."[14]

2. History of the Kingston Ash Retention Facilities.

The Kingston Fossil Plant has nine generating units that create approximately ten billion kilowatt-hours of electricity annually. Approximately 360,000 cubic yards of coal byproduct results annually from the burning. Consistent with TVA's initial approach when building all of

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[10] A starter dike is the initial dike constructed at the base of a stack to begin the process of storing fly ash.

[11] Freeboard is the distance between normal water level and the top of a structure, such as a dike, that impounds or restrains water.

[12] TVA must actively dredge the Kingston ash pond four to five days a week at least eight to nine months each year to maintain adequate settling capacity.

[13] Bottom ash is reused beneficially more frequently than fly ash, since its primary uses are as structural fill and road base. The primary use for fly ash is as an additive in concrete and cement products, which requires the fly ash to have limited carbon content.

[14] Tennessee Valley Authority, Kingston Annual Inspection Report (2002).

its fossil plants, TVA opted to create on-site storage facilities for the byproduct resulting from Kingston's coal burning operations. Each fossil plant has a unique structure for its storage facility based, at least in part, on the local topography. The structure for the Kingston facility, not unlike other TVA facilities and other similar industry facilities, developed over time as capacity needs increased.

Under the initial construction plans, TVA selected approximately fifty-nine acres north of the Kingston Fossil Plant for ash disposal. The selected area was a pond that adjoined the Emory River and was known by locals as Swan Pond. For its initial ash disposal needs, TVA created a disposal area in the location currently known as the ball field. To contain this disposal area, a dike was built to the north and east of the ball field area; these are known as the North Dike[15] and East Dike, respectively. The North Dike bounded the northern end of the disposal area, while the East Dike bounded the eastern side and provided a barrier between the disposal area to the west and the plant's water intake valve to the east. As part of the initial construction, TVA also constructed the Road Dike, which extended from the north end of the East Dike to the Emory River, thereby creating the inlet of the Emory River that supplies the plant's intake valve.[16] At the conclusion of the initial construction, the top of the North Dike was at an elevation of 746 feet and the top of the East Dike was at an elevation of 750 feet. At this point, TVA had tentative designs to build a future ash disposal area immediately north of the ball field area, which would provide a four-times greater disposal capacity.[17]

TVA realized those plans when it converted the rest of Swan Pond into an ash pond by confining the pond using existing islands as a rough guide for the location of the perimeter dike, known as Dike C. Dike C started at Swan Pond Road and extended east, enclosing Swan Pond from the adjoining coves and the Emory River and ultimately connecting with the north end of Road Dike. By the end of 1958, TVA completed the ash pond portion of the disposal area when the top of Dike C reached an elevation of 748 feet.[18]

Most of the initial dikes were constructed of imported local "earth and fine grained material" from the base of Swan Pond to form a "relatively impervious dam."[19] The later constructed West Dike, which was built along the west side of the ball field area, and the south end of Dike C were built and widened with ash.[20] The West Dike enclosed the ball field area by

[15] There is occasional confusion introduced by the term "North Dike." The North Dike was initially along the north side of the storage facility. However, over time, TVA expanded the Kingston Byproduct Facility to the north of the North Dike. Currently, the North Dike is actually located on the south end of the storage facility that failed.

[16] The Kingston Steam Plant, A Report on the Planning, Design, Construction, Costs, and First Power Operations, Technical Report No. 34,116 (1965) ("Brown Book").

[17] *Id*.

[18] Follow-Up Questions for Written Submission, 4 (January 8, 2009).

[19] *Id*.

[20] Tennessee Valley Authority, Kingston Annual Inspection Report (1973).

joining the west end of the North Dike to the south end of the East Dike, creating a fully enclosed triangle. At the time of construction, TVA anticipated that each of the dikes would be raised, using ash for fill material, as additional disposal capacity was needed.

The initial design for the disposal facility provided that all of the ash would be sluiced into the ball field area. Part of this ash was picked up with a dragline, allowed to drain, and then dry-hauled to the ash pond area, adjacent to and north of the North Dike, which Dike C had previously enclosed from the Emory River, where it was deposited in stages. As each stage reached the elevation of the top of the North Dike, it was covered with earth and seeded, thereby widening the North Dike. The ash water, carrying some light ash that was not picked up by the dragline, flowed through two plant-constructed spillways and skimmers into the ash pond area where the rest of the ash settled out. After the ash settled out, the water then flowed into the Emory River through two standard spillways that went through Dike C. During the 1970s, the dry-hauled ash was used to fill most of the ball field area to the elevation of the top of the West and North Dikes to make a construction area for planned new stacks.[21]

Beginning in 1974, the outside fifteen feet of the top of Dike C were raised approximately 1.5 feet with material that was excavated from the foundation area of the new stacks. The material was hauled to the dike in trucks, end dumped, spread and compacted with dozers and patrol graders. The raising of the outside fifteen feet of the top of Dike C was done to ensure adequate freeboard when the water level inside the ash pond area was raised. This material was used for freeboard purposes only and would eventually form the top of a berm when Dike C was raised for additional storage capacity.[22]

In 1978, there was a second raising of Dike C and new construction of Dike B (along the eastern edge of Swan Pond Road). Both were constructed with rolled earth or bottom ash materials. The dikes were designed to have a width of sixteen feet at the top with 2:1 side slopes and no riprap.[23] The design further called for the earth fill to be compacted to ninety-five percent maximum dry density and founded upon heavy ash that was dumped on the inside of the original dikes. During this same period of construction, the stilling pond was formed in the southeast corner of the ash pond area by constructing a divider dike with heavy ash from Dike C to the Road Dike, thereby creating a triangular shaped stilling pond in the southeast corner. The divider dike was built with a flow-through spillway, which allowed water from the ash pond area to flow into the stilling pool. Six new standard spillways with skimmers were then constructed in the stilling pool with outlet pipes through the Road Dike, which allowed the water in the stilling pool to discharge into the intake channel.[24]

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[21] Tennessee Valley Authority, Kingston Annual Inspection Report (1973).

[22] Tennessee Valley Authority, Kingston Annual Inspection Report (1974).

[23] Riprap is a permanent, erosion-resistant groundcover of large, loose angular stone.

[24] Tennessee Valley Authority, Kingston Annual Inspection Report (1978).

Although the exact date of construction is unclear from TVA's records, a deflector dike was constructed in the ash pond area to the north of the North Dike. The deflector dike is first reflected on the 1976 drawings of the ash disposal area. The deflector dike served to divert the ash slurry mixture that continued to the ash pond to the left, allowing more time for the ash to settle out of the water.[25]

In 1982, TVA began constructing the dredge cell structure in place at the time of the Kingston Spill. The construction of these dikes was also motivated by the storage of ash deposits from ongoing dredging.[26] The construction started with an interior dike of bottom ash, extending northeast from the existing deflector dike.[27] In 1984, the new interior dike in the dredge cell area, which had not been designed by engineers, failed, releasing some of the previously dredged ash back into the ash pond. To provide for storage for the dredged material after the failure, TVA extended the deflector dike to intersect with Dike B, where Swan Pond Road is located. In essence, this extension served as a foundation for dredge cell 1, which was completed in 1987.[28] After the failure of the interior dike in 1984, the engineer performing the annual inspection noted, "engineered interior dikes could reduce the risks of their failure."[29] This sentiment was echoed again in the 1986 inspection, when the engineer noted, "while the raising of internal dikes may be essential for the storage of ash due to ever decreasing available space these dikes should be analyzed for structural stability."[30] In the following inspection report in 1987, the engineer notes "future dredge cells 2 and 3 have been analyzed for stability by FEP [Fossil Engineering Project]."[31] The report does not state if dredge cell 1 was analyzed for stability.

In 1986, a finger dike was constructed of ash, extending several hundred feet southeast of the dike adjacent to Swan Pond Road.[32] Over time, this finger dike became a dividing dike between dredge cells 2 and 3. In 1986, a new deflector dike was also added to the ash pond to steer the ash slurry discharged from two spillways into the left side of the ash pond.

By 1987, dredge cell 1, the southern most cell located directly north of the North Dike, was complete. The external dikes of dredge cell 1 were constructed of compacted bottom ash and fly ash. Dredge cell 2, the northern most dredge cell, and dredge cell 3, located between

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[25] *Id*.

[26] Tennessee Valley Authority, Kingston Annual Inspection Report (1984).

[27] Tennessee Valley Authority, Kingston Annual Inspection Report (1982).

[28] Tennessee Valley Authority, Kingston Annual Inspection Report (1987).

[29] Tennessee Valley Authority, Kingston Annual Inspection Report (1984).

[30] Tennessee Valley Authority, Kingston Annual Inspection Report (1986).

[31] Tennessee Valley Authority, Kingston Annual Inspection Report (1987).

