

US EPA ARCHIVE DOCUMENT



AEP Muskingum River Power Plant
Waterford, Washington County, Ohio
US EPA Inspection - October 2009
Ash Pond Complex and Unit 1-4 Bottom Ash Pond
Action Plan based on Final Recommendations
March 2010

Facility Ratings:

Response:

Based on discussions with the US EPA's consultant, AEP understands that the "poor" rating of the Unit 1-4 Bottom Ash Pond is primarily due to the presence of very heavy woody vegetation that prevented the visual inspection of the entire diking system. In addition, the stockpiles of dredged material above the crest of the dike also influenced the rating. Since the date of the site inspection, AEP has removed all of the woody vegetation along the man-made diking system and removed/regraded the stockpiles to be at or lower than the crest of the embankments. AEP believes that this work addresses the concerns that were the basis for the "poor" rating. We request that EPA give due consideration to these facts and provide for a re-assessment of the Unit 1-4 Bottom Ash Pond as soon as possible.

General Comment:

In the sections below, CHA presents recommendations for maintenance and further studies to bring these facilities into satisfactory condition. CHA also recommends that the recommendations presented in BBCM's March 12, 2009 inspection report and ODNR's November 3, 2008 Dam Safety Inspection Reports be addressed.

Response:

AEP performed and completed numerous maintenance work items that were recommended by both BBCM and ODNR Safety Section since the date of this inspection. AEP has revised both the Emergency Action Plan (EAP) and the Operations, Maintenance and Inspection Manual (OMI). These two documents have been forwarded to the ODNR for review. AEP has repaired a section of the Muskingum River bank as recommended by BBCM. The remaining riverbank repair is further discussed in response to Section 4.8.

4.2 Monitoring of Seeps

Seeps were observed in the following locations during CHA's site assessment and by ODNR, BBCM and AEP Service Corporation:

- Mill Stone Creek Dam – isolated seep in the natural hillside at the right (southeast) abutment outside of the rock lined ditch (Section 2.2.1);
- Mill Stone Creek Dam – downstream face of the collection pond embankment (Section 3.5.1);
- No-Name Creek Dam – adjacent to the rock outcrop above the right (southeast) abutment ditch (Section 2.2.2) and BBCM noted that it is possible that seepage is passing under the embankment and emerging in the pond undetected (Section 3.5.1);
- Lower Fly Ash Dam (cement-bentonite-fly ash slurry wall installed, Section 1.4.4 and Section 2.4.1);
- Lower Fly Ash Dam – seeps at the downstream toe.

It is recommended that AEP develop a procedure to observe these areas on a routine basis (i.e. monthly) and document these observations in written reports that are kept on file at the facility. The procedure should outline steps that should be taken in the event that increased flow, muddy flow, or instability on or adjacent to an area of seepage is observed.

Response:

AEP will include these additional seepage areas as part of its Dam Inspection and Maintenance Program (DIMP). Quarterly inspections of the facility are performed by Plant personnel and AEP Engineering conducts an annual inspection. There is an existing inspection checklist that is completed during each inspection. These forms are kept at both the power plant and AEP's engineering office. Procedures for evaluating changing conditions of the seepage areas are discussed in both the EAP and OMI. A revision to the checklist will be developed to include the specific seepage areas by September 1, 2010.

4.3 Repair of Erosion

Areas of erosion were observed in the following locations during CHA's site assessment and by ODNR, BBCM and AEP Service Corporation:

- Wing Dam – upstream embankment slope where compacted ash was exposed (Section 2.2.3);
- Freeboard Dam – downstream embankment slope, particularly in the locations where ash is exposed and upstream embankment slope (Section 2.2.5);
- No-Name Creek Dam – on the crest of the dam (Section 3.5.1);
- Middle Fly Ash Dam – downstream embankment slope in the unarmored surface (Section 2.3.1);

- Emergency Spillway Dam – observed in the crest surface adjacent to the upstream slope (Section 2.3.2);
- Lower Fly Ash Reservoir Dam - beaching erosion on the upstream slope and downstream slope (Section 2.4.1);
- Units 1-4 Bottom Ash Pond – exterior slope (Section 2.5.1) and interior slopes (Section 3.5.1);

These areas typically had intermittent erosion rills, likely exacerbated when grading activities pushed loose material to the crest edge and sheet flow became concentrated during rain events. These erosion rills should be filled in with compacted material and stabilized (seeded and mulched).

