REPORT ON

CLOSURE ALTERNATIVE ASSESSMENT
FORMER HAVANA POWER STATION
HAVANA, ILLINOIS

by
ATON Environmental, LLC

for
Finch Development LLC
Former Havana Power Station
Havana, Illinois

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List of Acronyms and Abbreviations

Abbreviation	Definition
ATON	ATON Environmental, LLC
bgs	Below ground surface
CAA	Corrective Action Assessment
CBR	Closure by removal
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
CIP	Closure in Place
cm/sec	Centimeters per second
COC	Constituents of concern
CSM	Conceptual Site Model
DMG	Dynegy Midwest Generation, LLC
EAP	East Ash Pond System Complex
ft	Feet
GWPS	Groundwater protective standard
IEPA	Illinois Environmental Protection Agency
ILGA	Illinois General Assembly
MCL	Maximum contaminant level
MNA	Monitored natural attenuation
MSL	Mean sea level
NPDES	National Pollutant Discharge Elimination System
NRT	Natural Resources Technology
RCRA	Resource Conservation and Recovery Act
SDA	Spray dryer absorber
SR	State Road
SSI	Statistically Significant Increase
USEPA	United States Environmental Protection Agency

1. Introduction

ATON Environmental, LLC (ATON) is providing this Closure Alternative Analysis (CAA) on behalf of Finch Development LLC (Finch LLC) for the Former Havana Power Station in Havana, Illinois. This CAA is for the Coal Combustion Residual (CCR) units and specifically for the three CCR units / impoundments consisting of East Ash Pond Cells 1, 2, and 3, and the adjacent Cell 4 which is a stormwater management pond regulated by a National Pollutant Discharge Elimination System (NPDES) Permit. Collectively, CCR Cells 1, 2, and 3 and stormwater Cell 4 are referred to as the East Ash Pond System Complex (EAP) that was formerly part of the Havana Power Station previously owned by Dynegy Midwest Generation, LLC (DMG). The Havana Power Station ceased operations in 2019, and the ash ponds of the EAP have been inactive since that time. The EAP, or the Site, recently changed ownership and is now owned by Finch LLC, and this CAA deals exclusively with the impoundments of the EAP.

In 2015, in accordance with 40 CFR Part 257, Subpart D, (CCR Rule) DMG submitted to the Illinois Environmental Protection Agency (IEPA) a notice of intent to close the inactive EAP in place using a cover system comprised of a geomembrane with soil and vegetation cover. The cover system was not designed nor were the plans submitted to IEPA. This CAA carries forward DMG's intentions to close the inactive EAP.

Recently, applications were filed for Initial Operating Permits (Permits) for the CCR units of the EAP (i.e., Cells 1, 2, and 3). The previous geologic and hydrogeologic investigations and information necessary for the Permit applications and this CAA were conducted under the U.S. Environmental Protection Agency's (USEPA's) Final Rule to regulate the disposal of CCR as solid waste under Subtitle D of the Resource Conservation and Recovery Act (RCRA) [40 CFR 257 Subpart D; published in 80 FS 21302-21501, April 17, 2015]. The most comprehensive site assessment for the former Havana Power Station including the EAP is provided in the document entitled *Hydrogeologic Monitoring Plan* by Natural Resource Technology (NRT) (October 17, 2017) that is available on the federal CCR website (https://ccrhavana.com/) and the Illinois CCR website (https://illinois.ccrhavana.com/). Similarly, these websites contain a comprehensive set of assessments and groundwater monitoring reports utilized in the monitoring of the Site.

This CAA is guided in large part by USEPA's *Hazardous and Solid Waste Management System: Disposal of Coal Combustion Residuals from Electric Utilities*; *A Holistic Approach to Closure Part A: Deadline to Initiate Closure* (85 FR 53516 - effective 28 September 2020) and subsequent regulatory revisions and related rulings including the CCR Rule. This CAA evaluates potential corrective action alternatives intended to satisfy the closure criteria for the impoundments of the EAP in compliance with the Illinois General Assembly (ILGA) Administrative Code Title 35 Section 845.710.

1.1 FACILITY DESCRIPTION/BACKGROUND

The Former Havana Power Station is located south of the City of Havana along Illinois State Route 78 (SR 78) and on the East Bank of the Illinoi River near river mile 118.5. The generating station of the former Havana Power Station lies west of SR 78, and the four impoundment cells of the EAP (Cells 1 through 4 comprising CCR Unit ID 701) are located east of SR 78 and approximately 2000 ft east of the Illinois River **(Figure 1)**. Agricultural land bounds the EAP on the south and east, and industrial or residential land use to the North.

Cells 1, 2, and 3 of the EAP were used to store and dispose of bottom ash, fly ash, and spray dryer absorber (SDA) waste and to clarify non CCR process water prior to ultimate discharge into the Illinois

River in accordance with the station's NPDES Permit (Permit No. IL0001571). Cells 1 and 2 became inactive prior to 2016, whereas Cell 3 was active until closure of the Havana Power Station in November 2019. Cell 4, the stormwater pond, continued to be used in management of stormwater at the facility until the Power Plant was shut down. Site features are illustrated on **Figure 2**.

The EAP covers approximately 99 acres and includes the aforementioned inactive impoundment cells (Cells 1, 2, 3, and 4). EAP Cells 1 and 4 were constructed between 1992-1993, and they were lined with a 3-foot compacted clay layer. Construction of Cell 2 and an additional overflow spillway for Cell 4 was done in 1998, and these two features were lined with 45-mil polypropylene liners underlain by a 1-ft thick compacted clay layer. Cell 3 was constructed in 2003 with a synthetic liner underlain by a 1-ft thick compacted clay layer.