[32] Tennessee Valley Authority, Kingston Annual Inspection Report (1986).

dredge cells 1 and 2, remained under construction.[33] Dredge cell 2 was set 200 feet back from Dike C, since Dike C was not designed for additional interior cell stacking loads.[34] Dredge cell 2 was completed the next year in 1988. The records on dredge cell 3 are less complete.[35] It appears that the cell was cleaned out in 1990 and in 1993. By 1994, dredge cell 3 was receiving ash dredged from the ash pond. TVA continued to fill the dredge cells with ash from the ash pond as needed. By 2000, the ash dredged into dredge cells 2 and 3 had covered the dividing dike, creating in essence one larger cell where two had been previously.[36]

With the construction of the primary ash disposal scheme complete, TVA continued to operate the Kingston Fossil Plant. The ash byproduct was slurried through one of two channels, the bottom ash channel and the fly ash channel, to the ash pond area. The bottom ash was regularly draglined out of the channel and used either in dike construction, or, as the marketing of the product increased, it was sold to third parties for beneficial uses.[37] In the ash pond, the fly ash slurry separated into ash and water as the suspended fly ash fell to the bottom of the pond. The water drained from the ash pond through a spillway into the neighboring stilling pond, where any remaining ash could settle out of the water, before the water passed through a second spillway into an inlet of the Emory River. In 2005, TVA installed new spillways from the ash pond to the stilling pond to replace the aging structures then in use.[38] The ash that settled to the bottom of the ash pond was dredged regularly into the dredge cells, where it was stacked in successive plats.

In recent years, as additional capacity was needed, the dikes were raised primarily through a process that involved rim ditching. As the ash in the dredge cell reached the elevation of the dike, HED would dig a rim ditch a few feet along the inside of the dike, depositing the dug out material on the top of the dike. Each raise of the dike generally was between eight to twelve inches. As a result of this method, each subsequent lift of the dike rested in part on the ash previously deposited in the dredge cell. After each raising, the newly deposited layer of ash was compacted using rubber-tired machinery, primarily plane scrappers and dozers. As the dikes were raised, the circumference of the dredge cell shrank and, therefore, in the subsequent year, TVA stacked the resulting byproduct in a smaller area, which increased the load in the stack's center.

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[33] Tennessee Valley Authority, Kingston Annual Inspection Report (1987).

[34] Tennessee Valley Authority, Kingston Annual Inspection Report (1984).

[35] Tennessee Valley Authority Kingston Annual Inspection Reports for 1989, 1991 and 1992 were not produced by TVA and, therefore, were not included in our review.

[36] Tennessee Valley Authority, Kingston Annual Inspection Report (2000).

[37] As indicated previously, bottom ash is regularly used as structural fill and as road base.

[38] Tennessee Valley Authority, Kingston Annual Inspection Report (2005).

3. Storage Needs Increase Risks of Leaks.

With the constant demands to stack the ash higher came warning signs of potential problems. In October 2003, TVA experienced a blow-out on the west side of the dredge cells. Ash was released from the dredge cell, filling up a nearby drainage ditch and overflowing onto the adjacent Swan Pond Road. Although the depression area was a small slough, approximately five by ten feet in area, TVA employees present after the incident described a more serious situation than the size would indicate. One employee even stated that he felt that they had narrowly avoided disaster. Following the incident, TVA's internal engineers initially focused on stabilizing the site,[39] while Byproducts explored options for byproducts storage in the interim.[40] After stabilizing the dredge cells, in the first quarter of 2004, TVA hired Parsons E&C,[41] an outside engineering firm, to help engineer the proper fix for the dredge cell.[42] To review Parsons E&C's work, TVA hired Geosyntec Consultants ("Geosyntec") to perform an evaluation of the site and to review Parsons E&C's recommendations. Although the result was described as a "battle of the experts," in the end, TVA received presentations from both experts and decided (i) to install a riprap drainage ditch along the toe of the dredge cells along Swan Pond Road, and (ii) to install 8" underdrains, or French drains, on three upper benches to lower the phreatic surface and control seepage at the dike's toe.[43] Upon completion of the installation of the engineered fixes, TVA resumed dredging ash into the dredge cells in November 2005.

A year later, in November 2006, within 100 yards of the 2003 incident, a smaller slope failure occurred, causing ash to seep from the dike into the adjacent ditch. This time, TVA hired Geosyntec to assess the situation and engineer a fix to address the seepage. Following an elaborate geotechnical investigation process, including excavation of the affected slope, Geosyntec installed a well point dewatering and piezometer monitoring system along

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[39] To stabilize the site, TVA stopped dredging and employed a dipping and hauling method to increase byproduct capacity in the settling pond, thereby permitting the plant to continue its operations.

[40] At the request of TVA, following the 2003 incident, TDEC permitted the construction of the Phase 1 Interim Dredge Cell along the east side of the dredge cells, by enclosing a portion of the ash pond. This expansion area was constructed in 2004 and used regularly until 2006, when dredging resumed.

[41] Parsons E&C is currently known as Worley Parsons.

[42] With the introduction of the outside firm, the project expanded in scope as TVA grappled with both fixing the dredge cell and identifying a storage location for gypsum that would be produced at the plant in the future. At this point, TVA had already decided to install scrubbers at the Kingston Fossil Plant, but had not yet determined how the resulting gypsum would be stored. Because TVA had already hired Parsons E&C to look at the dredge cell issue, they also tasked the engineers with exploring options for gypsum disposal, including commingling the two products in the existing facility. One employee described the process as "getting wrapped around the axle," when the scope of the project was expanded to include gypsum disposal. Ultimately, TVA decided not to commingle fly ash with the gypsum.

[43] After the 2003 incident, TVA considered a number of alternatives for fly ash storage, including, among others (i) the conversion to a dry ash collection system, (ii) the installation of a synthetic liner, or (iii) the construction of a vibrating beam cut-off wall.

approximately 500 feet of the slope.[44] After considering several repair options, spring boxes, additional riprap and geonet were installed along the slope to address the drainage issues.[45] By April 2007, TVA had resumed dredging fly ash into the dredge cells.

In 2006, TVA also requested a permit modification for lateral expansion of the dredge cells, which would be located inside the existing stilling pond and cover approximately half of the pond's surface area. TDEC granted the modification, and by 2008, TVA had started construction of the divider dike inside the stilling pond to create the lateral expansion dredge cell. At the time of the Kingston Spill, Kingston's ash disposal facility consisted of a settling pond, with construction of an interior dike underway to provide for a future dredge cell expansion, a stilling pond, three initial dredge cells and an interim dredge cell.

D. Fragmented Ash Pond Management.

1. Form Over Substance Inspections.

Over the years, TVA developed an inspection program for the Byproduct Facilities resulting in various inspections at various times. The ash foreman performed a daily visual inspection of the ponds, indicating on a standard worksheet which wells in the dikes had flowing water and which, if any, had particles in the water. Quarterly, TDEC's Solid Waste Division conducted an inspection of the facility that the Kingston Program Administrator Environmental ("PAE") attended. The quarterly inspection was a visual inspection that lasted for about an hour. During the inspection, the TDEC inspector completed a checklist and provided a copy to the PAE upon completion. Annually, Fossil Engineering performed a full visual inspection of the disposal facility. The inspection process took about a day to complete at Kingston.[46] In the months following the inspection's completion, the engineer drafted an annual inspection report that detailed his findings. Often the report was drafted using the previous report and updating paragraphs as necessary. As noted below, the inspection process varied in rigor and quality with the individual inspectors involved.

2. Inconsistent Oversight of Byproduct Disposal Facilities.

As alluded to earlier, oversight of the retention ponds has remained in constant flux for at least the last thirty years. Most notably, Byproducts has been expanded and reduced at least three times since the 1980s. While Byproducts always has had the responsibility of marketing the byproduct for beneficial uses, the number of personnel assigned to the group has been increased periodically as the fossil plants neared capacity in their disposal facilities and decreased once the capacity issue had been addressed adequately. During its expanded periods,

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[44] The well point and piezometer system provided TVA with monthly monitoring of the water level in the dike.

[45] A spring box is a thirty-six inch concrete pipe that provides control relief of excess water pressure. As indicated previously, riprap is a permanent, erosion resistant groundcover of large, loose angular stone. Geonet is a permeable fabric used to permit draining while restraining particles.

[46] At the larger facilities, such as the Paradise Fossil Plant, the annual inspection took two to three days to complete.

the group's primary charge was to locate additional storage for the byproduct, whether on-site or offsite. Safety and environmental issues, while likely considerations, were not necessarily determining factors. For example, in the 1990s, TVA awarded a contract to a third party vendor to remove ash from one of Johnsonville Fossil Plant's ash cells to fill in a local reclaimed quarry. Although the contract provided the plant with additional disposal capacity, during the operation, the vendor received multiple environmental violations at its disposal site.

