**Memo**

| | | | |
|---|---|---|---|
| To | **Michelle Kaysen / USEPA** | File no | **377882016.2400** |
| From | **Peter Guerra**<br>**Russ Johnson** | cc | **Dan Sullivan / NIPSCO** |
| Date | **June 2, 2017** | | |
| Subject | **Revised Costs for SWMU 15**<br>**Corrective Measures Study for Area C**<br>**NIPSCO Bailly Generating Station** | | |

The Draft Area C Corrective Measures Study (CMS) report was issued in August 2015, which recommended encapsulation of coal combustion residuals (CCR) in Solid Waste Management Unit (SWMU) 15. In response to EPA comments dated December 3, 2015, a Revised Draft Area C CMS Report was filed on March 18, 2016 (Revised Draft CMS Report). The revised report maintained encapsulation as the recommended corrective measure for SWMU 15, comprised of a perimeter slurry wall to clay and an engineered, impermeable cover.

To further evaluate the corrective measure options, a geotechnical investigation was completed in July, August and September, 2016 (borings shown in **Figure 1**). Findings from that investigation were documented in a memorandum to EPA dated January 23, 2017. In the conclusions of that memo NIPSCO proposed to revise the conceptual designs and associated costs in a separate memo to EPA for: (1) encapsulation, (2) full excavation for off-site disposal, and (3) partial excavation for off-site disposal with in situ stabilization and solidification (ISS) of CCR left below the water table. Depending on the remedy evaluated below, the estimated costs have increased primarily because of the increased amount, density, and stability of CCR, and the increased cost of groundwater treatment for boron. The evaluation presented herein will start with the previously recommended encapsulation, followed by partial excavation and ISS. For each of these only one cost version is provided. Due to the much higher costs associated with full excavation and off-site disposal, four cost versions are presented that consider methods that may potentially reduce costs, primarily by eliminating dewatering and treatment of groundwater for the removal of boron, among other inorganics. As detailed in the Revised Recommendation section at the end of this memo, based on the geotechnical investigation findings and this cost re-evaluation, NIPSCO is now recommending partial excavation with ISS for SWMU 15.

## ENCAPSULATION

Findings from the 2016 geotechnical investigation and a more rigorous assessment of groundwater treatment costs, primarily for the removal of boron, have resulted in an increase to the Revised Draft CMS Report costs for encapsulation in the following ways. First, the slurry wall must be extended to a greater depth along portions of the wall alignment compared to the average depth of 20 feet assumed in the Revised Draft CMS Report costs. Based on the depths to clay that were encountered in the geotechnical borings, the wall would be extended to variable depths between 20 and 52 feet surrounding the southwest, southeast and northeast portions of SWMU 15. To the northwest, where the clays encountered were very thin, or non-existent, a hanging wall would be

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constructed to depths ranging from 53 to 72 feet. The new, revised square footage of slurry wall is compared to the Revised Draft CMS Report value in **Table 1**.

Second, due to the compressible nature of the CCR, a geogrid material will be placed between the CCR and natural materials used to grade the surface of SWMU 15 before the engineered cap is installed.

Finally, to maintain an inward gradient, groundwater would be extracted from inside the slurry wall to prevent seepage from leaving the encapsulated material. Groundwater modeling indicates that the flow rate should be approximately 5 gallons per minute (gpm). As indicated in **Table 1**, the total costs for the encapsulation remedy, including 30 years of operation and maintenance, is **$26.1M.** The encapsulation cost detail is included in **Attachment A**. A substantial contribution to the overall costs would be the long-term O&M attributed to water treatment. Capital costs for the treatment system include: site preparation; concrete slab and pre-engineered building; system components, including pumps (maximum design flow 20 gpm), tanks, storage/treatment vessels, filters, meters, lines, freight and taxes; electrical allowance; plant construction; and construction oversight. The capital cost for either ion exchange or reverse osmosis system is estimated at approximately $1.6M (**Attachment B**). The O&M includes consumables (e.g., depending on the technology, filters, membranes, acid, caustic), power, operation and maintenance, and disposal of concentrated brine (or reject water) for deep-well injection. The O&M is estimated to cost $146K (for ion exchange) or $155K (for reverse osmosis) per year. Treated groundwater would either be discharged to surface water pursuant to the state's NPDES program (henceforth referred to as an NPDES permit) or directed to a nearby publicly-owned treatment works (POTW).

**Attachment A** provides a costing spreadsheet for the encapsulation remedy assuming an ion exchange system will be constructed. Amec Foster Wheeler has collected groundwater samples for an ion-exchange, bench-scale test and for the chemical parameters needed to perform reverse osmosis (RO) modeling. Projection software will be used to model various preliminary designs or configurations for the RO membranes. The RO projections will provide insight on many things, including:

- recovery rates (how much water is purified and how much waste is created)
- equipment sizes (how many RO membranes and RO housings are needed)
- the piping and valve arrangement of the RO system
- the treated water (permeate water) quality
- the reject water (concentrate water) quality
- the power consumption for O&M estimates
- the chemical consumption for O&M estimates

Once the software modeling is complete, the system design (pretreatment, post-treatment, cleaning systems, etc.) will be completed and costed. If these evaluations indicate that RO is more appropriate treatment than ion exchange (as it can potentially reach lower end points with less waste residual or reject), then the 30-year cost presented in **Table 1** would increase approximately $400K. The water treatment estimates provided in **Attachment B** provide the appropriate level of detail for this Revised Draft CMS Report re-costing effort. Results from the ion exchange bench-scale study and RO modeling will be used to evaluate the most appropriate treatment technology. If both are equally effective, the lower cost option will be employed, considering such things as construction costs, consumables, waste disposal, and long-term operation and maintenance. It should be noted that approved effluent concentrations for metals (particularly boron) have not yet been identified as the permitting process has not been initiated. It is unlikely that the permitting agency will require lower discharge limits than can be reliably achieved; however, achieving very low effluent limits may have significant cost implications. Variable influent concentrations or groundwater temperatures may also affect boron removal efficiencies, with the associated cost implications. It is anticipated that the encapsulated groundwater will approach equilibrium with the CCR and be removed at a low enough rate (e.g., 5 gpm) to produce consistent influent concentrations; however, higher variability is expected for pumping rates (up to 100 gpm) and influent concentrations for the full excavation scenario discussed below.

The groundwater model presented in Appendix J of the Revise Draft CMS Report has been updated to include the new lithologic information from the 2016 geotechnical investigation. The lithology local to SWMU 15 was integrated into the regional geology based on publicly-available information. The model was used to simulate the slurry wall alignment and depths indicated in **Figure 2** to determine flux into/out of the encapsulated CCR via discontinuities in the clay base and seepage through the low-conductivity slurry wall (the total was calculated to be the 5-gpm value referenced above). The model was also used to simulate the plume downgradient of the encapsulated CCR. The modeling results will be presented in a separate technical memorandum.

## PARTIAL EXCAVATION AND ISS

Findings from the 2016 geotechnical investigation affect the Revised Draft CMS Report costs for this alternative in two ways. First, it was determined that the volume of CCR above and below water table was greater than previously quantified. Second, the CCR had a greater density than assumed in the Revised Draft CMS Report. These differences are compared in **Table 1**. The increased CCR volume contributes to the time needed to excavate and manage/transport the unsaturated CCR and to solidify/stabilize the saturated CCR left in the ground. The greater density contributes to the cost for disposal of unsaturated CCR removed from SWMU 15. Because CCR excavation will be conducted above the water table there is no need for sheeting/shoring or excavation dewatering and the associated treatment. As detailed in the Revised Draft CMS Report, ISS would be applied to the CCR left below the water table. Different solidification mixes were studied in support of this remedy (see Kemron Report, Appendix C of the Revised Draft CMS Report). The treatability study assessed twelve potential mix designs, which included varying percentages of the following reagents:

- Type I Portland Cement;
- Ground Granulated Blast Furnace Slag; and/or
- Enviroblend® 50/50 AS (a proprietary product)

The unconfined compressive strength of all 12 samples is greater than 55 pounds per square inch, which indicates a "hard" soil type, with a volumetric expansion ranging from 13.8% to 40.4%. The hydraulic conductivity for a subset of three samples was $3.9*10^{-7}$ cm/sec (cement only), $1.2*10^{-8}$ cm/sec (cement and slag), and $4.4*10^{-9}$ cm/sec (cement, slag, and Enviroblend®). The hydraulic conductivity of untreated CCR ranges from $5.9 * 10^{-5}$ to $9.03 * 10^{-6}$ cm/sec. Depending on the mix design, solidification of the CCR would reduce the hydraulic conductivity by nearly two to over four orders of magnitude, which would significantly reduce the flux of CCR constituents from the solidified mass, resulting in substantially improved groundwater quality. Note that the mix designs resulting in the lowest hydraulic conductivity values are associated with the greatest volumetric expansion.

As indicated in **Table 1**, the revised cost for ISS is **$22.7M**, approximately $3.6M greater than the Revised Draft CMS Report cost. The revised cost assumes that the excavated CCR from the unsaturated zone will be backfilled to the pre-excavation grade. **Attachment C** provides a revised cost spreadsheet for the partial excavation and ISS remedy. The cost spreadsheet assumes that the saturated CCR will be solidified/stabilized with cement and slag, resulting in a hydraulic conductivity of $1.2*10^{-8}$ cm/sec and an expansion factor of 21%, which will result in less imported backfill to cover the solidified mass and fill the void left by removal of the unsaturated CCR to achieve pre-excavation grades. Partial backfilling to cover the solidified CCR with a vegetative growth layer, but not to pre-existing grades (assume 50% of imported backfill) would reduce the revised costs by approximately $1.3M. This approach would yield a total revised cost for the encapsulation alternative of **$21.4M**.

**FULL EXCAVATION AND OFF-SITE DISPOSAL**

As indicated in **Table 1**, full excavation for off-site disposal is the most expensive corrective measure, particularly Version 1. Options to potentially reduce costs (Versions 2 through 4) were developed. Cost savings are primarily related to: (1) the elimination of high rates of construction dewatering for ion-exchange or RO treatment; (2) measures to reduce water content of excavated CCR; and (3) partial versus complete backfilling to grade. Excavation "in the dry" (Version 1) requires pumping from a sand-dominated aquifer to dewater the CCR with the associated treatment, and both pose technical and financial challenges. Although potentially less expensive, excavation "in the wet" also poses some significant challenges, and the lower cost remedies may be overly optimistic. Additional detail for each version is provided below.