1.2 GROUNDWATER MONITORING

Groundwater monitoring under the CCR Rule is being performed at EAP in accordance with Part 257.91 of the USEPA Final Rule to regulate the disposal of CCR as solid waste under Subtitle D of RCRA [40 CFR 257 Subpart D; published in 89 FR 21302-21501, April 17, 2015]. The monitoring plan implemented at the EAP is provided in the *Hydrogeologic Monitoring Plan* prepared for the EAP by NRT (October 17, 2017) with data analysis provided in the *Statistical Analysis Plan* also prepared by NRT (October 17, 2017). These documents are available on the federal CCR website (https://ccrhavana.com/) and the Illinois CCR website (https://illinois.ccrhavana.com/).

1.2.1 Ash Pond System Groundwater Monitoring

Monitoring wells were installed in 2015 in accordance with the Assessment Monitoring Program requirements outlined in 40 CFR § 257.95. The CCR groundwater monitoring network includes two background wells (HAMW-30 and HAMW-31) that are located east of the EAP and five downgradient monitoring wells located around the perimeter of the EAP. Monitoring well locations are shown on **Figure 3.** Monitoring wells and their respective locations and stratigraphic horizon are as follows:

- HAMW-30, HAMW-32, and HAMW-41 are screened in the upper part of the saturated zone;
- HAMW-39 and HAMW-40 are screened in the middle part of the saturated zone;
- HAMW-31 and HAMW-42 are screened in the lower part of the saturated zone.

Cross sections for the EAP are provided in **Figure 4** and **Figure 5**.

1.3 CLOSURE ALTERNATIVE ASSESSMENT PROCESS

This CAA is provided for the inactive ash ponds of the Site to meet requirements and objectives of the remedy per 40 CFR §257.96(c). Each remedy must meet the following threshold criteria as stated in the CCR Rule:

> (1) Be protective of human health and the environment.
> (2) Attain the groundwater protection standard as specified pursuant to §257.95(h);
> (3) Control the source(s) of releases so as to reduce or eliminate, to the maximum extent feasible, further releases of constituents in Appendix IV into the environment.
> (4) Remove from the environment as much of the contaminated material that was released from the CCR unit as is feasible, taking into account factors such as avoiding inappropriate disturbance of sensitive ecosystems.
> (5) Comply with standards for management of wastes as specified in §257.98(d).

The guidelines for selecting the corrective measure for surface impoundments are provided in Illinois Administrative Code 35 § 845.710 for Closure Alternatives, and they are summarized as follows:

a) Closure of a CCR surface impoundment, or any lateral expansion of a CCR surface impoundment, must be completed either by leaving the CCR in place and installing a final cover system or through removal of the CCR and decontamination of the CCR surface impoundment, as described in Sections 845.720 through 845.760.

b) Before selecting a closure method, the owner or operator of each CCR surface impoundment must complete a closure alternatives analysis. The closure alternatives analysis must examine the following for each closure alternative, and these become the criteria to evaluate the alternatives:

   1) The long-term and short-term effectiveness and protectiveness of the closure alternative, including identification and analyses of the following factors:

      A) The magnitude of reduction of existing risks;
      B) The magnitude of residual risks in terms of likelihood of future releases of CCR;
      C) The type and degree of long-term management required, including monitoring, operation, and maintenance;
      D) The potential short-term risks that might be posed to the community or the environment during implementation of a closure, including potential threats to human health and the environment associated with excavation, transportation, and re-disposal of contaminants;
      E) The time until closure and post-closure care or the completion of groundwater monitoring under Section 845.740(b) is completed;
      F) The potential for exposure of human and environmental receptors to remaining wastes, considering the potential threat to human health and the environment associated with excavation, transportation, re-disposal, containment or changes in groundwater flow;
      G) The long-term reliability of the engineering and institutional controls, including an analysis of any off-site, nearby destabilizing activities; and
      H) Potential need for future corrective action of the closure alternative.

   2) The effectiveness of the closure method in controlling future releases based on analyses of the following factors:

      A) The extent to which containment practices will reduce further releases; and
      B) The extent to which treatment technologies may be used.

   3) The ease or difficulty of implementing a potential closure method based on analyses of the following types of factors:

      A) Degree of difficulty associated with constructing the technology;
      B) Expected operational reliability of the technologies;
      C) Need to coordinate with and obtain necessary approvals and permits from other agencies;
      D) Availability of necessary equipment and specialists; and
      E) Available capacity and location of needed treatment, storage, and disposal services.

   4) The degree to which the concerns of the residents living within communities where the CCR will be handled, transported through, and disposed of are addressed by the closure method.

   5) The cost for implementing the corrective action is considered an important criterion, especially for the owner of the facility. Although this factor is not explicitly provided in the guidelines, it is added herein in recognition of its realistic and relative importance to selection of the corrective action.

c) In the closure alternatives analysis, the owner or operator of the CCR surface impoundment must:

   1) Analyze complete removal of the CCR as one closure alternative, along with the modes for

transporting the removed CCR, including by rail, barge, low-polluting trucks, or a combination of these transportation modes;

2) Identify whether the facility has an onsite landfill with remaining capacity that can legally accept CCR, and, if not, whether constructing an onsite landfill is possible; and
3) Include any other closure method in the alternatives analysis if requested by the Agency.

d) The analysis for each alternative completed under this Section must:
   1) Meet or exceed a class 4 estimate under the AACE Classification Standard, incorporated by reference in Section 845.150, or a comparable classification practice as provided in the AACE Classification Standard;
   2) Contain the results of groundwater contaminant transport modeling and calculations showing how the closure alternative will achieve compliance with the applicable groundwater protective standards;
   3) Include a description of the fate and transport of contaminants with the closure alternative over time, including consideration of seasonal variations; and
   4) Assess impacts to waters in the State.