In addition to the fluctuations in Byproducts, TVA repeatedly has reassigned the responsibility for the physical handling of the ash. In the 1980s, TVA hired contractors to handle dredging operations at Kingston.[47] By the early 1990s, ash handling was assigned to TVA employees who ultimately reported to the plant manager. In 1995, TVA reassigned the management of both ash disposal facilities and the yard to a Yard Ops Division, which did not report to the local plant manager. In 2003, TVA again separated the management of the ash disposal facility when TVA split the group from Yard Ops and moved it under HED.[48] Before the assignment in 2003, HED did not have prior experience with ongoing management of ash disposal facilities. In the fall of 2008, TVA decided to outsource ash handling to third party contractors in an effort to reduce cost and increase efficiency.[49] This progression over the last thirty years has resulted in different leadership, with varying degrees of expertise, handling the byproduct at TVA's facilities.

E. Failure of Adequate Systems, Controls and Accountability at Kingston.

1. Lack of Clarity for Ultimate Responsibility.

The number of TVA groups involved with the ash retention ponds coupled with frequent reorganizations led to a lack of accountability for the ponds. Although many employees alluded to policies that gave Fossil Engineering governance of safety matters, none could readily provide a written policy that confirmed the assertion. The lack of easily accessible documentation or a clear mandate of responsibility made it difficult to determine which party was ultimately responsible for the management of the ash retention ponds. Without a clearly responsible party, the groups often bickered as each believed the other was making a "power grab" when it tried to assert authority that had not been unambiguously assigned to it.

For example, as part of the fix for the 2006 slough at Kingston, TVA installed a well and piezometer monitoring system along the west side of the ash dredge cells. Pursuant to the monitoring plans, each month, a member of TVA's Environmental East team, based in

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[47] Tennessee Valley Authority, Kingston Annual Inspection Report (1987).

[48] HED is external to the Fossil Power Group and it charged with overseeing TVA's heavy equipment, including mobile cranes, aerial lifts, forklifts and rigging, and their respective operators. *See* TVA Website, Heavy Equipment Division page, http://www.tva.gov/power/hequip01.htm.

[49] Although TVA had made a decision in the fall of 2008 to outsource ash handling, TVA employees were still handling the ash at Kingston at the time of the Kingston Spill.

Knoxville, would visit the plant to measure the water level in the wells and piezometers.[50] The readings were sent to Fossil Engineering in Chattanooga, who entered the data into a computer program that had been created by Geosyntec in conjunction with the 2006 dredge cell fix.[51] The program charted the entries on a color coded graph containing red, green and yellow sections. If a piezometer data point fell within the red area of the graph, Fossil Engineering was tasked with informing Byproducts and instructing them to stop dredging immediately at Kingston. However, Byproducts employees indicated that had they received such a call from Fossil Engineering, the instruction to stop dredging would have been a recommendation rather than a requirement. Because Byproducts' mission was to ensure that there was adequate space for the plant to deposit the byproduct, its primary concern was not what the monitoring dictated, but instead, what its need for space dictated. Even after conceding that Fossil Engineering was tasked with ultimate governance of the ponds regarding safety, Byproducts still took the position that any order to stop dredging from Fossil Engineering would only be a recommendation.

During our investigation, members of Fossil Engineering also voiced concerns over the governance arrangement, indicating that they lacked the tools to enforce their decisions. When we inquired how an engineer would go about stopping a situation that he deemed to be unsafe, we received flippant responses such as "wave your hands around" or "stomp your feet." Although clearly not serious answers, the responses highlighted the fact that TVA did not have a procedure in place for stopping such activities on the spot. The lack of a stop-work order or similar documentation caused the engineers to feel that any concerns would not be taken seriously.

This perceived lack of authority was also evident in the reaction that the engineer's annual inspection report received. When the annual inspection report was complete, the inspection report was sent to various TVA employees, including the plant manager, Byproducts, HED, the plant's Program Administrator Environmental and the "dam safety" files. Although the report was sent to numerous individuals, none of the recipients were charged with reviewing or implementing the recommendations in the report. In fact, employees in Fossil Engineering openly doubted if some of the recipients, including the plant manager, ever read the reports. Regardless, Fossil Engineering was not required to follow-up on the implementation of its recommendations, and due to a lack of authority, never did. As a result, many of the recommendations either were not implemented or implemented and not maintained. If TVA had clearly assigned the ultimate authority for the ponds to a single division, it is unlikely that such inaction would have continued unaddressed.

2. Complete Lack of Standardization, Training and Metrics.

Despite TVA's maintaining wet ash ponds at five of its fossil facilities, the activities and regimens at each fossil plant were established by local employees, rather than pursuant to a standardized procedure that applied across the Fossil Fleet. For example, TVA did not have a

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50 The December 2008 reading of the instrumentation was scheduled for December 22, 2008, the day of the Kingston Spill.

51 *See* Section C(3), Page 11 for a discussion of the 2006 failure and the subsequent fix.

policy regarding pond maintenance during rain, despite the increased pressure rain water would place on the dikes. To compensate for the lack of a policy, at Kingston, the responsible employee devised his own plan, which consisted of visually monitoring the dikes after receiving two inches of rain or every two hours during an extended rain storm. Other plants may have had entirely different plans, or none at all. Regardless of the adequacy of the devised rain monitoring program at Kingston, because the employee tasked with monitoring the ponds devised his own rainfall monitoring plan, adherence to the plan was apparently unmonitored. Additionally, without standard procedures, new procedures could be developed by each new employee assigned to a position, potentially eliminating the benefit of consistency.

The lack of consistency between the plants can be attributed in part to a lack of training and manuals. The ash handlers were tasked with constructing the dikes in accordance with precise engineered plans, which they were not trained to read. Whereas in previous decades operations had engineers on staff to act as the liaison between the Fossil Engineering and the operators, HED did not have engineers on staff to "translate" the drawings for the operators. Instead, the operators were handed engineered drawings of the retention ponds and expected to complete the construction accordingly. In 2006, after years of construction miscues, Byproducts recognized that the HED operators were stacking the byproducts and building facilities without strict adherence to engineered plans.[52] In an effort to address this shortcoming, Byproducts created a manual in 2006 for the operators, the first of its kind, that contained instructions for dredging, including where the dredged material was to be placed over the next three years. The manuals were site-specific and thorough, providing dredging and placement instructions that accounted for the season and the weather. These first manuals, while an improvement, were too complex for most of the HED operators to understand. Although Byproducts had intended to update the manuals annually to address the comprehension issues, the manuals never were updated after being issued in 2006.

The lack of training and manuals was not isolated to HED operators; Fossil Engineering also did not benefit from specialized training or manuals for the inspection process. Despite having a certified Federal Dam Safety Officer on its staff, TVA did not use federal dam safety standards or any articulated standards during its inspection of the byproduct disposal facilities.[53] In fact, TVA's training for the dike stability inspections was limited to on-the-job mentoring.[54] Without the benefit of a standardized checklist or a detailed written inspection procedure, the

[52] Notably, employees repeatedly asserted that Kingston was likely the plant closest to the engineered designs, because of the geography of the Kingston stack and the experience of the team moving the ash at Kingston.

[53] Initially, the absence of incorporating dam safety standards into the inspection of Byproduct Facilities appeared to have been solely the result of the lack of communications between the two groups within TVA. This lack of communication may continue to explain the lack of implementation of these standards into a byproduct inspection regime within the last decade, but memoranda from the late 1980s (and as late as 1996) reveal that the issue of including the ash ponds as part of the dam safety program was raised and rejected.

[54] During an engineer's first inspection of a particular facility, an experienced engineer, with prior inspection experience at the facility, would attend the inspection to point out any unique characteristics and to provide guidance on what to inspect. During subsequent inspections of the facility, the new engineer was expected to conduct the inspection without such assistance.

engineers often structured an inspection using the previous inspection reports, examining which issues from the previous years still existed and noting any new issues.[55] Without uniform standards or training, however, the attributes of permissible features, such as the size of trees, varied by engineer and resulted in inconsistent recommendations to the plants. For example, in reviewing the annual inspection reports, it was apparent that some engineers would recommend the removal of all trees, regardless of size, while others would recommend leaving larger trees in place, asserting the damage to remove the larger trees would be greater than leaving them in place.[56]

Although inspection manuals did not exist, Fossil Engineering did have other manuals and/or guides that appear to have been ignored or forgotten over time. For example, Fossil Engineering issued a Civil Design Guide in 1978 (that was amended in 1981), which contained a guide for selecting the desirable factor of safety for holding ponds (including ash ponds). The guide stated that, at the end of construction, the desirable factor of safety for holding ponds with a raised dike and pool was 1.5. It is unclear, however, how the guide was used and how closely the guide was followed; in 1985, an attachment to a memorandum regarding Kingston's Dike C indicated that the dike's factor of safety was 1.2.[57] In early 2009, Fossil Engineering employees were not aware of the existence of this document.[58]

3. Absence of Controls, Checks and Balances.

a. Dikes Construction Variances from Drawings.