<u>Version 1</u> - This corrective measure includes the removal of CCR and soil at SWMU 15, off-site disposal, and replacement with clean backfill material to the existing grade. Excavated CCR would be disposed off-site, as well as a portion of intermingled soil that cannot be segregated from the CCR. It is assumed that overlying soils (approximately 35,000 cubic yards) would be segregated to the extent practicable, temporarily stockpiled, and reused as backfill. A total of approximately 193,000 in-bank cubic yards would be excavated and transported off-site to a licensed disposal facility as non-hazardous waste. It is estimated that over 16,000 truckloads of soil and CCR will be required (assuming 12 cubic yards per load) to move this amount of material.

Considerable planning would be required to implement this alternative. Several techniques were considered for excavating CCR located below the water table. Bracing, including sheet piles, trench boxes, and in-situ cement-stabilized walls; and/or sloping of the excavation would be required to reach the required depths, and other support systems may be necessary near the transmission tower foundations. The costing of this alternative for comparative purposes assumes sheet piling will be installed to shore excavations and limit horizontal groundwater flow into the excavation. The installation of sheet pile for wall stability and water management during excavation of CCR to the depths required at SWMU 15 would require large overhead equipment for positioning and driving the sheet pile. Driving sheet piles would not be allowed within a certain distance of energized power lines and would not be possible beneath the power lines (energized or de-energized). Excavation with long-stick equipment would also be prohibited near the energized lines. Much of the proposed excavation footprint is beneath or near the power lines. Alternative methods for slope stability and water management in areas near the power transmission lines would have to be employed.

A well-point system and/or construction sump system were considered to manage groundwater seeping and upwelling into the excavation. Excavation floor stability analysis suggests that a sump system in the deeper portions of the CCR would result in unacceptable exit gradients and instability within the floor of the excavation. Therefore, in areas of the planned excavation that are greater than approximately five (5) feet below the static water table, a well-point system that can maintain a drawdown at least a foot or more below the floor of the excavation is required to maintain stability. Assuming sheet pile is used to brace the excavation sidewalls, it is estimated that such drawdown would require pumping on the order of 100 gpm. Given the proximity of the Cowles Bog wetland complex, pumping at 100 gpm may adversely affect the local hydrology of the nearby Cowles Bog.

Recovered groundwater would be treated via ion exchange or reverse osmosis, as described above for the encapsulation remedy, and discharged to either surface water pursuant an NPDES permit or directed to a POTW. Treatment system components would have to be sized for 100 gpm, and the O&M would increase because more consumables would be needed. As indicated in **Attachment B**, the capital cost for either an ion exchange or reverse osmosis (RO) system is estimated at approximately $1.5M. The O&M cost is estimated to be $517K (ion exchange) to $533K (reverse osmosis) for one year (two, 6-month construction periods).

Based on data from the 2016 geotechnical investigation, fully saturated CCR is expected to have an in-situ density of approximately 1.75 tons per cubic yard (tpy). Based on review of the material texture analysis results, the saturated CCR is assumed to freely drain approximately 50% of its total porosity resulting in a material density of approximately 1.58 tpy. Stockpiling with minimum processing of the CCR is expected to result in this freely-drained state.

Excavated materials would likely need to be, at a minimum, temporarily staged on-site for dewatering and further characterization and coordination, and then later loaded into haul trucks for transport to the disposal facility. Stockpiled soils would require dust, erosion, and sedimentation controls. At a minimum, excavated soils would be stockpiled on an impermeable liner at designated locations away from the border between NIPSCO and the Indiana Dunes National Lakeshore (IDNL), potentially along the fence line that parallels the facility access road, or between the transmission towers and transformer yard. The pile(s) would be covered and weighted when not in use and at the end of each work day. Real-time monitoring of air-borne dust concentrations would be performed during movement or agitation of excavated soils.

The **Attachment D** costing spreadsheet for Version 1 assumes an ion exchange system will be constructed for a 100-gpm system, for a total remedial cost of **$31.9M**. As indicated above for the encapsulation remedy, Amec Foster Wheeler has collected groundwater samples for an ion-exchange, bench-scale test and for the chemical parameters needed to perform RO modeling to evaluate the best technology. If these evaluations indicate that reverse osmosis is the more appropriate technology, then the 1-year cost presented in **Table 1** would increase by $70K.

Version 2 – This alternative is similar to Version 1, with the following major differences: (1) limited dewatering of the excavation; (2) treatment of extracted groundwater to remove total suspended solids (TSS) only before recirculation back to the excavation; (3) material handling to remove moisture from the excavated CCR; and (4) partial backfilling (i.e., to the water table). Excavation with limited dewatering and/or in trench recirculation was considered to maintain static groundwater pressure and stability of the excavation floor. Based on excavation stability analysis results, if the static water table were maintained throughout the excavation process, then the excavation floor would remain stable and excess exit gradients resulting in heaving would be avoided. Excavation "in the wet" requires two key additions to the remedial action: 1) pre-excavation borings to map the excavation floor and walls below the water table with a high degree or resolution; and, 2) excavation with real-time GPS and laser-leveling monitoring systems. Pre-excavation CCR mapping could be accomplished with a detailed and high density grid (e.g., 20-feet on center) of direct-push coring coupled with the topographic surveying completed in 2016 over the limits of the CCR to map the excavation limits. The data from this survey with existing data would be used to generate a target surface for integration with the real-time GPS and laser-leveling monitoring system. Several systems (e.g., Ocala Instruments®, Excavision™, Leica® PowerDigger 3D™) that are commercially available allow the excavator operator to see slope and height differences compared to a reference elevation, in real time, on an LCD screen mounted in the cab of the excavator. Design cut elevations and surfaces can be preloaded into the monitoring system memory to help guide the operator; and excavator bucket position can be logged to confirm as-built excavation dimensions. The system also monitors the progress confirming that target elevations for the excavation are achieved. Visual confirmation of the limits of excavation may not be possible.

Under the limited dewatering option described in the paragraph above, groundwater in the trench would be removed, passed through a particulate filter to remove suspended CCR solids, and returned to the excavation and/or discharged to nearby areas yet to be excavated, but within the general area of excavation. The RO or ion-exchange treatment required to meet the NPDES permit would not be required for this scenario.

As mentioned above for Version 1, fully-saturated CCR is expected to have a density of approximately 1.75 tons per cubic yard (tpy), but is expected to freely drain to approximately 50% of its total porosity resulting in a material density of approximately 1.58 tpy. However, if the material is windrowed and processed more forcefully additional water could be removed resulting in CCR with an approximate density of 1.45 tpy. Windrowing is expected to remove approximately 50% of the water content between the residual saturation (assumed at 5%) and the effective porosity (assumed at 50% of the total porosity).

For Version 2, backfill material would be imported and the approximate 35,000 cubic yards of overburden material would be re-used for fill. Engineered placement of the fill would not be required and the resulting fill profile would be consistent with the surrounding loose/soft materials. Fill placement would likely result in an initial elevation above target, and significant settlement would likely occur over time compared to engineered backfill.

Costing details for Version 2 are provided in **Attachment D** and summarized in **Table 1**. Assuming excavation "in the wet" is possible, water treatment to remove boron is not required, efforts to remove excess moisture to reduce the CCR bulk density to 1.45 tpy are successful, and backfilling to the water table is acceptable, these measures may reduce the estimate costs for Version 1 by approximately $2.9M, to a remedy cost of **$29.8M**. These potential savings are related primarily to the elimination of groundwater treatment to remove boron. If the excavations were not backfilled at all, and open ponds remained, the estimated remedy costs would be approximately **$28.3M**.

Version 3 – The difference between this alternative and Version 2 is the additional processing of excavated CCR to reduce the bulk density. Processing the CCR with a filter press is assumed to remove water from the CCR down to residual saturation. Following processing using a filter press, the resulting density of the CCR was calculated to be approximately 1.32 tpy. A portable filter press capable of processing approximately 650 tons per hour of CCR slurry is assumed sufficient to keep up with excavation and limited dewatering processes. As detailed in Attachment D and summarized in **Table 1**, the Version 3 costs is estimated at **$28.4M**.

In discussions with filter press vendors, depending on the consistency and processes used to excavate and move the CCR to the filter press, the process may not be viable. A key consideration of the filter press operation depends on the flowability of the CCR. If the mixture of CCR and water is such that, either as excavated or amended following excavation, it is in a slurry state, then the filter press might be effective. Conversely, if the material drains readily and exhibits stiffness or a low slump characteristic, the CCR may not be amenable to filter press. Given the latter case, the filter press may not be required, and windrow processing might result in a lower water content than originally assumed for this feasibility study.

Version 4 - The difference between this version and Version 3 is the elimination of backfilling, leaving ponded water below the power transmission lines to the depth of excavation. Because there is no fill placement and potential for settlement, there would be no need for periodic grading. An approach for re-vegetating slopes surrounding the ponded water would be developed in consultation with National Park Service (NPS) staff from the IDNL. As detailed in Attachment D and summarized in **Table 1**, the Version 4 costs is estimated at **$26.9M**.

**SOURCE CONTROL**

Appendix J of the Revised Draft CMS Report includes natural attenuation simulations of the boron plume based on source isolation (encapsulation), partial source removal and solidification of CCR below the water table (ISS) and full source removal (excavation). To simulate these, the hydraulic properties of the SWMU15 footprint were altered. For example, the in-situ solidification alternative is represented by a MODFLOW variant that has a greatly reduced hydraulic conductivity (0.001 m/d) within the SWMU15 footprint, whereas the excavation and backfill alternative is represented by a variant that has a hydraulic conductivity within the SWMU15 footprint consistent with that of the surrounding aquifer. For the scenario representing capping and barrier wall construction, the SWMU15 footprint was specified as a no-flow zone to the bottom of the model, such that groundwater can neither enter nor exit the area.