Surface sloughs were noted in over-steepened areas (i.e. Units 1-4 Bottom Ash Pond interior slopes). These areas should be regraded to a flatter slope where possible and reseeded or armored with a stone material. Monitoring of these areas should be conducted to check for any continued movement.

Response:

AEP has completed additional maintenance work items since the date of this inspection. The work included repairs to erosion rills at the ash pond complex reservoirs (Upper, Middle and Lower dams). AEP will continue to monitor these areas as part of its Dam Inspection and Maintenance Program (DIMP). Quarterly inspections of the facility are performed by Plant personnel and AEP Engineering conducts an annual inspection. If additional erosion areas are noted during the inspections, repairs will be performed to stabilize the area.

The beaching erosion of the upstream slope of the Lower Dam will be further evaluated and an action plan will be developed by December 31, 2010. The action plan will present any necessary recommendations including the method and schedule to complete the work within financial budget cycles.

Repair and regrading of the interior slopes of the Unit 1-4 Bottom Ash Pond will be completed as part of the riverbank enhancement, discussed in Section 4.8.

4.4 Repair of Rodent Burrows

Evidence of animal burrows was observed in the following locations during CHA's site assessment and by ODNr, BBCM and AEP Service Corporation:

- Mill Stone Creek Dam – right (southeast) abutment in the natural hillside (Section 2.2.1);
- Lower Fly Ash Reservoir Dam – observed in the portion of the embankment not armored with rip rap (Section 2.4.1);
- Units 1-4 Bottom Ash Pond – exterior slope (Section 2.5.1 and Section 3.5.1);

CHA recommends that AEP keep notes of areas disturbed by animal activity, trapping of the animals, and repair to the areas. BBCM recommended that burrows be filled with bentonite slurry.

Response:

AEP has completed repairs to the rodent holes as per the ODNR recommended procedures since the date of this inspection. AEP will continue to monitor this area as part of its Dam Inspection and Maintenance Program (DIMP). Quarterly inspections of the facility are performed by Plant personnel and AEP Engineering conducts an annual inspection. If rodent holes are noted during the inspections, repairs will be performed.

4.5 Additional Stability Analyses – Upper Fly Ash Reservoir

CHA recommends that rapid drawdown analyses be performed for the current conditions and for the final raised embankment condition at the Upper Fly Ash Reservoir. While CHA understands that rapid drawdown via pumping or other discharge methods may be undesirable for a waste disposal impoundment, CHA suggests that in the event of an emergency at the facility, rapid drawdown may be more desirable to reduce hydrostatic pressures on the dam, thereby preventing a more catastrophic collapse. There have also been documented case histories where other types of failure (such as a gate failure) have resulted in rapid drawdown conditions developing which have led to a domino effect and made the situation worse. For these reasons, CHA recommends that a rapid drawdown analysis be performed.

Response:

AEP will develop a rapid drawdown scenario and perform a stability analysis. This work will be completed by December 31, 2010.

4.6 Additional Stability Analyses – Middle Fly Ash Reservoir

CHA recommends that an updated stability analysis be performed for the Middle Fly Ash Reservoir Dam using the data obtained during the recent subsurface investigation. The analyses should reflect the current phreatic surface in the embankment. Soil properties to be used in the analysis should be reflective of the material encountered in the three borings advanced at the structure in September 2009 as well as historical data available for the structure. Loading conditions that should be considered in the analyses should include: steady state conditions at present pool or maximum storage pool elevation, rapid drawdown conditions from present pool elevation, maximum surcharge pool (flood) condition, seismic conditions from present pool elevation and liquefaction.