Over time, the lack of authority coupled with deficient or non-existent standards created a system without adequate checks and balances to ensure that each group effectively performed its assigned responsibilities. The primary example of the lack of checks and balances is the lack of oversight of the on-going dike construction. Although Fossil Engineering had created the drawings for the disposal facilities, the group was not funded to ensure that the dikes were raised in accordance with the drawing's specifications. Without regular review of the dikes' construction, the ash retention facilities deviated from the plans. The deviations varied from

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[55] The inspectors focused on general maintenance issues, looking for trees growing in the dikes, animal boroughs, wetness or sloughing.

[56] Another variation occurred in mowing frequency. Some engineers indicated in their reports that annual mowings of the facilities would be sufficient, while others repeatedly recommended a regular, more frequent mowing schedule.

[57] The 1985 memorandum, titled "Kingston Steam Plant – Dike C Soils Investigation and Engineering Study Results," contained the following "As you are aware, the dike was not built according to design drawings…The minimum 'as-built' factor of safety is 1.2±….Since a factor of safety of 1.5 is desirable, we recommend daily inspections of this dike by plant personnel. Construction of an engineered dredge pond dike adjacent to Dike C will not increase the probability of a slide failure of the exterior slope; however, the dredge pond would increase the risk of seepage thru Dike C."

[58] Because the document contained information about a number of retention structures including dams, TVA's dam safety team recently had the hard copy of the document converted to an electronic document to form the basis of a new dam safety manual. The document did not appear to have been in use by Fossil Engineering.

expansion outside of the permitted footprint to the incorrect location of certain designed features.[59] As an example, one fossil plant had a ditch located fifty feet from the location designated on the design drawing. Over time, small deviations became large variations, and without a trained engineer or surveyor monitoring the process and updating the drawings, the original drawing for the facility became obsolete, leaving TVA without a correct record of its facility.

b. Lack of a Meaningful Quality Assurance Plan.

TVA also lacked a meaningful Quality Assurance and Quality Control Program ("QA/QC").[60] When asked about testing of the dikes, the employees indicated that testing of compaction and moisture content of the dikes was required by the solid waste permit. TVA outsourced this testing to a third party engineer.[61] While the testing complied with TDEC's requirements, TVA did not perform other quality control tests to ensure that the dikes were constructed in accordance with the plans. For example, although the plans called for a bottom ash and fly ash mixture, TVA did not conduct regular borings of the dike to ensure that the material used was consistent with the plans. Notably, when TVA excavated the northeast corner of the Kingston settlement pond to install new spillways in 2005, the material excavated contained trash and other foreign objects in quantities large enough to require TVA to deposit the excavated material in a landfill rather than reuse it in dike construction. Further, the existence of foreign material in the dike impacts the engineers' stability calculations for the dike and can result in an incorrectly calculated factor of safety.

The lack of QA/QC manifested itself in other ways. Without regular supervision from engineers, TVA employees often devised ways to do their jobs better, not recognizing the potential negative consequences of their actions. At Kingston, one of the HED employees relayed that they had built the dikes "better than the drawings" by extending the dike's width to better accommodate the ash handling equipment's size.[62] At Cumberland Fossil Plant, TVA employees opted to wet-sluice gypsum to the gypsum stack, despite the fact that the gypsum

[59] At Widows Creek, engineers noted in the annual inspection reports conducted from 2001 to 2004 that the gypsum stack had been stacked without the inclusion of underdrains that were required by the drawings. The inspectors noted in the absence of the drains, "the factors of safety for the stack slopes…, <u>which are the design basis for the stack configuration</u>, will not be applicable." (*Emphasis in the original*.)

[60] ISO 9000 defines quality assurance as "a set of activities intended to establish confidence that quality requirements <u>will be</u> met" and defines quality control as "set of activities intended to ensure that quality requirements <u>are actually being</u> met." (*Emphasis added*.)

[61] While employees are certain that TVA complies with the testing requirements articulated in the permit, one senior manager indicated that he had been unable to find written records on the testing, which prohibited TVA from reviewing the historical record after the Kingston Spill.

[62] The standard equipment size was fourteen-feet wide so, instead of building the benches to sixteen feet as called for in the drawings, Kingston's ash-handling team built the benches twenty-feet wide to better accommodate the equipment.

stack had not received substantial gypsum in years, causing serious safety concerns.[63] Presumably, the decision was not made with ill-will, but was instead an effort to perform the assigned task without awareness of potential safety considerations. Without a QA/QC program, TVA was unable to identify these potentially harmful deviations. In fact, the wet-sluice to the gypsum stack was not uncovered until TVA began its post-Kingston remediation efforts.[64]

4. Siloed Responsibilities and Poor Communication.

Throughout the course of our investigation, the concept of informational or organizational silos[65] repeatedly was used to identify a prevalent problem within TVA. Employees tended to use the concept of "silos" to refer to two related, but yet distinct, phenomena — (1) the more common use of the term indicating a lack of collaboration among various business units across TVA or within a particular department and (2) the tendency within TVA not to readily share information with one's superiors.

a. Background.

From its beginning, TVA was designed to be "a corporation clothed with the power of government but possessed of the flexibility and initiative of private enterprise."[66] The TVA Act provided that a three-member board, whose members were appointed by the President, confirmed by the Senate and served for nine-year terms, would preside over TVA, both making and implementing TVA's policies. But soon after TVA's creation and intermittently thereafter, questions surfaced in Congress and in thought centers as to whether the political appointee

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[63] Cumberland Fossil Plant sells its gypsum byproduct to a wall board plant located on an adjacent property. The wall board plant dewaters the gypsum, retains the byproduct, and sends water with only minimal byproduct into the pond. Despite a warning in the 2008 annual inspection report that TVA could have issues with the pond if the wall board company cut production, when the wall board company cut production in 2009, TVA employees merely redirected the sluice to the pond, increasing the load placed on the dikes.

[64] TVA also uncovered other operational issues as part of its post-Kingston remediation efforts. For example, at Bull Run Fossil Plant, TVA determined that the plant's equipment for dry stacking was inoperable and as a result, the plant had returned to wet sluicing to a legacy pond. The change in operations reduced the plant's remaining capacity from six years to two years. The discovery caused TVA to prioritize the repair of the dry system.

[65] The term silo is currently popular in the business and organizational communities to describe a lack of communication and common goals between departments in an organization. The silo gets its name from the farm storage silo, because there could be two silos right next to each other and if people were inside them they would not be able to communicate, because silos are tall, narrow buildings with no windows and are supposed to be airtight. The expression is typically applied to management systems where the focus is inward and information communication is vertical. Critics of silos contend that managers serve as information gatekeepers, making timely coordination and communication among departments difficult to achieve, and seamless interoperability with external parties impractical. They hold that silos tend to limit productivity in practically all organizations, provide greater opportunity for security lapses and privacy breaches, and frustrate consumers who increasingly expect information to be immediately available and complete.

[66] Franklin D. Roosevelt, *The Public Papers and Addresses of Franklin D. Roosevelt, Volume 2, The Year of Crisis, 1933* 122 (1938).

triumvirate board could allow TVA to achieve "the flexibility and initiative of private enterprise." It has been advanced consistently by many that the original governance structure, which was, in effect, a three-headed executive, created organizational inefficiencies and patterns of behavior that combined with political instability to rob TVA of its intended private enterprise attributes.

It was recognized in the 1980s that TVA needed the benefits of private-sector governance, management systems, controls and standards that would provide private-sector agility to deal with constant market changes. In 1987, in response to TVA's nuclear safety issues and the sustained regular increases in TVA's rates,[67] the Southern States Energy Alliance Board created an advisory committee (the "Baliles Committee") to study TVA, to identify any shortcomings and to provide recommendations for rectifying them. In its report (the "Baliles Report"), the Baliles Committee found that the management structure of TVA presented certain defined problems, including:

- it was inimical to strong executive leadership and timely decision making;
- it divided responsibility and accountability for management results;
- it limited diversity of strategic views;
- it fostered insularity and limited exposure to external view points; and
- it provided no separation of the responsibility for policy making and day-to-day operations.

The report also set forth four overarching recommendations to Congress: (i) establish a modern board structure; (ii) authorize a Chief Executive Officer; (iii) eliminate the statutory pay cap; and (iv) establish accountability.