The results of these three scenarios indicate that the sandy aquifer has the capacity to attenuate the IDNL boron plume within 3 years regardless of the source area remedy, principally due to the relatively high dispersivities and the fact that the target concentration (1,600 ppb) is less than an order of magnitude below the maximum starting concentration (15,000 ppb) in the transport model. Since Appendix J was issued the encapsulation scenario has changed, and the assumption of a no flow barrier is no longer valid, although groundwater seepage through and below the low-conductivity slurry wall significantly reduces the mass flux of boron compared to current conditions.

## REVISED RECOMMENDATION

Given the increased costs for encapsulation, the uncertainty associated with containment due to the bottom clay integrity, and the long-term O&M (i.e., required beyond 30 years), NIPSCO is no longer recommending this Alternative #6. Considering cost, implementation, and degree of permanence, as well as effectiveness at plume reduction that is similar in duration to the excavation scenario, NIPSCO now recommends Alternative #4 – Partial Excavation, Off-Site Disposal and Solidification. More than half of the CCR will be removed from SWMU 15 without having to manage and treat groundwater, with much less concern about the excavation floor and sidewall stability. Low-profile equipment exists for the removal of unsaturated CCR and for the ISS of CCR below the water table. This is an extremely important safety and implementation consideration given the overhead, high-voltage transmission lines. The amount of backfill to be placed above the solidified CCR can be adjusted in consultation with NPS to leave a more natural topographic transition from SWMU 15 to the IDNL, with enough soil cover to sustain re-vegetation. Breaks in the existing dike can also be contoured into the finished grade of SWMU 15. The treated CCR would result in a solidified mass with a hydraulic conductivity of approximately $1.2*10^{-8}$ cm/sec, almost three orders of magnitude less than the untreated CCR hydraulic conductivity, with a commensurate reduction in chemical mass flux from the solidified CCR.

The Full Excavation and Off-Site Disposal remedy (Alternative 1#) remains the most expensive and difficult alternative to implement. Water management and treatment, excavation floor and sidewall stability, and the overhead utilities are all difficult challenges for the full excavation option. Dewatering and water treatment, excavation, free drainage and windrowing, transportation and offsite disposal with full or partial backfilling is the most likely cost scenario, ranging from **$28.3M** to **$29.8M** for purposes of comparison to the recommended Alternative #4 **($21.4M to $22.7M**).

## ATTACHMENTS

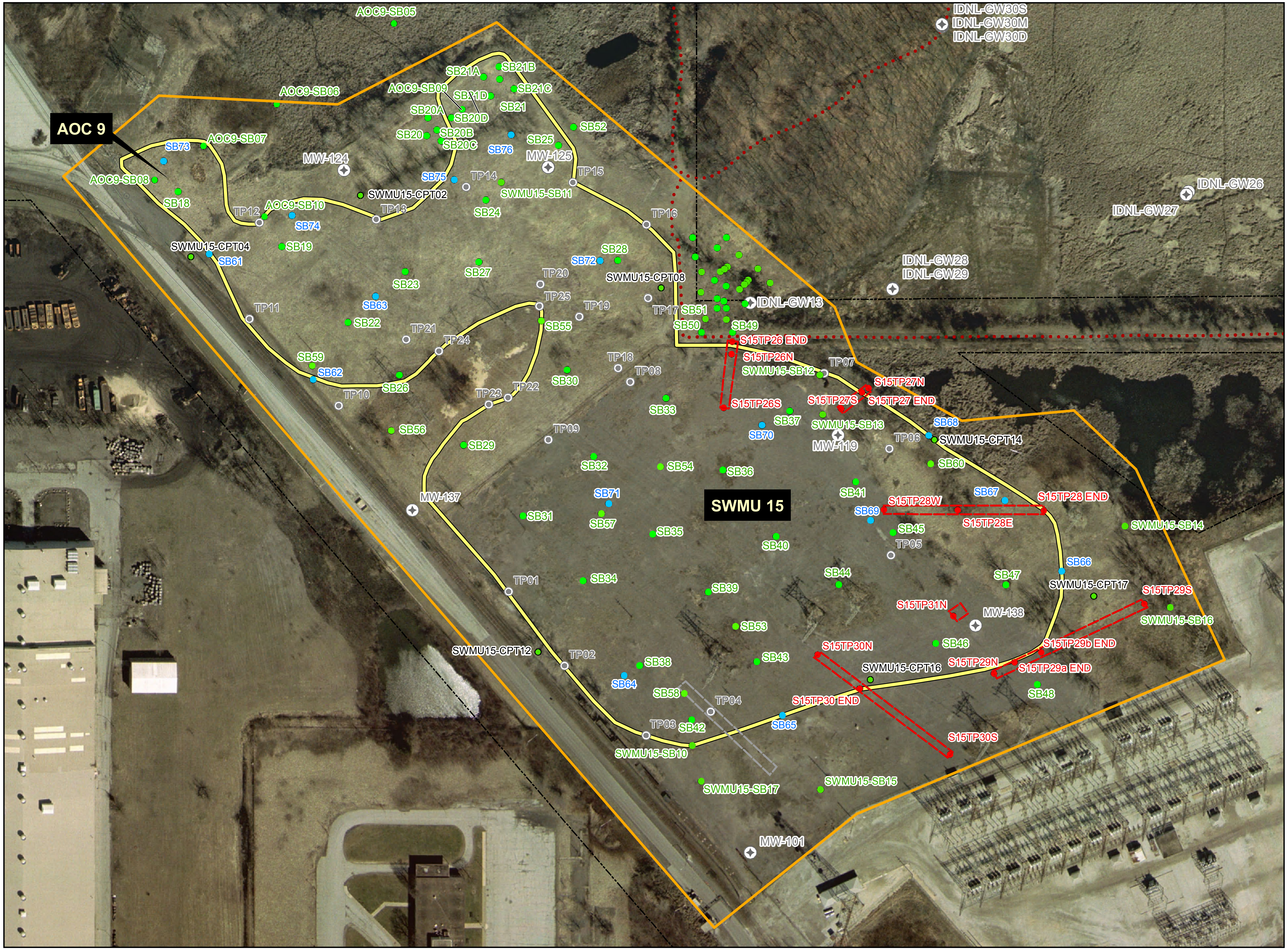
Table 1 – Comparison of Revised Costs
Figure 1 – SWMU 15 Investigation Locations
Figure 2 – Slurry Wall Alignment and Depths

Attachment A – Revised Cost Estimate – Encapsulation
Attachment B – Revised Cost Estimate – Water Treatment
Attachment C – Revised Cost Estimate – Partial Excavation, Off-Site Disposal and ISS
Attachment D – Revised Cost Estimates – Full Excavation and Off-Site Disposal

**Table 1. Comparison of Revised Costs**
**Area C Corrective Measures Study**
**Bailly Generating Station**
**Chesterton, IN**

| Remedy | Element of Cost Estimate | Base Case (included in 2015 CMS Report) | Version 1 | Version 2 | Version 3 | Version 4 |
|---|---|---|---|---|---|---|
| **In-Situ Encapsulation** | **Total Cost (Millions)** | **$16.2** | **$26.1** | | | |
| | Construct Slurry Wall (sf) | 136,000 | 219,770 | | | |
| | Water Treatment | Included | Ion Exchange with deep well injection of brine | | | |
| | Cover System | Natural materials with impermeable liner | Geogrid before natural materials with impermeable liner | | | |
| **Excavation Above Water Table, ISS Below** | **Total Cost (Millions)** | **$19.1** | **$22.7** | | | |
| | Specific density of material for disposal | 1.2 tons/cy | 1.6 tons/cy | | | |
| | Excavation volume of segregatable overburden (cy) | 49,437 | 21,640 | | | |
| | Total volume of CCR/soil matrix for disposal | 85,430 | 100,383 | | | |
| | Total volume of CCR/soil matrix for ISS | 77,681 | 91,287 | | | |
| **Full Excavation and Off-Site Disposal** | **Total Cost (Millions)** | **$30.4** | **$31.9** | **$29.8** | **$28.4** | **$26.9** |
| | Specific density of material for disposal (tons/cy) | 1.2 | 1.58 | 1.45 | 1.32 | 1.32 |
| | Volume of segregatable overburden (cy) | 49,437 | 35,156 | 35,156 | 35,156 | 35,156 |
| | Total volume* of CCR/soil matrix above water table | 85,169 | 100,383 | 100,383 | 100,383 | 100,383 |
| | Total volume* of CCR/soil matrix below water table | 77,681 | 91,287 | 91,287 | 91,287 | 91,287 |
| | Segregation of CCR/soil matrix prior to T&D | All CCR and overburden soils are segregatable | CCR and overburden soils are partially segregatable | CCR and overburden soils are partially segregatable | CCR and overburden soils are partially segregatable | CCR and overburden soils are partially segregatable |
| | Water Reduction | Drying amendments | Free-drain only | Windrowing | Windrow unsaturated / filter press saturated | Windrow unsaturated / filter press saturated |
| | Soil drying amendments | Included to reduce moisture below water table | None | None | None | None |
| | Sheeting/shoring | Included for below water, and around transmission towers | Included for excavation below water table only | Temporary cells to create smaller excavation segments below water table | Temporary cells to create smaller excavation segments below water table | Temporary cells to create smaller excavation segments below water table |
| | Dewatering | Dewatering with well-point system | Dewatering with well-point system | Limited to maintain excavation stability | Limited to maintain excavation stability | Limited to maintain excavation stability |
| | Water Treatment | Included | Ion exchange with deep well injection of brine | TSS removal with recirculation to area occupied by next cell being excavated | TSS removal with recirculation to area occupied by next cell being excavated | TSS removal with recirculation to area occupied by next cell being excavated |
| | Pre-excavation base of CCR confirmation | NA | NA | Conducted on grid (e.g., 20-foot spacing) prior to excavation | Conducted on grid (e.g., 20-foot spacing) prior to excavation | Conducted on grid (e.g., 20-foot spacing) prior to excavation |
| | Excavation confirmation | Visual | Visual | GPS guided, laser leveling | GPS guided, laser leveling | GPS guided, laser leveling |
| | Backfill | To original grade | To original grade | To water table only | To water table only | None |

* Volume presented is indicative of current in-place volume estimate




## SWMU 15
## Investigation Locations

Northern Indiana Public Service Company

Bailly Generating Station
Chesterton, Indiana

## Legend

- Soil Boring Location
- Soil Boring Location 2016
- Test Pit End Location 2009
- Test Pit End Location 2005
- Monitoring Well Location
- Trail
- Bailly Generating Station Property Line
- Test Pit Location 2009
- Test Pit Location 2005
- Coal Combustion Residual Fill Area
- Approximate Area of Topographic Survey

## Location of Site


## Notes and Sources

# FIGURE 1

Aerial Photo: 2005.
Courtesy of LizardTech, Inc.