   Since impacts to groundwater are below groundwater protective standards (GWPS), the potential groundwater pathways for exposure to contaminants is not present. This alleviates the need for modeling and calculations of groundwater transport.

e) At least 30 days before submission of a construction permit application for closure, the owner or operator of the CCR surface impoundment must discuss the results of the closure alternatives analysis in a public meeting with interested and affective parties (Section 845.240).

f) After completion of the public meeting under subsection e), the owner or operator of a CCR surface impoundment must select a closure method and submit a final closure plan to the Agency under Section 845.720(b). All materials demonstrating completion of the closure alternatives analysis specified in this Section must be submitted with the final closure plan.

g) The selected closure method must meet the requirements and standards of this Part, ensure the protection of human health and the environment, and achieve compliance with the groundwater protection standards in Section 845.600.

The intentions of threshold criteria from Federal guidelines overlap the intentions within the Illinois guidelines. With each alternative considered herein, the above criteria are met, or will be met as the process for review, design, and implementation is completed. The focus for this CAA becomes the discretionary evaluation best captured by comparing alternative using the criteria identified in paragraph b) above. These five criteria are the focus of the selection of the specific alternatives which each meet the intentions that are provided in each of the above criteria.

1.4 PURPOSE OF CAA

The purpose of this CAA document is to provide the basis for selection of the corrective measures to implement for closure of the impoundments of the EAP. Once the alternative is selected and approved by IEPA, an engineering design will be prepared and submitted to IEPA.

2. CONCEPTUAL SITE MODEL

To assist in the evaluation of potential remedy options, a conceptual site model (CSM) is presented that takes into account regional and site geology and hydrogeology, groundwater data and related protective standards, and the nature and extent of constituents of concern (COC) across the Site. The presented CSM derives from previous investigations including the *Hydrogeologic Monitoring Plan* (Natural Resources Technology, 2017) and the *Geotechnical Data Package for Dynegy Havana Station; East Ash Pond CCR Unit* (AECOM, January 2016). The CSM is also utilized to evaluate potential pathways of exposure and risks associated with those potential exposures.

2.1 SITE SETTING

The Havana Power Station is located south of the town of Havana in central Illinois on the east bank of the Illinois River, and approximately 38 miles southwest of Peoria (**Figure 1**). The power generating facility of the Havana Power Station is located west of SR 78. The four cells of the EAP are located just east of SR 78 (Oak Road). Cell 1 within the EAP is the southernmost cell. Cell 4, used for stormwater management, is directly north of Cell 1; Cell 2 is directly north of Cell 4; Cell 3 is directly east of Cells 2 and 4, but it extends farther north than Cell 2. As previously mentioned, the four cells of the EAP are east of SR 78 whereas the Havana Power Station lies west of SR 78 and along the Illinois River (see **Figure 2**).

2.2 GEOLOGY AND HYDROGEOLOGY

Geologic units present in the vicinity of Havana Power Station include fill, unconsolidated eolian dune and ridge deposits, unconsolidated alluvial sediments, unconsolidated glacial outwash from Wisconsinan Glaciation deposits, basal sand and gravel from pre-Illinoisan Sankoty Sand deposits, and shale and limestone bedrock from the Mississippian-age Salem Formation.

Previous investigations identified the approximately 80 to 90 ft thick unconsolidated sand and gravel deposits of the Havana Lowlands present at the Site as a single hydrogeologically connected and high-yield unconfined aquifer. The uppermost aquifer in the vicinity of the Site extends from the top of the water table to the top of underlying Mississippian-age bedrock that appears to occur at depth beneath the Site. A search of the Illinois State Geological Survey database, ILWATER, indicates numerous water supply wells located near the Site and screened in the unconsolidated materials overlying the bedrock, confirming the local use of the sand and gravel aquifer as a groundwater resource. The lower limit of the uppermost aquifer is the top of the uppermost bedrock (i.e., Mississippian-aged shale and limestone). This Mississippian bedrock formation in the vicinity of the Site is generally considered a hydrogeologic confining unit. **Figure 3** shows cross sections locations, and the cross sections are presented on **Figures 4 and 5**.

Hydraulic conductivity tests were performed for a dozen locations in the vicinity of the Site by the Illinois State Water Survey (ISWS) in a Report dated 1982. The reported range in median hydraulic conductivity values (i.e., for multiple tests from individual wells) from the ISWS Report was 4.7×10^{-3} to 1.1×10^{-1} centimeters per second (cm/s) with a geometric mean of the median conductivity values of 5.1×10^{-2} cm/s. Additionally, NTR performed hydraulic conductivity tests for 8 monitoring wells using falling/rising head tests within the uppermost aquifer in the vicinity of the Site. The resulting hydraulic conductivity values ranged from 4.4×10^{-3} to 2.7×10^{-1} cm/s with a geometric mean of 3.5×10^{-2} cm/s. Hydraulic conductivity values identified by these two testing activities are typical of unconsolidated clean sand (Freeze and Cherry, 1979).