Seventeen years later, in 2004, Congress responded to the concerns articulated by the Baliles Report, amending the TVA Act to overhaul the triumvirate model and thus providing the organization the flexibility needed to change with the times (the "Frist Legislation"). When commenting on the legislation, Senator Frist stated, "[I]t's time to modernize TVA's management structure to bring it in line with other corporations of similar size and scope. These reforms will help to increase accountability and oversight, which will be good for both TVA and for its ratepayers."[68] Consistent with the Baliles Report's recommendations, the Frist Legislation created a larger, nine-member part-time board that was authorized to hire a chief executive officer to implement its policies. The legislation also removed the pay cap for executives. All of the changes were designed to create a governance and management structure that would allow TVA to operate in a manner similar to a private enterprise. In 2006, the new board took office and a CEO was formally appointed. From 2006 to 2008, several new senior managers were brought into TVA from the for-profit electric industry to implement needed changes in TVA's operations. At the time of the Kingston Spill, the intended reforms had not yet been implemented in a meaningful way throughout the enterprise.

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[67] TVA increased its rates 500 percent (an average of 10.4 percent a year) between 1967 and 1988.

[68] TVA Board Expanded To 9 Members: New Panel To Hire Chief Executive Officer, The Chattanoogan, November 20, 2004.

b. TVA Culture.

Although silo-type behavior is by no means a reality unique to TVA, there are some unique factors in TVA's history that create a more dramatic impact of the silos that is different in degree, if not also in kind, from similar behaviors that exist in other organizations. There were three legacy TVA structural issues — all at least partially addressed by the Frist Legislation — that exacerbated the creation of silos: (1) the three-headed executive structure; (2) the strategic/tactical changes that coincided with the arrival of new politically appointed Directors; and (3) the lack of an enterprise success metric such as the private-sector concept of profit for shareholders. These three factors, along with periods of intense competition within TVA for limited financial resources, appear to have profoundly inhibited both horizontal and vertical communication patterns within TVA.

The three-headed executive structure operated to weaken centralizing forces within TVA. TVA created the position of General Manager in 1936 in an attempt to address some of the management weaknesses inherent in a three-headed executive structure, but, as noted in the Baliles Report, "the legal power vested in the Board prevent[ed] the General Manager from operating as a chief executive officer."[69] The leaders of organizational units within TVA could, and often did, bypass the General Manager and appeal directly to the individual TVA directors (the "Directors"). Over time, this structure operated to create an environment in which personal relationships, considerations regarding turf and ad hoc decision making processes became somewhat commonplace. Senior management and organizational leaders would engage in shuttle diplomacy and forum shopping among the three Directors to obtain the results that they desired. These tendencies would become particularly acute during periods of scarce financial resources when internal TVA organizations felt pitted against each other. It appears that the sharing of information between organizations was discouraged for two reasons: (1) it could make an organization less relevant because it was no longer the sole source of the knowledge and (2) fear that another organization could use the shared information against the organization that volunteered the information.

From time to time, in an effort to alleviate the tension inherent in a system in which three people were effectively in charge of the day-to-day operations, the three Directors would divide the organization into various spheres of influence in which one of the three Directors would take the lead. In other words, each of the three Directors would take ownership of a certain area and the other two Directors would defer to the decisions made by a Director within that Director's sphere, except on the biggest of questions. This division of responsibilities would partially eliminate the need for shuttle diplomacy and forum shopping, but appears to have worked to further silo the enterprise.

The sense of instability brought on by the changes at the top of the organization also led to siloing behavior. Because of the dynamics of a triumvirate structure, the replacement or absence of any member of the triumvirate operated to alter the dynamics and the direction of the

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[69] Governor L. Baliles, Southern States Energy Board, TVA: A Path to Recovery, Report of the Advisory Committee on the Tennessee Valley Authority 9 (1987).

organization. Between 1980 and 2005, the chairman changed seven times and there were three other shifts in the Board created by a vacancy or a new appointee. These changes resulted in an average of 2.5 years of the same governance dynamics for a twenty-five-year period of time. Because there was "no separation of the responsibility for policy making and day-to-day operations,"[70] the effect of the sudden shifts could be felt immediately within the organization. Over time, the organization, or more accurately, subdivisions thereof, built up defensive mechanisms to cope with these sudden shifts. This attitude was described as "regardless of what they do, the electrons still need to flow and so middle managers just did their jobs." Others have described it as (a) "getting whipsawed by radical and complete changes in direction," (b) "people decided to keep their heads down to keep their jobs," or (c) "ducking and thinking 'this too shall pass.'" In short, employees adapted to doing a difficult job in an unstable environment by retreating within their respective silos.

The pay cap prior to its elimination by the Frist Legislation also was cited as a reason for the siloed operations. The theory advanced was that the possibility of rising to a near-autonomous plant manager position operated to ameliorate the effect of the fact that employees could not be remunerated as well as their peers working in the private sector. Whether caused by the pay cap, geographic isolation or other factors, the role of plant manager evolved into one where the plant manager was king of the realm inside of the "fence" surrounding the plant.

Whatever its causes, the silo behavior created organizational inefficiencies in the management of the Byproduct Facilities, as described below.

c. Organizational Silo—Competing groups.

The number of groups that were involved in ash pond construction, maintenance and inspection created silos of responsibility that failed to collaborate effectively. Based on the various functions associated with the ash retention ponds, the silos related to byproduct management performed tasks that were necessarily interdependent and, therefore, the silos were required to interact. Despite the forced interaction, however, the silo mentality persisted, manifesting itself in limited, terse, incomplete communication without meaningful collaboration.

During the course of our investigation, it became apparent that each group viewed its contribution as uniquely and predominately significant to the overall project, in the process belittling the contributions made by other groups. The wide-spread failure to appreciate the skills, experience and capabilities of TVA's other groups served to fortify the insulated silos, as each group recognized little to no value in the others. Over time, each group came to view the others as obstacles to getting its own tasks accomplished. For example, as a control, TVA requires an in-house engineer to stamp a drawing before the drawing can be entered into its system through a design change notice ("DCN").[71] During our investigation, Byproducts argued that Fossil Engineering's control over the DCN process impeded its progress, failing to recognize

[70] *Id*.

[71] Due to Byproducts' regular displeasure with the "useless" drawings produced by Fossil Engineering, Byproducts hired outside engineers to complete some of its needed drawings. These drawings had to be stamped to be entered into the system.

the benefit of the additional review by engineers that had full access to all of the facilities records. Byproducts felt that Fossil Engineering was twenty five years behind the times and saw little benefit in contracting with third party engineers through Fossil Engineering. As a result, Byproducts often expressed a desire to contract with third-party engineers directly.

Although the exact cause of the aversion to collaboration is difficult to ascertain, the historical restructuring and reorganizing likely heightened the divisions' preservation instincts, creating an "us versus them" mentality. Over time, this perception manifested itself in debilitating disagreements between divisions, which were compounded further by the lack of a common supervisor to settle disputes amicably. Instead, the disbursement of authority made the first common supervisor, the Senior Vice President of Fossil Fleet Operations, the COO, or in some instances, the CEO. The existence of unsettled disputes further compounded the already strained communications.

d. Informational Silo—Failure to Communicate.

In addition to the lack of collaboration, silos also emerged in the employee tendency to avoid disclosing potentially harmful information to the proper channels, opting instead to handle situations through personal relationships. Although a different form of silo, the failure to share information with superiors creates the harmful dynamic of supervisors being unaware of important information. The reluctance to share information is likely attributable, in part, to a self-preservation strategy. Particularly acute in long-time TVA employees, there was sentiment of wanting to avoid embarrassment. One employee stated that his supervisor told him to "dance like no one was watching," but noted if he had, the supervisor would have "cut him off at the knees." In an effort to avoid embarrassment, employees relied heavily on personal relationships, indicating "I knew who to call" or "they would call me directly, which my supervisors didn't like." Often, the individual contacted for certain tasks was not the person best equipped to handle it, and as a result, the dependence on personal relationships prevented TVA from most efficiently utilizing its resources. Further, without a common recipient for similar information, TVA was unable to use the lessons learned from one incident to prevent or to respond better to future incidents. Additionally, the lack of a functional reporting structure prevented TVA from analyzing data trends to determine if an issue was an isolated or regular occurrence.