- Area of SWMU 15 landfill is 16.56 acres.

-For abbreviated soil boring locations, the full location name is SWMU15-SB##.

N

0 160 Feet

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## Slurry Wall Alignment and Depths

Northern Indiana Public Service Company

Bailly Generating Station
Chesterton, Indiana

### Legend

- Bailly Generating Station Property Boundary
- Trail
- 2-Foot Thick Slurry Wall into Clay
- 2-Foot Thick Hanging Slurry Wall (No Clay)
- Coal Combustion Residual Fill Area
- 34 ft — Slurry Wall Depth in Feet Below Ground Surface

### Location of Site


### Notes and Sources

# FIGURE 2

Aerial Photo: 2005.
Courtesy of LizardTech, Inc.

Area of SWMU 15 landfill is 16.56 acres.

N

0 160 Feet


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## ATTACHMENT A

## Revised Cost Estimate
## Encapsulation

| | |
|---|---|
| Project: | Bailly Generating Station |
| Project No: | 377882016.2400 |
| Date: | 6/2/2017 |
| Calc. By | D. Pettit & D. Schneider & L. Tracy |
| Checked By: | R. Johnson & T. Delano |

**SWMU 15**

**Corrective Measure Alternative #6 - In-situ Encapsulation: Slurry Wall Around CCR Below the Water Table; Cap Entire SWMU-15 (Version 1)**

| Item | Unit | Cost per Unit | Quantity | Cost per Item | Source |
|---|---|---|---|---|---|
| **Site Prep** | | | | | |
| Prep Work - Permits, Work Plans, contracting, etc. | LS | $ 20,000 | 1 | $ 20,000 | AMEC estimate |
| Survey | Acre | $ 590.00 | 16.60 | $ 9,794 | RS Means 02 21 13.09 0020 |
| Mobilization | LS | $ 75,000 | 1 | $ 75,000 | Similar project SOW; quoted price from Buffalo Color |
| Site Security (perimeter fence) | month | $ 14,300 | 6 | $ 85,799 | AMEC estimate |
| Field office | month | $ 2,500 | 6 | $ 15,000 | AMEC estimate |
| Install E&S controls | LF | $ 4.38 | 4,531 | $ 19,846 | AMEC estimate |
| | | | *Site Prep Subtotal* | *$ 225,439* | |
| **Slurry Wall** | | | | | |
| Set-up Slurry Plant | LS | $ 50,000 | 1 | $ 50,000 | Similar Project to Chesterfield, VA |
| Construct Working Platform | CY | $ 30.00 | 13,900 | $ 417,000 | Amec FW estimate |
| Construct Slurry Wall | SF | $ 16.00 | 219,770 | $ 3,516,320 | Amec FW estimate |
| Stabilize Excess Slurry | CY | $ 20.00 | 1,450 | $ 29,000 | Amec FW estimate |
| Dispose of Excess Slurry Below Cap | CY | $ 10.00 | 1,600 | $ 16,000 | Amec FW estimate |
| Dispose of Excess Trench Spoils Below Cap | CY | $ 10.00 | 6,100 | $ 61,000 | Amec FW estimate |
| Install Slurry Wall Cap | LF | $ 51.00 | 5,284 | $ 269,484 | Amec FW estimate |
| Slurry Wall Superintendent | HR | $ 125.00 | 800 | $ 100,000 | Amec FW estimate |
| Slurry Wall Crew Per Diem | Day | $ 142.00 | 640 | $ 90,880 | FY 2017 GSA rates |
| Demobilization | LS | $ 50,000 | 1 | $ 50,000 | Similar Project to Chesterfield, VA & Buffalo Color, NY |
| | | | *Slurry Wall Subtotal* | *$4,599,684* | |
| **Cover System** | | | | | |
| Clearing & grubbing | Acre | $ 9,000 | 8.28 | $ 74,520 | Similar project SOW; quoted price |
| Place geogrid | Acre | $ 88,803 | 16.60 | $ 1,474,122 | RACER Software Ver. 11.3 |
| Characterize, import, place, and grade cap subgrade | CY | $ 24.74 | 97,801 | $ 2,419,595 | NIMCO Quote for Horseshoe Area and RS Means 31 23 23.20 + 31 23 23.17 + 31 23 23.23 |
| Imported 6" topsoil for cover | CY | $ 28.05 | 13,391 | $ 375,608 | NIMCO quote for Horseshoe |
| Imported 18" cap subsoil material | CY | $ 25.00 | 40,172 | $ 1,004,300 | Could be lower if CUT job nearby |
| Liner components | sf | $ 0.50 | 723,096 | $ 361,548 | Engineering Est |
| Cover construction | Acre | $ 125,000 | 16.60 | $ 2,075,000 | Engineering Est |
| | | | *Cover System Subtotal* | *$ 7,784,693* | |
| **Install Hydraulic Control System** | | | | | |
| Install extraction wells within cover system | EA | $ 11,100 | 2 | $ 22,200 | 2008 AMEC P&T estimate for BGS |
| Install piping to treatment system | LF | $ 21.26 | 1000 | $ 21,260 | 2008 AMEC P&T estimate for BGS |
| Water Treatment System | LS | $ 1,557,514 | 1 | $ 1,557,514 | AMEC Estimate (Christiansen) |
| | | | *Installation Subtotal* | *$ 1,600,974* | |
| **Oversight** | | | | | |
| Construction & Engineering Oversight | HR | $ 100.00 | 1,200 | $ 120,000 | AMEC estimate |
| Lodging & per diem | Day | $ 142.00 | 120 | $ 17,040 | FY 2017 GSA rates |
| | | | *Oversight Subtotal* | *$ 137,040* | |
| | | | *Construction Subtotal* | *$ 14,347,830* | |
| **Operation & Maintenance (30-year Projection)** | | | | | |
| Cap maintenance | quarter | $ 1,200 | 120 | $ 144,000 | Past project & Est. |
| Water Treatment System (20-gpm system) | year | $ 146,368 | 30 | $ 4,391,037 | Past project & Est. |
| System Operator | month | $ 2,880 | 360 | $ 1,036,800 | AMEC estimate |
| | | | *O&M Subtotal* | *$ 5,571,837* | |
| | | | *Construction & O&M Subtotal* | *$ 19,919,666* | |
| Project Management | 3% | $ 19,919,666 | | $ 597,590 | |
| Engineering | 6% | $ 19,919,666 | | $ 1,195,180 | |
| | | | *PM & Design Subtotal* | *$ 1,792,770* | |
| Contingency | 20% | | | $ 4,342,487 | |
| | | | **Total** | **$ 26,054,923** | |

Assumptions:

1. CCR remains in-place with engineered cover system, including topsoil, subsoil, geocomposite, and LLDPE liner
2. Working platform requires 15' wide x 2' tall around the perimeter of SMWU 15 (5,047 x 15 x 2).
3. Slurry wall will be perimeter of SWMU-15 (5,047') at 2' wide, up to 72 feet deep.
4. 5% excess slurry will be waste can be used as cap subgrade.
5. Slurry wall construction duration including set-up and clean-up = 8 weeks.
6. Contractor crew for slurry wall includes 3 full-time personnel for 8 weeks working 10 hour days.
7. Slurry wall will be installed first and then cover system.
8. Cover system construction duration = 4 months.
9. Total estimated duration = 6 months.
10. Engineer oversight includes 1 full-time field engineer for 6 months.
11. Cover construction includes effort for subgrade preparation; cover system installation; stormwater management; E&SC measures.
12. Additional contouring of imported subgrade fill materials will be needed to prep subgrade. Cover system will rise to a maximum, approximately seven feet over existing grade, pending cap design.
13. Air monitoring & dust control are included as part of construction costs.
14. Water for slurry will be available near SWMU 15.
15. Hydraulic control system assumes operation at 5 gpm is required to maintain an inward hydraulic gradient.

