Memo

To	**Michelle Kaysen / USEPA**	File no	**377880004.0100**
From	**Russ Johnson** **Greg Miller**	cc	**Dan Sullivan / NIPSCO**
Date	**May 7, 2014**		
Subject	**NIPSCO Bailly Generating Station** **Corrective Measures Study for Area C** **Revised Work Plan** **SWMU 15 Supplemental Landfill Delineation**		

On April 25, 2013, representatives of EPA met with NIPSCO to discuss agency comments on the Baseline Ecological Risk Assessment (BERA), dated March 15, 2013, and a path forward for Area C. EPA followed up with a letter dated May 10, 2013, which included four bullet items. The first three items were related to the BERA, Human Health Risk Assessment (HHRA), and RCRA Facility Investigation (RFI) Report for Area C, and further evaluation of risk associated with SWMU 14. Actions in response to the first three items are currently in progress. The fourth item addressed the evaluation of potential risk management options, and requested the preparation of a Corrective Measures Study (CMS) outline. The CMS outline and associated discussion topics were submitted to EPA on June 27, 2013. The outline identified potential remedial technologies for the removal, containment, and/or treatment of coal combustion residuals (CCR) and related constituents in soil and groundwater for SWMU 15, the previously barren soils in Central Blag Slough, and groundwater within the Indiana Dunes National Lakeshore (IDNL). A broad range of remedial technologies for each area of interest was presented to EPA and the National Park Service (NPS) in a meeting at NIPSCO on August 27, 2013.

As discussed at the meeting with EPA and NPS on November 6, 2013, each of the remedial technologies for soil and groundwater for SWMU 15 and groundwater in the IDNL require additional data and analysis to evaluate feasibility. This work plan addresses additional delineation of SWMU 15, focusing mainly on the vertical dimensions of the landfill interior (i.e., thickness of CCR, relative position of CCR to the water table, thickness of sand above clay, and depth to clay). Samples of CCR and the underlying sand will also be collected to better understand the physical and chemical properties of the CCR and the potential for underlying native soils to be a post-remediation, continuing source of metals dissolution into groundwater. Sampling of the underlying native soils will assist in determining the amount of CCR and native material to be addressed by the selected remedial alternative. Geotechnical testing of CCR will be undertaken to support removal or containment remedial options. All work will be performed according to the RFI Work Plan, the Quality Assurance Project Plan (QAPP) and the site-specific Health and Safety Plan (HASP) submitted in 2005.

This Work Plan was originally submitted to EPA on February 28, 2014. This revised Work Plan reflects changes in response to comments prepared by EPA in a letter dated April 8, 2014.

AMEC Environment & Infrastructure, Inc.
271 Mill Road
Chelmsford, MA 01824 USA
Tel (978) 692-9090
Fax (978) 692-6633
www.amec.com

BACKGROUND

As reported in the RFI Report for Area C dated April 9, 2011, previous efforts to delineate the amount of CCR in SWMU 15 were conducted in 2005 and 2009 (see **Figure 1**). The work conducted in 2005 consisted of 25 test pits (TP-01 through TP-25) to evaluate the thickness of CCR and cover materials. One analytical sample was also collected from test pit TP-18 for extraction by synthetic precipitation leaching procedure (SPLP) and the analysis of total metals and semi-volatile organic compounds (SVOCs). The SWMU 14 investigation conducted concurrently with the SWMU 15 effort also included a CCR sample for SPLP characterization.

In 2009 and 2010, an additional six test pits (S15TP-26 through S15TP-31) were completed along with 16 soil borings (SWMU15-SB10 through SWMU15-SB17; SWMU15-CPT02; SWMU15-CPT04; SWMU15-CPT08; SWMU15-CPT12; SWMU15-CPT14; SWMU15-CPT16; and SWMU15-CPT17). The purpose of the test pits was to further refine the horizontal extent of the CCR. As a result of these test pits the landfill boundary was expanded to the south and east. The purpose of the soil borings was to refine the horizontal and vertical extents of CCR, understand the relative elevation of CCR and the water table, and improve understanding of site stratigraphy. Following the 2009-2010 delineation work, a three-dimensional model of SWMU 15 was created using Environmental Visualization System (EVS) software. The EVS output was included as Appendix K of the Area C RFI Report, dated April 29, 2011. As indicated by the EVS model, some of the thickest CCR is located in the southeast portion of SWMU15 (e.g., SWMU15-SB13, MW-119, TP-06, and S15-TP28E). Due to the absence of data in the south central portion of SWMU15, the kriging algorithm in the EVS model uses data primarily from the landfill perimeter, which will bias the interpretation of CCR thickness where data are lacking.

The soil borings proposed herein are planned primarily within SWMU15, particularly to the south where data are lacking, and to the north where previous test pit explorations were relatively shallow. The goal for these interior borings is to refine the current understanding of the CCR thickness based largely on visual observation. A few borings are also proposed outside the landfill perimeter to confirm the SWMU15 horizontal delineation in those areas, particularly near existing well IDNL-GW13. As indicated in **Figure 1**, this well is located on the border between the NIPSCO property and the IDNL. Borings will be advanced between the known boundaries of SWMU 15 and IDNL-GW13 to determine if CCR extends further towards the IDNL than currently mapped. NIPSCO will solicit input from the NPS on the final location of proposed borings near IDNL-GW13. Additional objectives of the boring program include determining depths to groundwater, the thickness of sand below the landfill, and the depths to confining clay layers. Results from the soil borings will be incorporated into the existing three-dimensional EVS model, the revised model to be used to calculate remediation volumes in the CMS.