When the personal relationships necessary to address a situation did not exist, the existence of silos prevented dissemination of important information. For example, in the fall of 2007, TVA suspended dredging into the dredge cells based on concerns voiced by Geosyntec. In the fall of 2008, however, dredging was not suspended, although some employees noted that the Geosyntec recommendations stated that dredging might need to be suspended during the wet season for several years. When asked why the dredging continued in the fall of 2008, despite the suspension in 2007, the Byproducts and HED employees stated simply that nobody had told them to stop. The engineers' response to the same question was "we did not go out of our way to repeat, and they did not ask."[72]

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[72] The 2009 annual inspection report for Kingston, which was based on the physical inspection performed on October 20, 2008, provided, "Dredging to [dredge] cells was stopped in mid-November 2007 based on recommendations from EDS and Geosyntec Consultants, Inc. This preventative measure was taken to reduce water

(footnote continued on next page)

5. Lack of Prevention, Priority and Resources.

The budget for ash retention ponds was split between two organizations. Byproducts had a budget for handling, marketing and storing the byproduct, but the plant was responsible for budgeting for the ongoing maintenance of the pond. Each ash retention pond requires standard routine maintenance, such as mowing and tree removal, as well as certain specific maintenance items set forth in the pond's annual inspection reports.[73]

The TVA budget process often left the maintenance of the disposal facilities meagerly funded. Historically, TVA's operations budget had been allocated first to the regulated activities and then to other generating assets. As a result, the nuclear facilities and certain transmission divisions were the operational units funded first; the remaining operations budget was allocated to non-regulated operations, including River Operations and the Fossil Power Group. The Fossil Power Group then divided its budget among the individual plants. Although the exact rationale for the budget allocation among the plants is unclear, it is apparent from the condition of the various facilities that the allocation was not in proportion to the relative need of each facility.[74] As a result, the larger facilities had to stretch their budgets further. Each fossil plant allocated its budget as it desired. Employees noted that, with respect to maintenance of the impoundments, the budgets bore very little relationship to the actual needs of the impoundments and often were overridden if money became tight.[75] For example, in 2008, at one plant, the money that was allocated to purchase heavy equipment to facilitate the mowing of the sides of the dikes was diverted to buying a barge.

According to some employees, some plants (generally the larger plants) allocated only a minimal amount to the upkeep and maintenance of the ash retention ponds, providing funds for mowing the dikes only twice a year. In some cases, this infrequent attention and mowing allowed vegetation on the dike to get so overgrown that the plant was unable to mow the dike at the appointed time. As an example, during its remediation efforts, TVA removed seventeen dump trucks worth of overgrowth from the dikes at its Paradise Fossil Plant. The dense overgrowth, in turn, prohibited effective inspections of the dikes.[76] Although the engineers could

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levels in the dredge cell through the winter months. Dredging restarted in March 2008 and was still in operation at the time of this inspection."

[73] Specific maintenance included tasks such as re-grading the dike benches or ditches or adding gravel to certain areas and usually addressed drainage issues.

[74] Employees noted that budget allocation among the fossil plants was not per need or importance, but rather was designed so that each plant received its "fair share" of the overall budget.

[75] When compiling the post-Kingston budgets for the operation and maintenance of the impoundments, the old budgets were reviewed in an attempt to use them to forecast the new budgets. The rationale behind the old budgets could not be gleaned and they were not used in projecting the new budgets because, according to one employee, "the old budgets did not appear to have any basis in reality."

[76] At Paradise Fossil Plant, a slough in need of immediate repair was found when overgrowth was removed during the post-Kingston remediation efforts.

not complete their inspections due to the overgrowth, they did not require the removal of the vegetation so the inspection could occur, noting in their reports that they were unable to inspect, but doing nothing further to rectify the situation. Over time, trees in the uninspected dikes grew to such sizes that they could not simply be cut down for fear that the remaining roots would affect the dike's stability after the tree was removed. Of course, a more involved removal process that accounted for the complex underground network of roots required a larger budget, which the plants generally failed to allocate. As a result, some of the dikes had trees that had to be removed with back-hoes during TVA's remediation efforts post-Kingston.

In addition to the inability to mow the facility, plants often did not allocate all of the funds necessary to implement the recommendations made in the previous year's annual inspection. As a result, many of the recommendations were unaddressed, even after appearing in the annual reports for several years.[77] Over time, the compounding problems and the reoccurring problems, such as the large trees in dikes or habitually unaddressed specific maintenance items, without any inquiry from Management,[78] created the perception that the ash retention facilities were unimportant to the plant's mission.[79] The perceived unimportance undoubtedly caused the plants to further reduce the attention and resources allocated to the ponds.

6. Failure to Look for the Pervasive Cause of Systems Failures or Culture Flaws that Caused or Contributed to an Incident.

During the course of our investigation, we identified a pattern at TVA of reacting to problems as they arise rather than proactively rectifying issues before they develop into larger, more complex problems. Throughout our work, the consistent theme emerged that TVA employees never thought that a spill similar to the Kingston incident was possible; they always thought the dike would leak before it would break. In making these statements, the employees failed to observe the events that were going on outside of TVA, and more importantly failed to appreciate the seriousness of the events that were going on inside TVA.

In August 2005, PPL Martins Creek LLC spilled fly ash into the Delaware River in Pennsylvania after wooden stop logs that held back water in the basin breached. As a result, the utility spilled approximately 100 million gallons of contaminated water and fly ash from a settling pond into the river. Although the Kingston Spill undoubtedly was not caused by a

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[77] At Widows Creek Fossil Plant, warning about a deviation that impacted the pond's factor of safety was repeated for four years in annual inspection reports before it was corrected. The annual inspection reports from 2001 to 2004 contained the following statement: "Pond 2B and Pond 3 of the Active Gypsum Stacking Area have been raised above the elevation at which underdrain systems should have been placed. Construct underdrain systems in these areas as closely as possible in accordance with drawings (3 numbers given). If underdrain systems are not placed at these locations, the factors of safety for the stack slopes developed by Ardaman & Associates, which are the design basis for the stack configuration, will not be applicable." (*Emphasis in the original.*)

[78] As used in this report, "Management" refers to members of TVA's staff with the title of Vice President or higher.

[79] The perceived unimportance of the Byproduct Facilities was evident by references to the facilities as the "trash" and the "sewer."

breached pipe, there is no indication that TVA utilized the misfortune of another power utility as a catalyst to assess the safety and integrity of its own facilities.

In addition to the 2005 release in Pennsylvania,[80] TVA experienced its own serious incidents that should have prompted its employees to raise concerns about the ponds' integrity. One TVA employee, who was present shortly after the 2003 Kingston incident,[81] stated that he felt that TVA had narrowly avoided disaster; another described the ground as walking on a waterbed. Three years later, after a fix had been installed, a second incident occurred within 100 yards of the first. While TVA took both of these incidents seriously, calling in outside experts to assess the situation and to devise a plan for patching the problem, TVA did not view these incidents as possible warnings of other or deeper issues with the dikes either at Kingston[82] or at its other plants.[83] Instead of using the smaller, more contained sloughs as an impetus for a full review of its ash retention ponds, TVA focused solely on correcting the immediate harm. As evidenced by its limited corrective actions, TVA focused on the earlier incidents as the problem, rather than as a symptom of a larger trouble.[84]

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[80] Although they involved coal mines, there were two incidents, an historical one in West Virginia and a recent one in Kentucky, that could have triggered a review of the impoundments.

On February 26, 1972, the coal slurry impoundment dam at Buffalo Creek collapsed, sending 132 million gallons of black wastewater through the Buffalo Creek hollow. The water and coal refuse was 30 feet high and 550 feet across, and it rushed more than 15 miles down Buffalo Creek. During the days preceding the dam's collapse, rain fell continuously in Logan County, West Virginia, filling the coal slurry impoundment dam with water and rendering the dam unstable. One hundred and twenty-five people were killed, 1,121 were injured and more than 4,000 people were left homeless. Property damage included the destruction of 507 houses, 44 mobile homes, 30 businesses, 10 bridges, 1,000 vehicles and the destruction of power, water and telephone lines.

The Martin County Sludge Spill was an accident that occurred after midnight on October 11, 2000, when the bottom of a coal sludge impoundment in Martin County, Kentucky broke into an abandoned underground mine below. An estimated 306 million gallons of sludge went through an abandoned mine below the impoundment and then down two tributaries of the Tug Fork River. The spill was over five feet deep in places and covered nearby residents' yards. The spill affected over one hundred miles of the Big Sandy River and migrated into the Ohio River. The water supply for over 27,000 residents was impacted. The spill was thirty times larger than the Exxon Valdez oil spill and, at the time, was considered one of the worst environmental disasters ever in the southeastern United States.

[81] See Section C(3), Page 11 for a discussion of the 2003 Kingston incident.

[82] In separate reports issued in 2004, both Parsons E&C and Geosyntec expressed concerns about potential liquefaction of the ash which do not appear to have been followed up on. Liquefaction is the process by which sediment that is very wet starts to behave as a liquid.

[83] Additionally, in its report presented after the 2006 seeps along the Kingston dredge cell, Geosyntec included the following, "Based on experience gained at [Kingston], it may be beneficial to review drainage requirements of other facilities." This does not appear to have happened.