**ATTACHMENT B**

**Revised Cost Estimate**
**Water Treatment**

| Line | Cost Elements | | | | | Ion Exchange Options: Option 1A 100 gpm x 6 months x 2 years | Ion Exchange Options: Option 2A 10 gpm x 12 months x 30 years | Reverse Osmosis Options: Option 1B 100 gpm x 6 months x 2 years | Reverse Osmosis Options: Option 2B 10 gpm x 12 months x 30 years | System to Remove TSS | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Project Element** | **Cost Basis** | **Qty.** | **Unit Cost** | **Extension** | | | | | | |
| 1 | Site preparation, clearing, grading, SWPP, plus tent or shelter for equipment | Similar Project, Detroit MI 6 months per | 1 | $65,000 | $65,000 | $65,000 | $65,000 | $65,000 | $65,000 | $65,000 | Clear, add 3" pea gravel, tent, scaffold tent over equipment, applies to all cases. |
| 2 | Metal, pre-engrd bldg, 16'Lx20'Wx12'H, concrete slab, power, lighting, heated, insulated, w/windows, roll-up door+1 | Previous projects | 1 | $100,800 | $100,800 | | $100,800 | | $100,800 | | The small prefabrication building only applies to Option #2. |
| 3 | 8' x 40' x 7' trailer for mobile system built up this hold all equipment for either IX or RO, salable after use | | 1 | $410,000 | $410,000 | $410,000 | | $410,000 | | | Based on a custom trailer built for E&I for Ross in Colorado 2015. |
| 4 | Support slabs (12' x 50') for double wall tanks in Option 2 30-yr system. | | | | | | $37,500 | | $37,500 | | Pour in place. Slab for long term basis. |
| 5 | Feed, WW storage 2 x 10,000 gallon double wall PolyTank, insulated on gravel bed (or drain in freezing weather), 142" diameter x 202" height (added for insulation and HT plus special freight) | Bailiff Tanks, New Caney, TX | 2 | $28,999 | $57,998 | $0 | $57,998 | $0 | $57,998 | $57,998 | Eq tanks, purchased, not insulated but includes platform and stairs, custom fittings. Option 2 includes purchased tanks for feed and permeate. |
| 6 | Transfer pump, 2gpm @ 75 psi, Goulds, 2 HP, 230v/260v, 3Ph (2000', 1.5" pipe) | Goulds | 1 | $8,200 | $8,200 | $8,200 | $16,400 | $8,200 | $16,400 | | From eq tank to treatment. Single pumps on 100 gpm system. Redundant pumps on 10 gpm - 30 yr system. |
| 7 | Cartridge filters (2), 10 micron, housings | AA Quote | 2 | $3,750 | $7,500 | $7,500 | $7,500 | $7,500 | $7,500 | $7,500 | In line cartridge filter, (2) required. |
| 8 | Calcium Ion IX System DOW-Hungerford, vessels and control system, 20 gpm capacity, 4 x 80 CF Resin, 30 gpm regen pump @ 40 psi 3 HP | Marshall Davidson, GE Water | 1 | $59,333 | $59,333 | $59,333 | $59,333 | | | | Calcium removal, one train x 2 vessels, skid-mounted unit with PLC and backwash pumps, 5 HP and 2 HP. |
| 9 | Boron IX System DOW-Hungerford, vessels and control system, 20 gpm capacity, 4 x 160 CF Resin | Marshall Davidson, GE Water | 1 | $75,333 | $75,333 | $75,333 | $75,333 | | | | Boron units, two in one train, skid-mounted unit with PLC and backwash pumps. |
| 10 | Reject GW WW storage 5,000 gallon double wall PolyTank, insulated on gravel bed (or drain in freezing weather), 120" diameter x 152" height added for insulation and HT plus special freight) | Bailiff Tanks | 2 | $14,999 | $29,998 | $0 | $29,998 | $0 | $29,998 | | Required to hold spent brine or RO reject, applies to all options, could consider FT for Option 1. |
| 11 | $H_2O$ Innovation 15 HP 23gpm reverse osmosis skid, complete | Evoqua $H_2O$ Innovation | 1 | $162,750 | $162,750 | | | $162,750 | $162,750 | | Not available as rental unit but may have 50% resale value, latest pricing. |
| 12 | Effluent 3000 gallon tank for pump suction Polywall 64" Dia 116" Height, single wall | Bailiff Tanks | 1 | $3,028 | $3,028 | $3,028 | | $3,028 | | $3,028 | Polywall tank, 15 minutes retention time. |
| 13 | Effluent 300 gallon tank for pump suction Polywall 48" Dia 45" Height, single wall | Bailiff Tanks | 1 | $608 | $608 | | $608 | | $608 | | Polywall tank, 15 minutes retention time. |
| 14 | Effluent transfer pump (20gpm @ 50psi) 2 HP, 230v/260v, 3Ph | Goulds | 2 | $8,200 | $8,200 | $8,200 | $16,400 | $8,200 | $16,400 | $8,200 | From effluent to discharge. Single pumps on 100 gpm system. Redundant pumps on 10 gpm - 30 yr system. |
| 15 | New flow meter | Quote (Magmeter) | 1 | $7,800 | $7,800 | $7,800 | $7,800 | $7,800 | $7,800 | $7,800 | Flow meter and logger for discharge. |
| 16 | Clean effluent line discharge line **(2000' x 2")**, assume HDPE DR11 | Means x 1.25 | 1 | $121,000 | $121,000 | $121,000 | $121,000 | $121,000 | $121,000 | $121,000 | Assume 3" HDPE DR 11, buried. |
| 17 | Electrical allowance | Allowance | 1 | $45,000 | $45,000 | $10,000 | $45,000 | $10,000 | $45,000 | $10,000 | Assumes local 40 amp, 480v service. |
| 18 | I&C allowance | Allowance | 1 | $55,000 | $55,000 | $55,000 | $55,000 | $55,000 | $55,000 | | Assumes PLC built into major equipment (IX or RO) with additional I/O for pumps added during engineering. |
| 19 | Resale of equipment at end of project (35% recovery) | | | | | ($163,400) | | ($171,825) | | | |
| 20 | **Total Direct Costs** | | | | | **$666,995** | **$695,671** | **$686,653** | **$723,754** | **$280,526** | |
| 21 | Construction (above items $65/hr., 1.74 OH) | | | | | $493,576 | $514,796 | $508,123 | $535,578 | $207,589 | Construction 1.764 x Direct Cost (Means). |
| 22 | Taxes | | 0.07 | | | $11,858 | $18,996 | $13,823 | $20,962 | $5,917 | Sales tax on equipment. |
| 23 | Freight | | 0.06 | | | $10,164 | $16,282 | $11,849 | $17,967 | $5,072 | Freight to site. |
| 24 | **Indirect Costs (Contractor OH&P)** | | | | | **$515,597** | **$550,074** | **$533,795** | **$574,507** | **$218,578** | Indirect cost summary. |
| 25 | Engineering (PD, DD, CS, ABs) | | | | | $200,000 | $200,000 | $200,000 | $200,000 | $200,000 | Engineering allowance. |
| 26 | 3rd Party NDE | | | | $25,000 | $25,000 | $25,000 | $25,000 | $25,000 | $25,000 | NDE allowance. |
| 27 | **Subtotal** | | | | **$0** | **$1,407,592** | **$1,470,745** | **$1,445,448** | **$1,523,261** | **$724,104** | |
| 28 | NIPSCO Project Management (on Site) | | | | $50,000 | $50,000 | $50,000 | $50,000 | $50,000 | $50,000 | |
| 29 | Escalation 2.5% | | | | 2.50% | $35,190 | $36,769 | $36,136 | $38,082 | $18,103 | |
| 30 | Winterization-remobilization | | | | | $25,000 | | $25,000 | | | |
| 31 | **Total Installed Cost (Project CPEX)** | | | | | **$1,517,782** | **$1,557,514** | **$1,556,585** | **$1,611,343** | **$792,206** | |
| 32 | Frac tank rentals | | | | | $25,475 | | $25,475 | | $25,475 | Feed FT (100 BBL Baker) rented 180 days per year x 2 years plus $4K mob/demob/clean (Baker). |
| 33 | Filters | | | | | $4,680 | $4,680 | $4,680 | $4,680 | $4,680 | |
| 34 | Acid consumption | 0.375 | | | | $4,106 | $1,500 | $4,106 | $1,500 | | 20 lb. HCL/day, for IX Regen, 10 lbs./day for RO pH adjustment feed so Calcium ions are soluble, HCL price $750/ton. |
| 35 | Caustic, 25% consumption | 1 | | | | $8,760 | $1,500 | | | | 12 lb. NaOH Regen, 25% NaOH $1/lb |
| 36 | Power cost @$0.10/kwh | | | | | $15,357 | $4,574 | $39,210 | $14,377 | $14,377 | Each system has different amount of power. |
| 37 | Maintenance @3% | | | | | $45,533 | $47,725 | $46,698 | $47,725 | $46,698 | The IX system generates 3% regen fluid (24 hour basis) ; the RO generates 5% reject with all ions (brine). |
| 38 | Disposal of liquid to Deep Well Ohio | Clean Harbors | | | | $272,160 | $55,188 | $272,160 | $55,188 | | The IX system generates 3% regen fluid (24 hour basis) ; the RO generates 5% reject with all ions (brine). |
| 39 | Contract operations | | | | | $141,000 | $31,200 | $141,000 | $31,200 | $141,000 | Option 1 assumes one operator, 5 days per week, 12 hours per day, 52 weeks with 25% OT; loaded rate $50/hr., plus $25K for technician service; Option 2 assumes a portion of security guard or service to check on facility 5 days x 52 weeks plus call out, 2 hrs. x 5 days x $60 x 52 weeks. |
| 40 | **Total Annual Operating Costs 365 days** | | | | | **$517,072** | **$146,368** | **$533,329** | **$154,670** | **$232,229** | Assumes 2 x 180 day period during bottom half of the year. |
| | **6-month annual cost** | | | | | **$258,536** | | **$266,664** | | | |

amec foster wheeler

# ATTACHMENT C

## Revised Cost Estimate
## Partial Excavation, Off-Site Disposal and ISS

| | |
|---|---|
| Project: | Bailly Generating Station |
| Project No: | 377882016.2400 |
| Date: | 6/2/2017 |
| Calc. By | D. Pettit & D. Schneider |
| Checked By: | R. Johnson |

**SWMU 15**

**Corrective Measure Alternative #4 - Partial Excavation and Off-Site Disposal of CCRs, In-Situ Solidification of CCRs Below the Water Table (Version 1)**

| Item | Unit | Cost per Unit | Quantity | Cost per Item | Source |
|---|---|---|---|---|---|
| **Pre-design** | | | | | |
| Predesign Mapping - Direct Push and Analysis | EACH | $ 267 | 1,024 | $ 273,408 | AMEC estimate |
| | | | *Pre-design Subtotal* | *$ 273,408* | |
| **Site Prep** | | | | | |
| Prep Work - Permits, Work Plans, contracting, etc. | LS | $ 20,000 | 1 | $ 20,000 | AMEC estimate |
| Site Security (perimeter fence) | month | $ 12,838 | 17 | $ 218,243 | AMEC estimate |
| Field office | month | $ 2,500 | 17 | $ 42,500 | AMEC estimate |
| Install E&S controls | LF | $ 4.38 | 4,531 | $ 19,846 | AMEC estimate |
| | | | *Site Prep Subtotal* | *$ 300,589* | |
| **Excavation** | | | | | |
| Clearing & grubbing | Acre | $ 9,000 | 17.2 | $ 154,530 | Similar project SOW; quoted price |
| Excavate and stockpile SWMU 15 cover soil for reuse | CY | $ 4.38 | 21,640 | $ 94,784 | RS Means 31 14 13.23 1430 |
| Excavate, haul, stockpile & load CCR | CY | $ 12.00 | 100,383 | $ 1,204,602 | Contractor & Expr. |
| Disposal Characterization | EACH | $ 500.00 | 317 | $ 158,556 | one sample per 500 tons @ $500/sample |
| Transportation to landfill | Ton | $ 21.60 | 158,556 | $ 3,424,803 | NIMCO quote for Horseshoe area, adjusted |
| Disposal Fees | Ton | $ 17.00 | 158,556 | $ 2,695,447 | Tipping fee for Newton County Landfill, MI |
| Backfill Material (imported) + characterization | CY | $ 15.40 | 81,213 | $ 1,250,685 | NIMCO quote for Horseshoe area |
| Haul/place/compact backfill | CY | $ 4.78 | 102,853 | $ 491,640 | RS Means 31 23 23.14 5420 & 31 23 23.23 0020 & 31 23 23.23 5 |
| Stabilize (seed, amend, mulch) | SY | $ 1.62 | 83,103 | $ 134,627 | NIMCO quote for Horseshoe area |
| | | | *Excavation Subtotal* | *$ 9,609,673* | |
| **ISS application** | | | | | |
| ISS | CY | $ 70.16 | 91,287 | $ 6,404,300 | Unit rate derived from Chartis quote for ISS at NStar Milford, MA |
| | | | *ISS Subtotal* | *$ 6,404,300* | |
| **Oversight** | | | | | |
| Construction & Engineering Oversight | HR | $ 100.00 | 8,080 | $ 808,000 | AMEC estimate |
| Lodging & per diem | Day | $ 142.00 | 790 | $ 112,180 | FY 2017 GSA rates |
| | | | *Oversight Subtotal* | *$ 920,180* | |
| | | | *Construction Subtotal* | *$ 17,508,149* | |
| Project Management | 3% | $ 17,508,149 | | $ 525,244 | |
| Engineering | 5% | $ 17,508,149 | | $ 875,407 | |
| | | | *PM & Design Subtotal* | *$ 1,400,652* | |
| Contingency | 20% | | | $ 3,781,760 | |
| | | | **Total** | **$ 22,690,562** | |