Depth to groundwater beneath the EAP ranges generally from approximately 14 to 40 ft bgs. Groundwater elevations in the general area fluctuate according to the river stage in the Illinois River with greater influence of river stage for wells closer to the river. Groundwater elevations at the Site averaged approximately 447.1 ft above mean sea level (MSL) (NAVD88) with groundwater highs at 458.5 ft MSL to the southeast of the EAP (HAMW31 and HAMW38) and 446.2 ft MSL to the northwest of the EAP (HAMW32 and HAMW33) based on 1992 to 2013 data (NRT, 2017A). In general, flow reversals of gradients alternately toward and away from the river, have been identified from wells located close to the river. Groundwater flow reversals have not been identified in the wells that are part of the EAP CCR Unit (NRT, 2017A). Horizontal hydraulic gradient for the EAP ranged from 0.003 to 0.005 foot per foot (ft/ft) in November 2015 and February 2016 as groundwater flowed from southeast to northwest across the Site (i.e., generally toward the Illinois River). There was also little seasonal variation in horizontal hydraulic gradient beneath the Site; horizontal gradients in February 2016 were only 0.001 ft/ft less than in November 2015. This relatively low gradient is typical of high permeability unconsolidated material.

A range for average linear velocity was estimated using the gradients from November 2015 to February 2016 (0.003 to 0.005), the geometric mean values identified for the unconsolidated materials comprising the aquifer (3.5×10^{-2} to 5.1×10^{-2} cm/s), and an estimate for effective porosity (estimated from Freeze and Cherry, 1979 at 0.3). The calculated groundwater flow velocity ranged from 1 to 2.5 ft per day (ft/day). This is consistent with the groundwater velocity range presented in NTR, 2017A which provided a range in groundwater velocities of 0.5 to 2.6 ft/day.

2.3 GROUNDWATER MONITORING

Groundwater is being monitored at the EAP in accordance with the Assessment Monitoring Program requirements outlined in 40 CFR § 257.95, and as described in NTR documents (2017A and 2017B). Groundwater monitoring has been occurring at the Site since 2015, and the monitoring well network was formerly evaluated and accepted in NRT's *Hydrogeologic Monitoring Plan* (2017A). NRT's *Statistical Analysis Plan* (2017B) provided the framework for evaluating groundwater monitoring by the CCR Rules with four phases of groundwater monitoring:

- Background Monitoring in accordance with 40 CFR 257.90(b)(iii) and 257.94(b)
- Detection Monitoring in accordance with 40 CFR 257.94
- Assessment Monitoring in accordance with 40 CFR 257.95
- Corrective Action Monitoring in accordance with 40 CFR 257.95(g) and 257.98.

Each phase of the groundwater monitoring required specific statistical procedures as defined in the *Statistical Analysis Plan* (NRT, 2017B). Based on groundwater monitoring performed to date for the Site, Boron has exceeded the background concentration in monitoring well HAMW-40 leading to Assessment Monitoring based on GWPS established for Appendix IV constituents listed below.

The GWPS used to evaluate the Appendix IV constituents are defined in the CCR Rule at §257.95 Assessment Monitoring Program:

> (h) The owner or operator of the CCR unit must establish a GWPS for each constituent in Appendix IV to this part detected in the groundwater. The groundwater protection standard shall be:
>
> > (1) For constituents for which a maximum contaminant level (MCL) has been established under §§141.62 and 141.66 of this title, the MCL for that constituent;
> > (2) For constituents for which an MCL has not been established, the background

concentration for the constituent established from wells in accordance with §257.91; or (3) For constituents for which the background level is higher than the MCL identified under paragraph (h)(1) of this section, the background concentration.

Assessment monitoring of both upgradient and downgradient wells were compared to Appendix IV parameters in relation to GWPS (NTR, 2017B). The GWPS for the Appendix IV constituents are established as follows:

- Antimony- 0.006 mg/L
- Arsenic- 0.01 mg/L
- Barium- 2 mg/L
- Beryllium- 0.004 mg/L
- Cadmium- 0.005 mg/L
- Chromium- 0.1 mg/L
- Cobalt- 0.006 mg/L
- Fluoride- 4 mg/L
- Lead- 0.015 mg/L
- Lithium- 0.04 mg/L
- Mercury- 0.002 mg/L
- Molybdenum- 0.1 mg/L
- Radium 226+228- 5 pCl/L
- Selenium- 0.05 mg/L
- Thallium- 0.002 mg/L

2.4 NATURE AND EXTENT OF GROUNDWATER IMPACTS

Groundwater monitoring has occurred since 2015 with sampling results summarized in yearly Groundwater Monitoring and Corrective Action reports. During each sampling event, one sample is collected from each background and downgradient well in the monitoring system. Analytical data are evaluated after each event in accordance with the *Statistical Analysis Plan* (NTR, 2017B) which identified statistically significant increases (SSIs) of Appendix III parameters over background concentrations. Starting in 2018, wells were sampled for all Appendix IV parameters due to Boron being detected during the first Assessment Monitoring sampling event. The sampling events and whether SSIs were identified are provided in applicable Groundwater Monitoring and Corrective Action Reports.

Since 2015, only one well (HAMW-40) installed downgradient of the EAP measured a single constituent, Cobalt, at a level that exceeded its respective MCL in a single event (November 19, 2015). The original data are not available to check the veracity of this detection as the concentration is coincidently the same at the lead value. However, since that one event, there have been no exceedances of GWPS for Cobalt in monitoring well HAMW-40, and there have not been exceedances of GWPS for any other Appendix IV constituent for any of the site monitoring wells.

No SSIs of 40 CFR Part 257 Appendix IV constituents were determined in 2020, and the former Havana Power Station EAP remains actively monitored according to the *Hydrogeologic Monitoring Plan* (NTR, 2017A) in the Assessment Monitoring Program described in *Statistical Analysis Plan* for the Site (NTR, 2017B).

2.5 EVALUATION OF POTENTIAL EXPOSURE PATHWAYS AND RISKS

The presence of CCR units indicate the presence of CCR that potentially come into contact with human or environment receptors through direct or indirect contact. The evaluation of the exposure pathways is based on the risk characterization principle that a risk can only occur if there is a complete exposure pathway, linking the source(s) of exposure and people or ecological receptors. In summary, three elements are required:

- Potential source or chemical release from a source.
- A receptor at the exposure point (e.g., people, plants, or aquatic animals); and
- An exposure route by which contact can occur (e.g., ingestion).