Response:

AEP completed a site investigation of the Middle dam which included soil borings, installation of piezometers and laboratory testing in December 2009. This information

will be used to refine the stability analyses for the recommended loading conditions. This work will be completed by December 31, 2010.

4.7 Additional Stability Analyses – Lower Fly Ash Reservoir

CHA recommends that an updated stability analysis be performed for the Lower Fly Ash Reservoir Dam using the data obtained during the recent subsurface investigation. The analyses should reflect the current phreatic surface in the embankment. Soil properties to be used in the analysis should be reflective of the material encountered in the four borings advanced at the structure in November 2009 as well as historical data available for the structure. Loading conditions that should be considered in the analyses should include: steady state conditions at present pool or maximum storage pool elevation, rapid drawdown conditions from present pool elevation, maximum surcharge pool (flood) condition, seismic conditions from present pool elevation and liquefaction.

Response:

AEP completed a site investigation of the Lower dam which included soil borings, installation of piezometers and laboratory testing in December 2009. This information will be used to refine the stability analyses for the recommended loading conditions. This work will be completed by December 31, 2010.

4.8 Stability of the Units 1-4 Bottom Ash Pond East Dike

The stability analyses conducted by BBCM (outlined in Section 3.3.4) indicated that at three of the four cross sections examined through the active pond east embankments factors of safety were found to be below 1.5. According to the USACE, computed factors of safety less than the preferred values for new dams may be acceptable based on past performance and current condition of the dam. BBCM suggested that a revetment would significantly increase the factor of safety against failure of the east embankment. Factors of safety were computed for a section of the northern slope which was repaired in such a manner. Based on observed conditions on the Muskingum Riverbank which supports the east dike, and a past history of ash release from failure of the Riverbank impacting the dike stability, CHA recommends that AEP improve the east dike as suggested by BBCM. CHA understands that such improvements to the present stream bank will have to be coordinated with the USACE with respect to navigable waters and acceptable river bank preservation measures.

Response:

AEP agrees that improvements to the natural riverbank along the east embankment would enhance the overall condition of the facility. Improvements have already been completed in a critical section. AEP will enhance the remaining length of riverbank along the active section of the east dike. AEP will file the necessary permit applications by December 31, 2010. At a minimum, this includes approval of a Section 10/404 permit from the U.S. Army Corps of Engineers and a modification of the existing permit from the

ODR Dam Safety Section. Construction activities will be completed within two full construction seasons upon approval of all required permits.

4.9 Trees and Stumps

Trees were noted on Units 1-4 Bottom Ash Pond east dike at the lower portion of the slope. Some trees observed were on the order of 12 inches in diameter (Section 2.5.1 and 3.5.2). Tree roots can allow for seepage of the retained water through the dikes, which could lead to internal erosion such as is the concern in an impoundment with free water. Internal erosion would weaken the dike, and could result in a slope failure.

Additionally, the uprooting of trees during storms can create large voids in the embankment that are then susceptible to erosion. Considering the progressive erosion that could occur during a storm which blows the tree over during heavy rains (i.e., hurricane type storm systems) progressive erosion could potentially result in enough loss of soil from the dike to create an unstable situation, which if failure occurs could result in a release of ash. CHA recommends the removal of tree, brush and roots at the locations notes above. Large trees and roots should be removed and the areas repaired with the direction of a qualified engineer. Once trees and roots are removed, proper, short vegetation should be established to allow for more thorough observation or changing conditions that may require routine maintenance before they become larger problems.

Response:

Since the date of the inspection, plant personnel have completed removal of trees and brush from the man-made dike as intended in the above recommendations. Trees present along the water's edge provide ecological benefit within the riparian right-of-way. Removal of these trees will be part of the riverbank enhancements as recommended in the assessment report.

AEP will continue to monitor these areas as part of its Dam Inspection and Maintenance Program (DIMP). Quarterly inspections of the facility are performed by Plant personnel and AEP Engineering conducts an annual inspection. AEP will continue periodic mowing in the area that will prevent the growth of woody vegetation.