Assumptions:

1 Overlying soil and CCR will be excavated to the top of the current water table. Deeper CCR remains in-place. No cover system other than backfill of overlying soils.
2 Volume to be excavated includes mixture of ash and overlying soils, 50% of Sand1 soils can be segregated from CCR and reused as backfill.
3 Below the water table, pre-design data will be gathered and can allow target solidification of CCR soil layers (i.e., CCR of intervening layers not required).
4 Assumed CCR bulk density = 1.6 tons/cy
5 Only half the area requires clearing & grubbing.
6 Materials sent off site will be disposed as non-hazardous at Newton County Landfill, MI.
7 Disposal fee based on estimate received from facility manager. Additional fees could be applied based on CCR analytical and physical characteristics.
8 Rates are based on live loading excavated materials directly onto trucks for disposal.
9 ISS will be performed using a blend of Type I Portland Cement and Grade 120 Ground Granular Blast Furnace Slag. ISS will result in 21% bulking of the material addressed below the water table, and a hydraulic conductivity of 1.2x10-8 cm/sec.
10 Excavated areas will be backfilled to previous grade.
11 Estimated production rate of 1,000 cyd/day for earthwork (excavation & hauling).
12 Additional fees for winter weather shutdown and re-start not included.
13 Disposal characterization sampling prior to shipment will indicate CCR meets landfill acceptance criteria. Sampling costs are included.
14 The security fence will be constructed along the eastern edge of SWMU-15, to restrict access from the IDNL property. Quantity assumes 1/3 of total perimeter.
15 ISS line item includes mobilization/demobilization, materials, plant, equipment & labor for in-situ mixing, and QA/QC protocols such as field sampling.
16 Mixing will be accomplished by dual axis rotary blender method.
17 No subsurface obstructions.
18 Air monitoring & dust control costs are for equipment & supplies only. Labor fees captured under oversight costs.
19 Excavation Construction & Engineering Oversight includes 2.5 full-time personnel (Supervisor, Health & Safety, Field Engineer) for 11 months of earthwork working 10 hour days.
20 ISS Engineer oversight includes 1.5 full-time field engineer for 8 months working 10 hour days.
21 Total estimated duration = 19 months.
22 Amendment material for excavated CCR is not required.
23 Dewatering is not required.
24 A shoring system is not required.

**ATTACHMENT D**

**Revised Cost Estimate**
**Full Excavation and Off-Site Disposal**

| | |
|---|---|
| Project: | Bailly Generating Station |
| Project No: | 377882016.2400 |
| Date: | 6/2/2017 |
| Calc. By | D. Pettit & D. Schneider |
| Checked By: | R. Johnson & T. Delano |

**SWMU 15**

**Corrective Measure Alternative #1 - Full Excavation and Off-Site Disposal of CCRs (Version 1)**

| Item | Unit | Cost per Unit | Quantity | Cost per Item | Source |
|---|---|---|---|---|---|
| **Site Prep** | | | | | |
| Prep Work - Permits, Work Plans, contracting, etc. | LS | $ 50,000 | 1 | $ 50,000 | AMEC estimate |
| Mobilization/Demob | LS | $ 25,000 | 1 | $ 25,000 | AMEC estimate |
| Site Security (perimeter fence) | month | $ 12,838 | 12 | $ 154,054 | AMEC estimate |
| Install E&S controls | LF | $ 4.38 | 4,531 | $ 19,846 | AMEC estimate |
| Field office | month | $ 2,500 | 17 | $ 42,500 | AMEC estimate |
| | | | *Site Prep Subtotal* | *$ 291,400* | |
| **Shoring** | | | | | |
| Shoring Design | LS | $ 25,000 | 1 | $ 25,000 | C. Ramsey x 2 for Dewater |
| Shoring System Install & Removal | LF | $ 1,200 | 2,400 | $ 2,880,000 | Chris Ramsey, no bracing |
| | | | *Shoring Subtotal* | *$ 2,905,000* | |
| **Excavation Water Treatment and O&M** | | | | | |
| Install Extraction Wells | EA | $ 11,100 | 10 | $ 111,000 | 2008 AMEC P&T estimate for BGS |
| Install Piping to Treatment System | LF | $ 21.26 | 3500 | $ 74,410 | 2008 AMEC P&T estimate for BGS |
| Construct Ion Exchange Water Treatment System | LS | $ 1,517,782 | 1 | $ 1,517,782 | AMEC Estimate (Christiansen) |
| Annual Operations and Maintenance (6-month period) | Year | $ 258,536 | 2 | $ 517,072 | AMEC Estimate (Christiansen) |
| | | | *Dewatering Subtotal* | *$ 2,220,264* | |
| **Excavation** | | | | | |
| Clearing & Grubbing | Acre | $ 9,000 | 8.6 | $ 77,273 | Similar project SOW; quoted price |
| Excavate and stockpile SWMU 15 cover soil for reuse | CY | $ 4.38 | 35,156 | $ 153,983 | RS Means 31 14 13.23 1430 |
| Disposal Characterization | EACH | $ 500 | 383 | $ 191,670 | one sample per 500 tons @ $500/sample |
| Excavate, Haul, Stockpile & Load CCR & 50% of Sand1 | CY | $ 12.00 | 191,670 | $ 2,300,040 | Contractor & Expr./exc/dozer/truck/loader |
| Transportation to Landfill | Ton | $ 21.60 | 302,743 | $ 6,539,244 | NIMCO quote for Horseshoe area, adjusted |
| Disposal Fees | Ton | $ 17.00 | 302,743 | $ 5,146,627 | Tipping fee for Newton County Landfill, MI |
| Backfill Material (imported) + Characterization | CY | $ 15.40 | 191,670 | $ 2,951,718 | NIMCO quote for Horseshoe area + characterization |
| Haul/place/compact backfill | CY | $ 4.78 | 226,826 | $ 1,084,228 | RS Means 31 23 23.14 5420 & 31 23 23.23 0020 & 31 23 23.23 5080 |
| Stabilize (seed, amend, mulch) | SY | $ 1.62 | 83,112 | $ 134,641 | NIMCO quote for Horseshoe area |
| | | | *Excavation Subtotal* | *$ 18,579,424* | |
| **Oversight** | | | | | |
| Construction & Engineering Oversight | HR | $ 100.00 | 7,400 | $ 740,000 | AMEC estimate |
| Lodging & per diem | Day | $ 142.00 | 740 | $ 105,080 | FY 2017 GSA rates |
| | | | *Oversight Subtotal* | *$ 845,080* | |
| | | | *Construction Subtotal* | *$ 24,841,168* | |
| Project Management | 3% | $ 24,841,168 | | $ 745,235 | |
| Engineering | 4% | $ 24,841,168 | | $ 993,647 | |
| | | | *PM & Design Subtotal* | *$ 1,738,882* | |
| Contingency | 20% | | | $ 5,316,010 | |
| | | | **Total** | **$ 31,896,059** | |

Assumptions:

1. Volume to be excavated includes mixture of ash and overlying soils, soils can be segregated from CCR and reused as backfill.
2. Assumed CCR bulk density = 1.6 tons/cy
3. Only half the area requires clearing & grubbing.
4. Excavated materials disposed as non-hazardous at Newton County Landfill, MI.
5. Shoring system is 30 feet deep.
6. The perimeter of the shoring (2,400) follows the contour of CCR below the groundwater table, assumed to be 6 feet or more below ground surface.
7. Shoring will need to be provided around towers.
8. Shoring costs are based on installation, removal, and rental fees.
9. Dewatering assumes ion exchange treatment for boron followed by discharge to surface water.
10. A well point system with treatment system will be used for dewatering and on-site treatment prior to discharge to surface water.
11. Dewatering system costs calculated based on rental rates per calendar day for 5 months of operation; labor rate based on 5-day work week.
12. Disposal fee based on estimate received from facility manager. Additional fees could be applied based on CCR analytical and physical characteristics.
13. No drying amendment will be needed to reduce moisture from CCR excavated from below the water table.
14. Rates are based on stockpiling followed by loading onto trucks for disposal.
15. Excavated areas will be backfilled to previous grade.
16. Excavation & backfilling will be phased but occuring simultaneously.
17. Estimated production rate of 1,000 cyd/day for earthwork (excavation & hauling).
18. Estimated duration = 17 months of which 14 months is active earthwork (7 months "in the wet" and 7 dry), 2 months to install shoring/dewatering system and 1 month is set-up/recovery.
19. Additional fees for winter weather shutdown and re-start not included.
20. Construction & Engineering Oversight includes 2.5 full-time personnel (Supervisor, Health & Safety, Field Engineer) for 14 months of earthwork working 10 hour days; 1 personnel for 2 months of shoring/dewatering installation for 10 hour days.
21. Disposal characterization sampling prior to shipment will indicate CCR meets landfill acceptance criteria. Sampling costs are included.
22. The security fence will be constructed along the eastern edge of SWMU-15, to restrict access from the IDNL property. Quantity assumes 1/3 of total perimeter.