In the absence of any one of these elements, the exposure pathway is incomplete and therefore the potential for risks is not significant from the prospective CCR unit that is evaluated. The identification of these three elements is the first step of the risk characterization process, also known as the problem formulation. The remaining components in the process are exposure assessment, toxicity assessment, and risk characterization. Brief descriptions of these components are presented below, followed by the qualitative risk characterization results for the CCR units in the EAP. It is important to note that this CAA will identify a corrective action that fundamentally changes the current site conditions.

2.5.1 Problem Formulation

Problem formulation is used to identify COC, potential human and ecological receptors and exposure pathways applicable for current and potential future land use. It is used to determine whether potential concerns are present and whether a risk assessment is required. Evaluation of potential exposure pathways was conducted to determine the applicability of the respective exposure pathway to Site conditions.

The COCs were identified as the Appendix IV constituent (metals) associated with CCR sites. The potential exposure pathways were considered for each media.

2.5.2 Comparison to CCR Standards

In a qualitative risk assessment, the exposure assessment and toxicity assessment components of the process are intrinsic in the comparison to regulatory guidelines. The derivation of generic guidelines use default assumptions of how receptors are exposed to chemicals. Chemical toxicity values are also used in the guideline derivation. Consequently, although the exposure and toxicity assessment components were not implicitly assessed as part of the qualitative risk assessment, they are indirectly incorporated when comparing COC concentrations to the applicable guidelines based on the site-specific human and ecological receptors identified for current and future site use. The GWPS for metals, presented above, serve as the screening level criteria for CCR sites.

2.5.3 Risk Characterization and Management

Risk characterization integrates information obtained from the risk assessment components, described above, with professional judgement to identify those exposure pathways which may result in adverse health effects for human health and ecological receptors. Should potential risks be identified for site conditions then the corrective actions for the CCR units should address these potential risks normally through elimination of pathways of exposure or management of source areas.

2.5.4 Identification of Receptors

The Site is currently comprised of open space mostly occupied by the for Cells, three of which are CCR units (Cells 1, 2, and 4), and the other an NPDES regulated stormwater pond. Potential receptors can include trespassers, workers (on the pond structures, for example), and ecological receptors including free-ranging animals and riparian fauna and vegetation surrounding the Site. The future conditions for the Site are not expected to include occupations by residences or businesses.

2.5.5 Identification of Exposure Pathways

An evaluation of the exposure pathways and their applicability to the Site is presented as follows.

- Direct Contact Pathway. The open CCR units make possible direct exposure to CCR materials.
- Vapor Inhalation Pathway. By nature, CCR material does not contain COC that can volatilize into the surrounding environment. The need to consider this pathway is therefore eliminated.
- Potable Groundwater Pathway. Groundwater flows beneath the CCR cells, and leakage from the cells can affect underlying groundwater. The groundwater monitoring program has shown impacts from boron (an Appendix III constituent) above background concentrations but none of the metal show concentrations above their respective GWPS. From groundwater modeling performed at other CCR sites in similar settings, capping the CCR material can return COC to background concentrations. It can be noted that there are no current users of groundwater at the Site, and it is likely that groundwater usage will be restricted for the Site in the future.
- Offsite Migration. Offsite migration can occur through leaching of dissolved COC into groundwater and subsequent groundwater migration or through airborne processes that move CCR particulate material. The groundwater monitoring program evaluates the potential for offsite migration through groundwater flow. Similarly, a dust survey evaluates the potential for particulate migration through airborne process.
- Ecological Direct Contact Pathway. Most of the Site's surface is covered by the cells with fringing embankments covered with grasses. Ecological exposures can occur by direct contact with the CCR material in the open cells.
- Freshwater Aquatic Life Pathway. Groundwater flow beneath the Site is toward the Illinois River with ultimate discharge into the river. The depth to groundwater beneath the EAP is generally below 14 ft bgs, which is generally below direct contact by burrowing wildlife. The presence of dissolved COC in groundwater can lead to exposures to freshwater aquatic life in the Illinois River. The results of groundwater monitoring suggests that the GWPS are not exceeded in groundwater leaving the Site. Additionally, discharge of groundwater into the Illinois River would be very small in comparison to the river flow thereby leading to considerable dilution of a potential COC in the discharge groundwater.

The Site is currently comprised of undeveloped and open space mostly occupied by the four Cells, three of which are CCR units (Cells 1, 2, and 3) containing CCR waste materials. Although the EAP is no longer active, potential exposures are possible, as noted above. The remedies considered in this CAA are all protective of human health and environment, and if implemented would significantly reduce if not eliminate potential exposure pathways and related risks in the present and extending into the future.

3. Corrective Action Alternatives

3.1 CLOSURE ALTERNATIVE ASSESSMENT GOALS

The overall goal for selection of the closure alternative is to select the one that best meets the following criteria. There are three alternatives evaluated and each are described, below.

3.2 CORRECTIVE MEASURES ALTERNATIVES

Corrective measures (remedies) are considered complete when pathways of exposure are addressed to reduce potential risks to acceptable conditions and when groundwater occurring beneath the Site does not show exceedances of any Appendix IV constituent above GWPS for three consecutive years of groundwater monitoring pursuant to §257.98(c)(2).