[84] This approach is inconsistent with the approach of public companies that employ commonly accepted risk management best practices. For example, following the 2005 explosion at its Texas City refinery, BP hired a Independent Safety Review Panel, headed by Former Secretary of State James A. Baker, III. The panel determined

(footnote continued on next page)

In addition to the foregoing incidents at Kingston as potential red flags, there were many other incidents over time suggesting a deeper root cause analysis of risks to the ash ponds in the Fossil Fleet. In reality, there were a number of opportunities to leverage problems with a single facility into a thorough investigation of the Fossil Fleet. A myriad of smaller incidents were relayed by the employees, ranging from the loss of a chemical pond in the 1980s to the wash-out of interior divider dikes in the 1980s[85] and 1990s.[86] One of the most notable was an incident that occurred at Widows Creek in 2000, which appears to have had the same failure mechanism as the gypsum release in January 2009. On January 9, 2009, the cap on an abandoned weir failed, causing 10,000 gallons of gypsum to be discharged into Widows Creek. Based upon a compilation of information, it appears that the weir was sealed by placing old railroad ties over the opening and then stacking bags of sakrete[87] on top of the ties to hold them in place. Current and past employees also revealed anecdotal evidence that a similarly-sealed weir in the same gypsum pond had failed around 2000. It is unclear to whom in the Widows Creek organization this was reported, but it does not appear to have been shared outside of the Widows Creek organization. Under a best practices system, the reporting of the 2000 event to the Board not only would have been required, but also would have led to measures that would have prevented the 2009 spill at Widows Creek.

TVA's Management Risk Committee noted in 2008 that TVA faced a potential risk if regulations required the lining of ash ponds in the future. However, the risk analysis simply concluded that the requirement was not yet mandated by law. The lost opportunity was the failure to ask why ponds might need lining and to examine the risks that TVA's ash ponds could be facing.

F. Post-Kingston Reforms.

1. Review of Structures.

Within three weeks of the Kingston Spill, in an effort to prevent another environmental release, TVA embarked on an ambitious review of all of its ponds, including the much-discussed ash and gypsum ponds. Instead of taking a reactive approach that narrowly focused on the ash and gypsum ponds, TVA took a proactive, expansive approach when assessing its ponds and, by February, had expanded its scope to include any structure that could cause a discharge into the environment or any structure that could have stability issues. Thus, the inspection includes the

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that better attention to the smaller incidents could have prevented the larger failure and recommended adopting industry best practices.

[85] One employee, who was employed in the 1980s, said that he had tried but was never successful in encouraging fellow employees, who were present at the time, to talk about what happened when the interior dike failed at Kingston in the 1980s.

[86] As part of the Investigation, we reviewed fifteen years of annual inspection reports for three fossil plants, in addition to the reports reviewed for Kingston. The reports were riddled with incidents of sloughing that had to be addressed with engineered fixes.

[87] "Sakrete" is a name brand of fast-setting concrete mix that was typically packaged in fifty-pound bags.

lesser-discussed coal yard runoff ponds, chemical ponds and other structures that were all-but-forgotten. At the suggestion of a Director, TVA also established an emergency response plan for each complex and stored emergency response materials at a central location.

To conduct the review, TVA hired Stantec Consulting Services, Inc. ("Stantec"), a reputable third party engineering firm. Recognizing the importance of both a quick and thorough review, TVA worked with Stantec to devise a four-phased approach to the pond inspections.[88] Phase 1, which consisted of a visual inspection of the ponds and a historical review of documentation, provided a quick initial assessment and uncovered the primary concerns that needed immediate attention.[89] To timely address the identified primary concerns, TVA, working in conjunction with Stantec, began designing and implementing fixes, while the pond inspections continued elsewhere. To date, all three of the identified primary concerns have been remedied.

In addition to completing inspections, as an extra precaution, TVA has installed monitoring devices in the dikes surrounding all of its ponds, which are measured weekly by Stantec. As a result of these monitoring devices, TVA was alerted to an increase in pressure in the dikes of the gypsum pond at the Cumberland Fossil Plant. Upon closer inspection, TVA's Management determined that the plant was wet-sluicing gypsum into the holding pond, which was causing additional pressure on the dike. Previously, the gypsum had been dewatered and utilized by a wall board plant, which had recently reduced production. Importantly, Management reacted by pushing for an immediate solution, and committing to shut down the plant temporarily until a solution could be implemented. The monitoring system provided Management with the ability to respond to the rising pressure before dike stability was affected and proactively to address the problem by providing an alternative sluicing plan for the plant.

Following Phase 1, Stantec started Phase 2, which was designed to be an in-depth, thorough review comprised of geotechnical investigations and engineering analyses for each of the structures. Based on the information uncovered during Phase 1, Stantec will investigate each of TVA's structures starting with the most troublesome. Phase 2 was designed to be an intensive investigation and, as such, was intended to be longer than Phase 1. Phase 2 includes sampling and lab analysis of the dike material, which will provide TVA with a comprehensive understanding of the dike's physical make-up. It is anticipated that Phase 2 will be ongoing as Stantec moves into Phase 3, which consists of designing fixes to the problems uncovered during Phases 1 and 2.[90] As part of its engagement, Stantec will oversee TVA's work to install the agreed upon fixes. Phase 4 consists of developing and implementing a training program, which

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[88] Phase 1 was subdivided into Phase 1a and 1b. Phase 1a consisted of site walk-downs, reviews of recent inspection reports and identification of Tier 1 concerns. Phase 1b consisted of reviewing all records and interviewing staff, detailed site reconnaissance, completion of detailed checklists to dam safety standards and freeboard analysis.

[89] These problems were labeled Tier 1 and consisted of the gypsum ponds at Paradise Fossil Plant and Widows Creek Fossil Plant and the ash pond at Johnsonville Fossil Plant.

[90] As noted previously, the Tier 1 concerns have been repaired. The ongoing fixes are other concerns identified by Stantec.

will provide inspection training to the Dedicated Program Managers[91] and the plant employees, who will be conducting the newly installed quarterly and daily inspection program.

In addition to expanding its review from ash and gypsum ponds to all ponds located in the plant yards, in March, TVA further expanded its review after Management conducted an on-site visit, which uncovered issues with exposed pipes in the plant yard. While visiting Widows Creek, Management noticed that a pipe was scouring material from under a roadway and that a second pipe appeared to have dry-rot due to sun exposure. Management noted that a pipe burst could cause a release into the environment just as or more easily than a failed impoundment and, therefore, expanded TVA's review to include all of the pipes that transport material from the plants to various locations throughout and around the yard. In response to these concerns, working in conjunction with plants, Management mobilized TVA's engineers to visually inspect all of the pipes located in the yard; many of the pipes were so covered with vegetation that it is difficult to speculate as to when the pipes could have last been inspected. These inspections were designed to uncover any weak or deteriorating pipes, which could cause another damaging environmental leak. By expanding its review to include the pipes, TVA broke from its historic pattern of limiting its reaction to the specific, isolated remediation and took a proactive approach, allowing TVA to correct potential issues before they result in an environmental release.

The inspection process has not been without some friction between the corporate function responsible for overseeing the process and some plant managers. To overcome this, Management within the Fossil Power Group has aligned its agendas through weekly meetings and regular communication, thereby eliminating the plant managers' ability to act independently of the Fossil Fleet. By collaborating and agreeing on an agenda, Management removed the ability of plant managers to escape a mandate by either appealing elsewhere or simply ignoring it and increased accountability among the employees.

2. Reorganization.

a. Creation of New Byproducts Organization.

The Fossil Power Group identified the handling of byproducts as an issue prior to the Kingston Spill.[92] After the Kingston Spill, the group worked feverishly to accelerate the creation of a new organization, which is responsible for every aspect of the Byproduct Facilities.[93] As part of the reorganization, TVA housed all of the operating functions involved with byproducts, including operations and maintenance, marketing and utilization, and inspections, under a single general manager. The new organization was given the sole authority for the ponds, which was communicated to the Fossil Power Group employees by email and has been supported fully by

[91] A Dedicated Program Manager is a mid-level employee in the reorganized Byproducts group, which oversees the Byproduct Facilities.

[92] In the Fall 2008, Management recommended hiring third parties to be responsible for ash handling.

[93] The new organization was formed in February 2009.

Management.[94] The employees drafted to be part of the new organization were introduced to the organization and its responsibilities by Management during an in-person lunch meeting. To facilitate its authority, the new organization has been given its own budget to provide for daily operations and ongoing routine and special maintenance of the dikes.

b. Systems.

As planned before the Kingston Spill, TVA has outsourced its handling function to third-party providers that specialize in ash handling. The third party providers are tasked with ensuring that the dikes are built to the designed specifications. To ensure adequate oversight, TVA has assigned a field supervisor to oversee the third-party operations; each field supervisor is responsible for overseeing two plants. As part of the new organization, TVA now has a centralized planning and scheduling function for the ash handling activities that is provided to each field supervisor. Whereas in the past, each HED foreman performed maintenance tasks on his own, often unwritten, schedule, the new work management plan charts the ongoing and one-time maintenance activities to be performed at each site, including both a start date and a projected completion date. The plan is comprehensive in nature, including routine maintenance items, such as mowing, and long term items, such as plans for closure.