| | |
|---|---|
| Project: | Bailly Generating Station |
| Project No: | 377882016.2400 |
| Date: | 6/2/2017 |
| Calc. By | D. Pettit & D. Schneider & P. Guerra |
| Checked By: | R. Johnson & T. Delano |

**SWMU 15**

**Corrective Measure Alternative #1 - Full Excavation and Off-Site Disposal of CCRs (Version 2)**

| Item | Unit | Cost per Unit | Quantity | Cost per Item | Source |
|---|---|---|---|---|---|
| **Site Prep** | | | | | |
| Prep Work - Permits, Work Plans, contracting, etc. | LS | $ 50,000 | 1 | $ 50,000 | AMEC estimate |
| Predesign Mapping - Direct Push and Analysis | EACH | $ 267 | 1,024 | $ 273,408 | AMEC estimate |
| Mobilization/Demob | LS | $ 25,000 | 1 | $ 25,000 | AMEC estimate |
| Site Security (perimeter fence) | month | $ 12,838 | 12 | $ 154,054 | AMEC estimate |
| Install E&S controls | LF | $ 4.38 | 4,531 | $ 19,846 | AMEC estimate |
| Field office | month | $ 2,500 | 17 | $ 42,500 | AMEC estimate |
| | | | *Site Prep Subtotal* | *$ 564,808* | |
| **Shoring** | | | | | |
| Shoring Design | LS | $ 25,000 | 1 | $ 25,000 | C. Ramsey x 2 for Dewater |
| Shoring System Install & Removal | LF | $ 1,200 | 2,400 | $ 2,880,000 | Chris Ramsey, no bracing |
| | | | *Shoring Subtotal* | *$ 2,905,000* | |
| **Excavation Water Treatment and O&M** | | | | | |
| Dewatering Extraction and Transfer Equipment | LS | $ 100,000 | 1 | $ 100,000 | AMEC estimate |
| TSS Removal and On-site Disposal | LS | $ 792,206 | 1 | $ 792,206 | AMEC estimate |
| Annual Operations and Maintenance (6-month period) | Year | $ 116,115 | 2 | $ 232,229 | AMEC estimate |
| | | | *Dewatering Subtotal* | *$ 1,124,436* | |
| **Excavation** | | | | | |
| Clearing & grubbing | Acre | $ 9,000 | 8.6 | $ 77,273 | Similar project SOW; quoted price |
| Excavate and stockpile SWMU 15 cover soil for reuse | CY | $ 4.38 | 35,156 | $ 153,983 | RS Means 31 14 13.23 1430 |
| Disposal Characterization | EACH | $ 500 | 383 | $ 191,670 | one sample per 500 tons @ $500/sample |
| Excavate, haul, stockpile & Load CCR & 50% of Sand1 | CY | $ 12.00 | 191,670 | $ 2,300,040 | Contractor & Expr./exc/dozer/truck/loader |
| Windrow Turning Material | CY | $ 15.00 | 191,670 | $ 2,875,050 | RACER equivalent |
| Transportation to landfill | Ton | $ 21.60 | 278,161 | $ 6,008,279 | NIMCO quote for Horseshoe area, adjusted |
| Disposal Fees | Ton | $ 17.00 | 278,161 | $ 4,728,738 | Tipping fee for Newton County Landfill, MI |
| Backfill Material (imported) + characterization | CY | $ 15.40 | 56,131 | $ 864,411 | NIMCO quote for Horseshoe area + characterization |
| Haul/place/grade backfill | CY | $ 4.37 | 91,287 | $ 398,922 | RS Means 31 23 23.14 5420 & 31 23 23.23 0020 |
| Stabilize (seed, amend, mulch) | SY | $ 1.62 | 83,112 | $ 134,641 | NIMCO quote for Horseshoe area |
| | | | *Excavation Subtotal* | *$ 17,733,009* | |
| **Oversight** | | | | | |
| Construction & Engineering Oversight | HR | $ 100.00 | 7,400 | $ 740,000 | AMEC estimate |
| Lodging & per diem | Day | $ 142.00 | 740 | $ 105,080 | FY 2017 GSA rates |
| | | | *Oversight Subtotal* | *$ 845,080* | |
| | | | *Construction Subtotal* | *$ 23,172,332* | |
| Project Management | 3% | $ 23,172,332 | | $ 695,170 | |
| Engineering | 4% | $ 23,172,332 | | $ 926,893 | |
| | | | *PM & Design Subtotal* | *$ 1,622,063* | |
| Contingency | 20% | | | $ 4,958,879 | |
| | | | **Total** | **$ 29,753,275** | |

Assumptions:

1. Volume to be excavated includes mixture of ash and overlying soils, soils can be segregated from CCR and reused as backfill.
2. Assumed CCR bulk density = 1.6 tons/cy (with free draining only). 1.45 after Windrowing
3. Only half the area requires clearing & grubbing.
4. Excavated materials disposed as non-hazardous at Newton County Landfill, MI.
5. Shoring system is 30 feet deep.
6. The perimeter of the shoring (2,400) follows the contour of CCR below the groundwater table, assumed to be 6 feet or more below ground surface.
7. Shoring will need to be provided around towers.
8. Shoring costs are based on installation, removal, and rental fees.
9. Dewatering assumes ion exchange treatment for boron followed by discharge to surface water.
10. A well point system with treatment system will be used for dewatering and on-site treatment prior to discharge to surface water.
11. Dewatering system costs calculated based on rental rates per calendar day for 5 months of operation; labor rate based on 5-day work week.
12. Disposal fee based on estimate received from facility manager. Additional fees could be applied based on CCR analytical and physical characteristics.
13. No drying amendment will be needed to reduce moisture from CCR excavated from below the water table.
14. Rates are based on stockpiling followed by loading onto trucks for disposal.
15. Excavated areas will be backfilled to previous grade.
16. Excavation & backfilling will be phased but occuring simultaneously.
17. Estimated production rate of 1,000 cyd/day for earthwork (excavation & hauling).
18. Estimated duration = 17 months of which 14 months is active earthwork (7 months "in the wet" and 7 dry), 2 months to install shoring/dewatering system and 1 month is set-up/recovery.
19. Additional fees for winter weather shutdown and re-start not included.
20. Construction & Engineering Oversight includes 2.5 full-time personnel (Supervisor, Health & Safety, Field Engineer) for 14 months of earthwork working 10 hour days; 1 personnel for 2 months of shoring/dewatering installation for 10 hour days.
21. Disposal characterization sampling prior to shipment will indicate CCR meets landfill acceptance criteria. Sampling costs are included.
22. The security fence will be constructed along the eastern edge of SWMU-15, to restrict access from the IDNL property. Quantity assumes 1/3 of total perimeter.

| | |
|---|---|
| Project: | Bailly Generating Station |
| Project No: | 377882016.2400 |
| Date: | 6/2/2017 |
| Calc. By | D. Pettit & D. Schneider & P. Guerra |
| Checked By: | R. Johnson & T. Delano |

**SWMU 15**

**Corrective Measure Alternative #1 - Full Excavation and Off-Site Disposal of CCRs (Version 3)**

| Item | Unit | Cost per Unit | Quantity | Cost per Item | Source |
|---|---|---|---|---|---|
| **Site Prep** | | | | | |
| Prep Work - Permits, Work Plans, contracting, etc. | LS | $ 50,000 | 1 | $ 50,000 | AMEC estimate |
| Predesign Mapping - Direct Push and Analysis | EACH | $ 267 | 1,024 | $ 273,408 | AMEC estimate |
| Mobilization/Demob | LS | $ 25,000 | 1 | $ 25,000 | AMEC estimate |
| Site Security (perimeter fence) | month | $ 12,838 | 12 | $ 154,054 | AMEC estimate |
| Install E&S controls | LF | $ 4.38 | 4,531 | $ 19,846 | AMEC estimate |
| Field office | month | $ 2,500 | 17 | $ 42,500 | AMEC estimate |
| | | | *Site Prep Subtotal* | *$ 564,808* | |
| **Shoring** | | | | | |
| Shoring Design | LS | $ 25,000 | 1 | $ 25,000 | C. Ramsey x 2 for Dewater |
| Shoring System Install & Removal | LF | $ 1,200 | 2,400 | $ 2,880,000 | Chris Ramsey, no bracing |
| | | | *Shoring Subtotal* | *$ 2,905,000* | |
| **Excavation Water Treatment and O&M** | | | | | |
| Dewatering Extraction and Transfer Equipment | LS | $ 100,000 | 1 | $ 100,000 | AMEC estimate |
| TSS Removal and On-site Disposal | LS | $ 792,206 | 1 | $ 792,206 | AMEC estimate |
| Annual Operations and Maintenance (6-month period) | Year | $ 116,115 | 2 | $ 232,229 | AMEC estimate |
| | | | *Dewatering Subtotal* | *$ 1,124,436* | |
| **Excavation** | | | | | |
| Clearing & grubbing | Acre | $ 9,000 | 8.6 | $ 77,273 | Similar project SOW; quoted price |
| Excavate and stockpile SWMU 15 cover soil for reuse | CY | $ 4.38 | 35,156 | $ 153,983 | RS Means 31 14 13.23 1430 |
| Disposal Characterization | EACH | $ 500 | 383 | $ 191,670 | one sample per 500 tons @ $500/sample |
| Excavate, haul, stockpile & Load CCR & 50% of Sand1 | CY | $ 12.00 | 191,670 | $ 2,300,040 | Contractor & Expr./exc/dozer/truck/loader |
| Windrow Turning Unsat Material | CY | $ 15.00 | 100,383 | $ 1,505,752 | RACER equivalent |
| Haul Saturated Material to Filter Press | CY | $ 2.56 | 91,287 | $ 233,693 | RACER equivalent |
| Filter Press Mob/Operate/Demob | CY | $ 6.00 | 91,287 | $ 547,719 | 5/9/2017 Discussion with Matt Binsfeld - JF Brennen |
| Transportation to landfill | Ton | $ 21.60 | 266,452 | $ 5,755,373 | NIMCO quote for Horseshoe area, adjusted |
| Disposal Fees | Ton | $ 17.00 | 266,452 | $ 4,529,692 | Tipping fee for Newton County Landfill, MI |
| Backfill Material (imported) + characterization | CY | $ 15.40 | 56,131 | $ 864,411 | NIMCO quote for Horseshoe area + characterization |
| Haul/place/grade backfill | CY | $ 4.37 | 91,287 | $ 398,922 | RS Means 31 23 23.14 5420 & 31 23 23.23 0020 |
| Stabilize (seed, amend, mulch) | SY | $ 1.62 | 83,112 | $ 134,641 | NIMCO quote for Horseshoe area |
| | | | *Excavation Subtotal* | *$ 16,693,170* | |
| **Oversight** | | | | | |
| Construction & Engineering Oversight | HR | $ 100.00 | 7,400 | $ 740,000 | AMEC estimate |
| Lodging & per diem | Day | $ 142.00 | 740 | $ 105,080 | FY 2017 GSA rates |
| | | | *Oversight Subtotal* | *$ 845,080* | |
| | | | *Construction Subtotal* | *$ 22,132,494* | |
| Project Management | 3% | $ 22,132,494 | | $ 663,975 | |
| Engineering | 4% | $ 22,132,494 | | $ 885,300 | |
| | | | *PM & Design Subtotal* | *$ 1,549,275* | |
| Contingency | 20% | | | $ 4,736,354 | |
| | | | **Total** | **$ 28,418,122** | |