In accordance with §257.97(b), for the groundwater remedies to be considered, they must meet, at a minimum, the following threshold criteria (provided in more detail in **Section 1.3**):

1. Be protective of human health and the environment;
2. Attain the GWPS as specified pursuant to §257.95(h);
3. Control the source(s) of releases so as to reduce or eliminate, to the maximum extent feasible, further releases of constituents in Appendix IV to this part into the environment;
4. Remove from the environment as much of the contaminated material that was released from the CCR unit as is feasible, taking into account factors such as avoiding inappropriate disturbance of sensitive ecosystems; and
5. Comply with standards (regulations) for management of waste as specified in §257.98(d).

It can be noted that data from the groundwater monitoring program show that none of the Appendix IV constituents is found at concentrations above the GWPS over the past 5 years. Each of the remedial alternatives assembled as part of this CAA meet the requirements of the thresholdcriteria for groundwater listed above.

This CAA has been prepared based on closure for the EAP cells. Once selected and potential review comments incorporated, ATON intends to present closure plans to the IEPA which can be initiated and implemented within the allowable timeframes as stated in §257.101 of the CCR Rule. The remedial alternatives presented, herein, contemplate closure in place (CIP) for the CCR units (Alternatives 1 and 2) or closure by removal (CBR) (Alternative 3) for the CCR units of the EAP.

Cover System Design. The final cover system design contemplated for Alternatives 1 and 2, described below, will meet the requirements of the CCR Rule such that the permeability of the cover system will be less than or equal to the permeability of the existing bottom liner or subsoils present below the CCR material, or a permeability no greater than 1×10^{-5} cm/sec, whichever is less. In order to avoid the elevation of the final cover from extending too high, it may be necessary to install a geomembrane directly on top of the graded CCR material. In this case, a geo-composite drainage layer will be installed directly over the geomembrane. Should the overall height of the cell allow, an eighteen-inch layer of low-permeability soil will be placed prior to installation of the geomembrane.

After placement of the geomembrane, eighteen inches of earthen material will be placed on the underlying geosynthetics and graded to meet the thickness and slope for the cover system. Organic earthen material will then be placed on top of the 18” of soils to create a 6” soil layer capable of sustaining native plant growth. The final cover surface will be seeded and vegetated. The final cover slope over the covered cells will have a minimum slope of 3% and will be graded to convey stormwater runoff to drainage channels and to the outfall structure on the west side of the EAP. CCR material will be relocated and regraded as necessary to prepare the surface for fill obtained, where possible, from berms surrounding the cells and supplemented with borrow soils as necessary to achieve design grade.

Monitored Natural Attenuation. Monitored natural attenuation (MNA) is a viable remedial technology for groundwater where the source is remediated, and it is recognized by both state and federal regulators for organic and inorganic constituents. It is anticipated that MNA will be a component of the selected remedy. The USEPA defines MNA as "the reliance on natural attenuation processes to achieve site-specific remediation objectives within a time frame that is reasonable compared to that offered by other more active methods." The "natural attenuation processes" that are at work in such a remediation approach include a variety of physical, chemical, or biological processes that, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil or groundwater.

These *in situ* processes include biodegradation, dispersion, dilution, sorption, volatilization, radioactive decay, and chemical or biological stabilization, transformation, or destruction of contaminants (USEPA, 2015). When combined with encapsulated CCR material between an engineered low-permeability cover system and an existing engineered bottom, the potential for dissolution of Appendix III and IV constituents in groundwater is reduced or eliminated. Where existing infiltration water or potential future groundwater includes Appendix III and IV constituents, MNA can reduce residual concentrations in groundwater at and beyond the EAP boundary. It is recognized that a few additional monitoring wells may be needed to focus groundwater monitoring after implementation of the remedy.

3.2.1 Alternative 1 – Ash Pond Closures by Consolidation of CCR into Cell 3, Capping of Cell 3, and Groundwater by Monitored Natural Attenuation

Cells 1 and 2 were filled to the design limits of the dikes surrounding the cells, and they became inactive before power generating activities ceased in 2019. Cell 3 had not been filled to capacity by the time the plant ceased operating in 2019. There remains volumetric capacity in Cell 3 to consider relocation of the CCR material from smaller Cells 1 and 2 into Cell 3 which would then be covered by an engineered cover system.

The excavation and transport from Cells 1 and 2 may require dewatering of CCR material and possible treatment of the cell water. Capping in place (CIP) the aggregate volume of CCR material in Cell 3 after transferring material from Cells 1 and 2 can be completed safely, in compliance with applicable federal and state regulations, and its implementation will result in a remedy that is sufficiently protective of human health and the environment. The cover system designed for this alternative will contain all of the CCR material into the Cell 3 area, and it is expected to significantly reduce if not eliminate infiltration from surface water or rainwater while resisting erosion. The subsurface areas left by excavating Cells 1 and 2 will be filled using berm material from the flanks of the original cells and, as necessary, borrow material from the Site or a nearby source that is projected to be available.

Following completion of the installation of the EAP capping, the owners would implementpost-closure care activities. Post-closure care includes cap system maintenance the continuation of groundwater monitoring pursuant to §§257.90 through 257.98. Although Appendix IV constituents are not present above GWPS, MNA will provide the approach to potential issues that may arise.

3.2.2 Alternative 2 – Ash Pond Closure by Capping Each Cell In Place and Groundwater by Monitored Natural Attenuation

Each of the three cells of the EAP would be closed in place using engineered covers to reduce or eliminate direct contact with ash material and potential leakage of Appendix IV constituents in groundwater due to infiltration of precipitation into and through the cells. This alternative differs from Alternative 1 by leaving the CCR materials within Cells 1 and 2 and providing engineered cover systems for each cell. The CCR material in Cell 3 would be consolidated within the partially filled Cell 3 area prior to placing an engineered cover. It is possible that water management will be necessary when consolidating the CCR material within Cell 3. Berms surrounding the cells will be utilized as the cover material. If necessary, the engineered cover will be placed directly over the CCR material that is shaped to meet contour specifications. Borrow material will be acquired from the site or nearby source as necessary to achieve complete cover design.