The use of a work management plan has also provided TVA with an opportunity to get ahead of issues. For example, in preparing the initial work management plans, TVA determined that two of its plants had Byproduct Facilities that would reach capacity in 2011.[95] Neither of these capacity issues had been addressed and because permitting a new site takes approximately two years, the shrinking capacity in these ponds was particularly troublesome. The work management plan allowed TVA to address the capacity issues before the remaining capacity was further reduced or non-existent.

In conjunction with the work management plan, Management has started bimonthly tours of the facilities to review the completed and ongoing work.[96] The tours have provided TVA with an opportunity to hold the field supervisors accountable for completing the work management plan and to articulate new maintenance standards for structures.[97] During the tours, Management

[94] One senior employee noted that he was given the authority to stop immediately the use of any disposal structure if he believed that the structure was unsafe, even if it would require the plant to come off-line. Although he has not needed to issue such a stop order, he believes Management would fully support his decision to stop the use of a pond.

[95] Colbert Fossil Plant had remaining capacity for two years of dry fly ash storage. At Bull Run Fossil Plant, the plant has both a dry ash system and a wet ash system. For most of 2009, the dry ash system has been broken requiring the plant to wet sluice to a legacy pond with only two years remaining capacity. The plant would have 6 years of remaining capacity if they used the dry ash system, but Bull Run's dry ash system is inoperable fifty percent of the time. Before the reorganization, the plant did not have the budget to fix the system.

[96] In addition to the on-site visits, the management team also conducts flyovers of the facilities to monitor the field supervisor's progress in between visits. The management team visits the plants with greater reform needs more often than it visits the plants in better shape.

[97] This was designed to correct a "culture issue" where good people had become complacent, accepting sub-par conditions as the norm.

can highlight maintenance issues and provide instructions on the proper fix. By maintaining documentation on the identified issues, Management can inspect progress on the following visit, or for particularly large projects, during a subsequent fly-over, which serves to increase the employees' accountability.

While assessing and completing routine and deferred maintenance on the Byproduct Facilities mitigates the short-term, immediate risks, TVA has also recognized that long-term closure of the ponds and plans for conversion from wet to dry are necessary to ensure that the aging byproduct impoundments do not fail in the future. Rather than looking at each potential conversion in isolation as a one-off event, TVA has decided to treat the conversions as a Fossil Fleet issue. All of the ponds that are converted will use one of two distinct systems for the dry fly ash to mitigate and manage costs. The transition to a Fossil Fleet view rather than an individualized approach will further reduce the fiefdom tendencies as unique knowledge of a particular system will not be necessary to manage each facility.

c. Capital Planning.

A second newly organized Fossil Fleet group, which is responsible for overseeing and administering capital projects related to the Byproduct Facilities, has developed a comprehensive program to address each Byproduct Facility that utilizes wet dredge cell pond construction. Pursuant to the plan, each such facility will be converted to either a dry disposal system or a wet-sluice system with reclaim and dry stacking capabilities. The proper system for each facility was determined using the site specific information gleaned by Stantec through borings and soil analysis, as well as the lessons learned from the root-cause analysis of the Kingston failure.[98] To ensure that best practices are incorporated into each design, TVA has included the on-going costs of these activities in each project's requested capital budget.[99] Further, to ensure that each project is constructed pursuant to the engineered plans, TVA will incorporate design limits into its operating processes and controls, and train the employees to understand these limits, neither of which had been done previously.

While TVA has an existing plan of work which addresses all of the applicable Fossil Fleet facilities, TVA has also recognized the need to remain flexible in order to adjust for changing realities or to mitigate costs. For example, the new byproducts organization will be mindful of and work strategically to incorporate pending legislation, such as the use of liners, as necessary. The group will also look for opportunities to incorporate lessons learned from earlier projects to ensure cost effectiveness of the later projects and for opportunities to enter into strategic contractor alliances to mitigate cost and accelerate work schedules. Unlike the isolated approach to projects in the past, TVA will be able to leverage lessons learned from one project to the next; the repetition should serve to increase efficiency while simultaneously reducing costs.

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[98] TVA will factor in information about the four contributing factors to the Kingston Spill—the foundation, loading, geometry and materials—into each design.

[99] TVA plans incorporate the costs to implement best practices for quality assurance, document control and configuration management into the capital budget. Additionally, TVA plans to install monitoring devices as part of the capital project.

d. Standards and Accountability.

In addition to establishing the new groups, TVA has also revamped the pond inspection program, which will include inspections performed by both TVA employees and outside contractors. As before, TVA will require on-site employees to complete daily inspections of the structures. Unlike before, the inspections will be standardized and the employees will be trained. The daily inspections will be supplemented by quarterly inspections performed by the Program Managers, who are engineers employed by the new organization. Prior to the installation of the inspection regime, as Phase 4 of its engagement, Stantec will provide thorough inspection training to both the daily and quarterly inspectors.[100] Annually, each dike will be inspected by a third-party engineer. Further, every five years, TVA will hire an independent engineering firm to inspect the dikes pursuant to dam safety inspection standards.[101] In April 2009, the Fossil Power Group consulted with River Operations regarding their knowledge of the Federal Dam Safety Guidelines and are seeking ways to utilize the in-house expertise with regard to the Byproduct Facilities.[102] This is a significant improvement in cross-enterprise communications and cooperation.

e. Culture of Accountability.

After reviewing the reorganization and reworked inspection process, it is apparent that TVA is making significant remedial progress in relation to preventing any future pond spills. By providing the necessary budget and increasing the accountability, TVA has been able to reengage its employees and set new standards and procedures for pond management. Whereas in the past, employees grew complacent with certain features of the ponds, such as trees on the slopes or beavers in the ponds, the new expectations coupled with the increased oversight and accountability to Management have resulted in the employees taking initiative and making significant progress in remedying years of deferred maintenance. For example, dikes with years of unattended overgrowth recently have been mowed and mature trees have been removed. At Paradise Fossil Plant, seventeen dump trucks worth of overgrowth were removed from slopes. Further, the employees feel empowered to complete outstanding maintenance items: at one plant, the field supervisor ordered 15,000 tons of rock to complete open recommended maintenance items which would aid slope drainage. At Widows Creek, TVA trapped and humanely removed thirteen beavers and six muskrats from the ponds, addressing years of animal burrow concerns articulated in the annual inspection reports.

[100] This class developed for the quarterly was described as a thorough class, likely a week in length. The class developed for the daily inspection will be approximately a day in length and less involved.

[101] The engineering firm conducting the five-year inspection will be entirely independent of TVA and have no prior experience working on TVA's ash disposal structures.

[102] Some of the discussed ideas include (i) selecting a single contractor to perform the five year dam inspections for both the hydro dams and the dikes, (ii) participation by the new organization in the Hydro Board of Consultants to glean learnings that can be used by Fossil, and (iii) establishing River Operations as the policy holder of the dam safety guidelines, to be responsible for updating Fossil on any modifications.

The rapid remediation progress confirms the magnitude of the deficiencies that existed at the time of the Spill, but also demonstrates that meaningful focus and priority are being given to the situation. The Fossil Power Group is successfully installing best practices with standards, training, controls and consistent processes, and, as a result, the risks of another Kingston Spill should be significantly reduced. However, the legacy culture challenges are still present. In TVA's past, new organizations have achieved successes, but after the initial push, the organizations have lapsed into mediocrity and were eventually reorganized or disbanded. The Fossil Power Group's newly installed best practices provide TVA with an opportunity to eliminate a reoccurrence of a Kingston Spill risk because the root-cause issues of systems, controls, standards and culture of accountability are being addressed. If the new byproducts organization is to be sustainable, there must be an enterprise-wide commitment to, and adoption of, such reforms.

G. Summary

As set forth in this report, our investigation found that TVA did not have adequate systems, controls and procedures in place prior to the Kingston Spill. TVA's Byproduct Facilities operated pursuant to decades of lore, without formalized standards or procedures. As a result, Management could not effectively monitor the employees' activities pursuant to acceptable performance standards. Through our investigation, we uncovered a myriad of issues that needed to be reformed. Although some of the identified deficiencies are now being addressed, such efforts are not pursuant to a top down comprehensive directive that provides assurance of best practices throughout the enterprise. History has shown that TVA can be resistant to the implementation of new directives and that progress in one area can be eroded by the legacy culture still existing in other parts of the enterprise. To be sustainable, the current remediation activities in the Fossil Power Group will need to be part of a comprehensive TVA remediation program owned by senior management under Board oversight.