Assumptions:

1. Volume to be excavated includes mixture of ash and overlying soils, soils can be segregated from CCR and reused as backfill.
2. Assumed CCR bulk density = 1.6 tons/cy (with free draining only). 1.45 after windrowing and 1.32 after Filter Press
3. Only half the area requires clearing & grubbing.
4. Excavated materials disposed as non-hazardous at Newton County Landfill, MI.
5. Shoring system is 30 feet deep.
6. The perimeter of the shoring (2,400) follows the contour of CCR below the groundwater table, assumed to be 6 feet or more below ground surface.
7. Shoring will need to be provided around towers.
8. Shoring costs are based on installation, removal, and rental fees.
9. Dewatering assumes ion exchange treatment for boron followed by discharge to surface water.
10. A well point system with treatment system will be used for dewatering and on-site treatment prior to discharge to surface water.
11. Dewatering system costs calculated based on rental rates per calendar day for 5 months of operation; labor rate based on 5-day work week.
12. Disposal fee based on estimate received from facility manager. Additional fees could be applied based on CCR analytical and physical characteristics.
13. No drying amendment will be needed to reduce moisture from CCR excavated from below the water table.
14. Rates are based on stockpiling followed by loading onto trucks for disposal.
15. Excavated areas will be backfilled to previous grade.
16. Excavation & backfilling will be phased but occuring simultaneously.
17. Estimated production rate of 1,000 cyd/day for earthwork (excavation & hauling).
18. Estimated duration = 17 months of which 14 months is active earthwork (7 months "in the wet" and 7 dry), 2 months to install shoring/dewatering system and 1 month is set-
19. Additional fees for winter weather shutdown and re-start not included.
20. Construction & Engineering Oversight includes 2.5 full-time personnel (Supervisor, Health & Safety, Field Engineer) for 14 months of earthwork working 10 hour days; 1
21. Disposal characterization sampling prior to shipment will indicate CCR meets landfill acceptance criteria. Sampling costs are included.
22. The security fence will be constructed along the eastern edge of SWMU-15, to restrict access from the IDNL property. Quantity assumes 1/3 of total perimeter.

| | |
|---|---|
| Project: | Bailly Generating Station |
| Project No: | 377882016.2400 |
| Date: | 6/2/2017 |
| Calc. By | D. Pettit & D. Schneider & P. Guerra |
| Checked By: | R. Johnson & T. Delano |

**SWMU 15**

**Corrective Measure Alternative #1 - Full Excavation and Off-Site Disposal of CCRs (Version 4)**

| Item | Unit | Cost per Unit | Quantity | Cost per Item | Source |
|---|---|---|---|---|---|
| **Site Prep** | | | | | |
| Prep Work - Permits, Work Plans, contracting, etc. | LS | $ 50,000 | 1 | $ 50,000 | AMEC estimate |
| Predesign Mapping - Direct Push and Analysis | EACH | $ 267 | 1,024 | $ 273,408 | AMEC estimate |
| Mobilization/Demob | LS | $ 25,000 | 1 | $ 25,000 | AMEC estimate |
| Site Security (perimeter fence) | month | $ 12,838 | 12 | $ 154,054 | AMEC estimate |
| Install E&S controls | LF | $ 4.38 | 4,531 | $ 19,846 | AMEC estimate |
| Field office | month | $ 2,500 | 17 | $ 42,500 | AMEC estimate |
| | | | *Site Prep Subtotal* | *$ 564,808* | |
| **Shoring** | | | | | |
| Shoring Design | LS | $ 25,000 | 1 | $ 25,000 | C. Ramsey x 2 for Dewater |
| Shoring System Install & Removal | LF | $ 1,200 | 2,400 | $ 2,880,000 | Chris Ramsey, no bracing |
| | | | *Shoring Subtotal* | *$ 2,905,000* | |
| **Excavation Water Treatment and O&M** | | | | | |
| Dewatering Extraction and Transfer Equipment | LS | $ 100,000 | 1 | $ 100,000 | AMEC estimate |
| TSS Removal and On-site Disposal | LS | $ 792,206 | 1 | $ 792,206 | AMEC estimate |
| Annual Operations and Maintenance (6-month period) | Year | $ 116,115 | 2 | $ 232,229 | AMEC estimate |
| | | | *Dewatering Subtotal* | *$ 1,124,436* | |
| **Excavation** | | | | | |
| Clearing & grubbing | Acre | $ 9,000 | 8.6 | $ 77,273 | Similar project SOW; quoted price |
| Excavate and stockpile SWMU 15 cover soil for reuse | CY | $ 4.38 | 35,156 | $ 153,983 | RS Means 31 14 13.23 1430 |
| Disposal Characterization | EACH | $ 500 | 383 | $ 191,670 | one sample per 500 tons @ $500/sample |
| Excavate, haul, stockpile & Load CCR & 50% of Sand1 | CY | $ 12.00 | 191,670 | $ 2,300,040 | Contractor & Expr./exc/dozer/truck/loader |
| Windrow Turning Material | CY | $ 15.00 | 100,383 | $ 1,505,752 | RACER equivalent |
| Haul to Filter Press | CY | $ 2.56 | 91,287 | $ 233,693 | RACER equivalent |
| Filter Press Mob/Operate/Demob | CY | $ 6.00 | 91,287 | $ 547,719 | 5/9/2017 Discussion with Matt Binsfeld - JF Brennen |
| Transportation to landfill | Ton | $ 21.60 | 266,452 | $ 5,755,373 | NIMCO quote for Horseshoe area, adjusted |
| Disposal Fees | Ton | $ 17.00 | 266,452 | $ 4,529,692 | Tipping fee for Newton County Landfill, MI |
| Haul/Place/Grade Stockpiled Soil | CY | $ 4.37 | 35,156 | $ 153,631 | RS Means 31 23 23.14 5420 & 31 23 23.23 0020 |
| Stabilize (seed, amend, mulch) | SY | $ 1.62 | 41,556 | $ 67,321 | NIMCO quote for Horseshoe area |
| | | | *Excavation Subtotal* | *$ 15,516,148* | |
| **Oversight** | | | | | |
| Construction & Engineering Oversight | HR | $ 100.00 | 7,400 | $ 740,000 | AMEC estimate |
| Lodging & per diem | Day | $ 142.00 | 740 | $ 105,080 | FY 2017 GSA rates |
| | | | *Oversight Subtotal* | *$ 845,080* | |
| | | | *Construction Subtotal* | *$ 20,955,471* | |
| Project Management | 3% | $ 20,955,471 | | $ 628,664 | |
| Engineering | 4% | $ 20,955,471 | | $ 838,219 | |
| | | | *PM & Design Subtotal* | *$ 1,466,883* | |
| Contingency | 20% | | | $ 4,484,471 | |
| | | | **Total** | **$ 26,906,825** | |

Assumptions:

1. Volume to be excavated includes mixture of ash and overlying soils, soils can be segregated from CCR and reused as backfill.
2. Assumed CCR bulk density = 1.6 tons/cy (with free draining only). 1.32 after Filter Press
3. Only half the area requires clearing & grubbing.
4. Excavated materials disposed as non-hazardous at Newton County Landfill, MI.
5. Shoring system is 30 feet deep.
6. The perimeter of the shoring (2,400) follows the contour of CCR below the groundwater table, assumed to be 6 feet or more below ground surface.
7. Shoring will need to be provided around towers.
8. Shoring costs are based on installation, removal, and rental fees.
9. Dewatering assumes ion exchange treatment for boron followed by discharge to surface water.
10. A well point system with treatment system will be used for dewatering and on-site treatment prior to discharge to surface water.
11. Dewatering system costs calculated based on rental rates per calendar day for 5 months of operation; labor rate based on 5-day work week.
12. Disposal fee based on estimate received from facility manager. Additional fees could be applied based on CCR analytical and physical characteristics.
13. No drying amendment will be needed to reduce moisture from CCR excavated from below the water table.
14. Rates are based on stockpiling followed by loading onto trucks for disposal.
15. Excavated areas will be backfilled to previous grade.
16. Excavation & backfilling will be phased but occuring simultaneously.
17. Estimated production rate of 1,000 cyd/day for earthwork (excavation & hauling).
18. Estimated duration = 17 months of which 14 months is active earthwork (7 months "in the wet" and 7 dry), 2 months to install shoring/dewatering system and 1 month is set-
19. Additional fees for winter weather shutdown and re-start not included.
20. Construction & Engineering Oversight includes 2.5 full-time personnel (Supervisor, Health & Safety, Field Engineer) for 14 months of earthwork working 10 hour days; 1
21. Disposal characterization sampling prior to shipment will indicate CCR meets landfill acceptance criteria. Sampling costs are included.
22. The security fence will be constructed along the eastern edge of SWMU-15, to restrict access from the IDNL property. Quantity assumes 1/3 of total perimeter.