Following completion of the installation of the EAP capping, the owners would implementpost-closure care activities. Post-closure care includes cap system maintenance the continuation of groundwater monitoring pursuant to §§257.90 through 257.98. Although Appendix IV constituents are not present above GWPS, MNA will provide the approach to potential issues that may arise.

3.2.3 Alternative 3 – Ash Pond Closure by Removal of All CCR Material Into a Type III Landfill, and Groundwater by Monitored Natural Attenuation

This alternative evaluates the removal of CCR from the three EAP cells and transporting the CCR material to an offsite engineered landfill. The CCR material would be completely removed, and the vacated cells would be backfilled using berms and supplemental borrow material to blend with ambient conditions. The offsite landfill would presumably meet appropriate standards to receive the CCR material consistent with the CCR Rule.

Removal activities would likely require dewatering and temporary staging/stockpiling of material for drying prior to transportation, which would affect the overall timeframe for complete removal. During periods of rain and inclement weather, the removal schedule would be negatively impacted. Excavation and construction safety during the removal duration is another concern due to heavy equipment (e.g., bulldozers, excavators, front -end loaders, and transportation vehicles).

There are several potential community impacts, safety concerns, and challenges associated with the off-site disposal CBR alternative. Given the magnitude of the total estimated truck trips (>350,000 trips) along with the combined travel distance required to transport the CCR to one or more landfills, there are increased exposures to transportation-related incidents. In addition, due to the volume and duration of loaded trucks travelling on public roads, it is anticipated that improvements to these roads may be necessary before or during large-scale removal of CCR. This could result in additional traffic flow disruptions and congestion due to road construction activities and delay in implementation or completion of this alternative. Fossil fuel consumption and vehicle emissions from transporting the CCR to a regional landfill are also significant in order to complete the off-site CBR alternative.

Assuming that a regional landfill is used for this alternative, it is presumed that the landfill owner already has a program for monitoring that would not require input or continued action from Finch. Following removal of the CCR material from the EAP, groundwater would be addressed through continued monitoring using MNA. It is anticipated that a demonstration of MNA could be obtained within 5 years of completion of this remedial action.

4. Comparison of Corrective Action Alternatives

4.1 EVALUATION CRITERIA

This section provides discussion of the corrective action alternatives that are summarized, above, in meeting the requirements and objectives of remedies for CCR impoundments as described under §257.97 and provided in Section 1, above.

The following five criteria, presented in Section 1.3, satisfy the threshold criteria and serve as the primary guidelines for selecting the corrective actions for ultimate closure of this Site. The five criteria [see Section 1.3(b)(1) through (5)] used to compare closure methods are summarized as follows:

1. The long-term and short-term effectiveness and protectiveness.
2. The control of future potential releases.
3. The implementability of the closure alternative.
4. Community acceptance of the closure alternative.
5. The overall estimated cost to implement the closure alternative.

These criteria are addressed in the next sections by relative comparison for each alternative to meet the criteria and meet ultimate closure. A numerical score of 1 to 3 will be given to each alternative for each of the 5 criteria, with 3 being the most favorable (i.e., best meeting the criteria) and 1 the least favorable. Where there is little distinction between alternatives to meet the criteria, the same numerical score may be given.

4.2 COMPARISON OF CRITERIA FOR EACH ALTERNATIVE

This section compares the three alternatives to each other for each of the five comparative criteria. **Table 2** provide the scores for each criterion and each alternative, and a discussion of each is provided, below.

4.2.1 Criterion 1 - Long- and Short-Term Effectiveness and Protectiveness

The relative success for this criterion depends on the alternative reducing or eliminating exposure pathways and hence potential contact with CCR material or dissolved metals in groundwater that may develop from contact with surface infiltration water and groundwater. Alternative 3 removes the waste to an onsite or offsite landfill thereby eliminating the pathway except for potential residual impacts in groundwater and hence the long-term potential risk. The short-term risk, however, are much greater for this alternative with prolonged efforts to excavate, load onto truck, then haul away (i.e., through the community) leading to potential short-term exposures through dust and dermal contact as well as increasing potential safety concerns by the prolonged field and transportation efforts. The extended time for cleanout of each of the cells is greater than consolidating Cells 1 and 2 into Cell 3 or simply consolidating Cell 3 material prior to capping each of the cells (Alternative 2). Since results from the groundwater monitoring program do not show groundwater impacts above GWPS for the Appendix IV metals, there does not appear to be a short-term advantage for any of the alternatives. However, by complete removal of CCR material (Alternative 3), it can be presumed that Alternative 3 is the best at diminishing or eliminating potential groundwater impacts. Altogether, Alternative 3 is the most favorable and thus is given a score of 3. Alternatives 1 and 2 are similar to each other in providing caps over the CCR waste to minimize future infiltration. However, Cell 1 does not have a synthetic liner beneath the bottom of the cell, suggesting less favorability for Alternative 2, and the extra handling of CCR material from Cells 1 and 2 to consolidate in Cell 3 suggests a more favorable situation for Alternative 2. Given that the bottom of Cell 1 is above the water table, there will not be continual contact from CCR material in groundwater for either Alternatives 1 or 2. The placement of an impervious cap over Cell 1 is expected to provide an effective reduction of the potential for groundwater to become impacted beneath Cell 1. Cells 2 and 3 have impervious bottom liners, and rainfall infiltration has been occurring for years to suggest that placement of impervious cover systems will diminish if not eliminate infiltration and hence future potential exposure. The reduced time for excavation and transportation of CCR waste by leaving Cells 1 and 2 intact favors this alternative. This results in Alternatives 2 receiving a score of 2, and Alternative 1 a score of 1.