4.10 Establishing Vegetation

CHA recommends that AEP seed the sparse areas on the upstream slope of the Middle Fly Ash Reservoir to establish a proper grass cover. A healthy grass cover should also be established on the Units 1-4 Bottom Ash pond east embankment adjacent to the Muskingum River through routine mowing. Mowing frequency on grassed portions of the embankment should be conducted at least twice a year. If grass does not become established on portions of the embankment following an increased mowing schedule, seeding, spraying or other maintenance may be necessary.

Response:

AEP has stabilized the upstream slope of the Middle dam using riprap. Vegetation will be established on the exterior slope of the Unit 1-4 Bottom Ash Pond east embankment upon completion of the riverbank enhancement project. AEP will continue to monitor these areas as part of its Dam Inspection and Maintenance Program (DIMP). Quarterly inspections of the facility are performed by Plant personnel and AEP Engineering conducts an annual inspection. If there are any areas of sparse vegetation noted during these inspections that are developing erosional features, work orders will be prepared to remediate the condition. AEP will continue periodic mowing of all vegetated surfaces.

4.11 Monitoring of Middle Fly Ash Reservoir Principal Spillway

As noted by ODNR, a spillway conduit system must perform properly without endangering the safety of the dam. The condition of the pipe joints in the principal spillway outlet pipe should be investigated and, as necessary, plans and specifications prepared for the repair of the pipe joints. Regardless of the results of the investigation, the condition of the entire spillway conduit system, must be monitored yearly.

Response:

AEP has conducted a camera inspection of the outlet pipe since the date of this inspection. This information has been forwarded to the Ohio DNR along with AEP's December 2009 dam inspection report. No repair work is required based on the camera inspection. AEP will perform periodic camera inspections of this pipe to assess if any improvements of the pipe are necessary.

4.12 Repair of Damaged Instrumentation

The staff gauge to obtain accurate water level readings for the Middle Fly Ash Reservoir should be replaced. The staff gauge at the Lower Fly Ash Reservoir next to the principal spillway inlet should be repaired so that elevations can be determined.

Response:

AEP has completed repairs of the staff gauges at both the Middle and Lower dams since the date of the inspection. No other action is required.

4.13 Routine Observations, Data Collection and Documentation

CHA was not provided with documentation that facility personnel perform routine observations of the dams and dikes or record data from monitoring instrumentation (piezometers, surface monuments, inclinometers). CHA recommends that AEP update their OMI for the structures to include the recommendation from BBCM, ODNR and CHA. Tasks that should be included in the OMI updates are:

- Establish 'action levels' for instruments. It was recommended to establish two criteria for action; change from previous reading and change from a baseline established for each instrument. Action levels recommended – Alert, Warning and Emergency Procedures.
- A procedure for monitoring repairs (such as the low point on the crest of the Middle Fly Ash Reservoir Dam) for recurrence.
- Monitor piezometers in the dam for any rise or fall of the phreatic surface within the embankments on a routine basis.
- Document monitoring of the condition of the Middle Fly Ash Reservoir concrete spillway riser yearly for further deterioration.
- Document monitoring of the condition of the Lower Fly Ash Reservoir discharge pipe outlet yearly for further deterioration of the interior bituminous coating.
- Record observations of flow exiting the toe drain outlet and the seepage quarterly. Have procedures in place should there be any sign of increased flow, muddy flow, or instability on or adjacent to the embankment.

Response:

AEP has an established Dam Inspection and Maintenance Program (DIMP). Quarterly inspections of the facility are performed by Plant personnel and AEP Engineering conducts an annual inspection as part of the DIMP. There is an existing inspection checklist that is completed during each inspection, which includes piezometer and seepage observations. These forms are kept at both the power plant and AEP's engineering office. Procedures for evaluating changing conditions of the seepage areas are discussed in both the EAP and OMI.

Quarterly deformation surveys are performed on the ash pond complex. This data is reviewed by AEP engineering for changing conditions.

AEP will establish written action levels that correspond to the respective instrumentation data by December 31, 2010.