4.2.2 Criterion 2 – Control of Future Potential Releases

The distinction between this criterion and the first criterion is mostly related to potential physical releases from breaches in construction. The relative success for this criterion depends on the effectiveness of the alternative at maintaining a stable environment free of unexpected or unintended releases. For Alternatives 1 and 2, onsite construction to shape the cells for placement of a cover system the placement of the synthetic liner and earthen cover system is not difficult given the open space surrounding the cells. It is projected that the alternatives will endure many decades without need of significant repairs. However, the removal of all waste to an onsite or offsite landfill (Alternative 3) is considered to eliminate potential releases altogether by ultimately restoring the property to open ground. As a result, alternative 3 (i.e., complete removal of CCR material) is the most favorable and thus a score of 3. Alternatives 1 and 2 are very similar in providing caps over the CCR waste to minimize or eliminate contact pathways. Alternatives 1 and 2 are both given scores of 2 since there is not a great distinction between the two regarding future potential releases.

4.2.3 Criterion 3 - Implementability

The relative favorability for this criterion depends on the degree of difficulty implementing the alternative, the availability of equipment and manpower to implement, the coordination / permitting with state and local agencies, and the relative ease of the Site in staging the alternative. Each of the alternatives involve some amount of earth-moving machinery and manpower with Alternative 2 being the least (i.e., leaving most of the material in place for capping), and Alternative 3 (complete removal) the greatest amount of CCR material and soil moving and time to complete the task. Similarly, leaving most of the waste in place (Alternative 2) involves the least effort from regulatory agencies in the form of less permitting and less review and oversight. The constructability of cover systems over smaller cells favors Alternative 2 over Alternative 3. The scoring for this criterion is 3 for Alternative 2, 2 for Alternative 1, and 1 for Alternative 3.

4.2.4 Criterion 4 – Community Acceptance

It is required that a community meeting be held within 30 days of submission of a construction permit for the closure plan. The degree to which the concerns of residents living within the community where the CCR material will be handled and disposed is accepted depends on the overall time it takes to complete the remedial activities and the relative disturbances experienced in the community. With the great volume of CCR material that is required to be removed in order to implement Alternative 3, this alternative becomes the least favorable. There would need to be a steady stream of trucks coming onto the property and traveling along the roadways to the landfill where dust control can become a problem, roadway become deteriorated, and roadway safety a challenge. Alternatives 1 and 2 are accomplished with most of the activities occurring onsite. For Alternative 2 (capping each Cell in place), there is less overall handling of CCR and soil making this alternative most favorable and thereby receiving a score of 3. Alternative 1 (transferring Cells 1 and 2 into Cell 3) receives a score of 2, and the Alternative 3 (complete removal) receives a score of 1.

4.2.5 Criterion 5 – Overall Cost

The costs for the alternative derive primarily from engineering and implementation. With engineering costs secondary to implementation costs, the volume of CCR material requiring excavation and transportation primarily determines the overall costs. Implementation of Alternative 3 becomes greatly more costly than the other two alternatives. Since the bulk of the CCR material stays in place for Alternative 2, Alternative 2 becomes the least expensive to implement. This results in Alternative 2 receiving a score of 3; $71.8 Million, Alternative 1 receiving a score of 2; $8.9 Million, and Alternative 3 a score of 1; $7.92 Million.

Table 1 presents the rollup of the evaluation of alternatives.

Table 1: Alternatives Evalation Comparison
Corrective Action Assessment
Finch Development LLC
Former Havana Power Station
Havana, Illinois

Criterion #	Description	Alternative 1	Alternative 2	Alternative 3
1	Long- and Short-Term Effectiveness and Protectiveness	2	2	3
2	Control of Future Potential Releases	2	2	3
3	Implement ability	2	3	1
4	Community Acceptance	2	3	1
5	Cost	2	3	1
6	Total	10	13	9

5. Summary

This Corrective Measures Assessment has evaluated the following alternatives:

- Alternative 1: Ash Pond Closure by consolidation of CCR into Cell 3 and capping, and MNA for potential groundwater issues.
- Alternative 2: Ash Pond Closure by capping CCR in place in Cells 1 and 2, and consolidating in Cell 3 prior to capping, and MNA for potential groundwater issues;
- Alternative 3: Closure by removal of CCR to an offsite landfill, and MNA for potential groundwater issues.

In accordance with §257.97(b), each of these alternatives has been confirmed to meet the following threshold criteria:

1. Be protective of human health and the environment;
2. Attain the GWPS as specified pursuant to §257.95(h);
3. Control the source(s) of releases so as to reduce or eliminate, to the maximum extent feasible, further releases of constituents in Appendix IV to this part into the environment;
4. Remove from the environment as much of the contaminated material that was released from the CCR unit as is feasible, taking into account factors such as avoiding inappropriate disturbance of sensitive ecosystems; and
5. Comply with standards (regulations) for management of waste as specified in §257.98(d).

This Closure Alternative Assessment selected a remedy (Alternative 2) that allows for leaving the CCR material in place in Cells 1 and 2 while consolidating the CCR in Cell 3 to reduce the overall size of this cell, capping each cell using a Type III landfill cap, and addressing potential groundwater issues via MNA. In accordance with the CCR Rule. §257.97(a), a semi-annual report is required to document progress toward remedy selection and design. Once a remedy is selected, a final remedy selection report must be prepared to document details of the selected remedy and how the selected remedy meets §257.97(b) and Section 845.710 requirements. The final selected remedy report will also be certified by a professional engineer and posted to the Dynegy CCR website.

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