Samples will be collected during the boring effort for geotechnical and environmental parameters. (Several samples will also be collected and archived in an on-site freezer.) The geotechnical program is confined to an initial evaluation of index properties of the four dominant material types within and below SWMU 15; fine ash, coarse ash, dune sand, and clay. This information is needed to support remedial technology evaluation in the CMS for SWMU 15. The selected remedial approach may require additional geotechnical information from the archived samples for final design or cost estimation.

Samples of CCR and CCR/soil mixtures were collected at SWMU 14 and 15 in 2005 and 2010 for the testing of metals in SPLP effluent. Several metals were not detected; however, some of the reporting limits for the 2005 and 2010 results may be greater than media cleanup standards for groundwater at SWMU 15 and the IDNL, which are still in development. More recently, in accordance with the Corrective Measures Implementation (CMI) Plan for Areas A and B (AMEC; October 12, 2012), SPLP testing was performed on post-excavation soil samples at the Horseshoe Area for boron and selenium. Samples were collected from visibly clean sand that was exposed after approximately 10,000 tons of material containing CCR was removed in late 2013. Aqueous SPLP concentrations were compared to the site-specific, target leachate goals developed in the CMI Plan for boron (16 mg/L) and selenium (0.046 ug/L). Both target leachate values were derived by multiplying the GLI value by a factor of 10. Boron was detected in all of the post-excavation samples collected at the Horseshoe Area; however, the highest concentration was 1.2 mg/L, which is below the site-specific, leaching-based standard of 16 mg/L. Selenium was not detected in any sample above the reporting limit of 0.015 mg/L, which is below the site-specific, leaching-based standard of 0.046 mg/L.

It is anticipated that similar leaching-based standards will be developed for soil at SWMU 15 by multiplying the appropriate media cleanup standard for groundwater by a factor of 10. It is anticipated that the native sands below SWMU 15 will not differ significantly from those encountered below the CCR removed from the Horseshoe Area in 2013. Although native soils are not expected to be a “secondary” source of metals at SWMU 15, sampling and SPLP analysis of vertical increments will be conducted to assess current conditions and to aid in the evaluation of remedial technologies.

INVESTIGATION LOCATIONS

Thirty-four direct-push borings will be advanced at the locations shown as blue dots in **Figure 1.** The borings are identified as SB-18 through SB-51, continuing the naming convention of the previous soil boring program. As indicated in **Table 1**, the full location ID for each boring includes the prefix SWMU15 (e.g., SWMU15-SB18). Coordinates will be loaded into a GPS unit and each boring location will be marked in the field with stakes and/or survey flagging. Once marked, 811 One Call utility clearance will be obtained. In addition, facilities personnel at Bailly Generating Station (BGS) will be contacted and shown each proposed location to clear any BGS-owned utilities. Locations proposed too close to utilities will be relocated or abandoned. No drilling will take place until all locations are clearly marked and determined to be away from underground utilities. Some borings will be located beneath high-voltage, overhead power lines. At these locations minimum safe clearances will be maintained.

BOREHOLE ADVANCEMENT AND SAMPLING

The objectives of the borehole program are to:

- Refine the volume estimates of CCR by in-fill boring and logging, expanding on previous data collection;
- Develop better resolution of depths to groundwater;
- Evaluate thickness and location of sand below CCR;
- Investigate the depth and minimum thickness of the uppermost clay layers beneath the fill;

- Collect undisturbed samples for geotechnical characterization of index parameters from fine ash, coarse ash, fine and coarse dune sand, and clay; and,
- Collect composite sample of sand under CCR for SPLP evaluation of metals leaching.
- Create a geomedia archive available for possible follow-on testing (either environmental or geotechnical) without remobilization.

Boreholes will be advanced using Geoprobe® direct-push drilling. At each of the 34 locations, 5-foot macro core samples will be retrieved using a discrete closed-piston system with clean new 5-foot acetate liners for each sample interval. Site specific experience using this sampling method indicates that most sample recovery will be 80-100% above the water table (≥4 feet of geomedia in each 5-foot acetate liner), with occasional lower to no-recovery of fine ash and sand below the water table. Clay closed-piston recovery is high (80-100%). Soil borings will be advanced to a depth of at least 30 feet below ground surface (bgs). If a thickness of clay equal to or greater than 4 feet has been recovered, the boring will be terminated at 30 feet bgs. Otherwise, the boring will be advanced until a clay thickness of at least 4 feet has been encountered, to a maximum depth of 40 feet bgs.

As indicated in Figure 6-2 of the Area C RFI Report (AMEC 2011), a thin silt and clay layer was encountered above sand before a more substantial clay unit was encountered. A clay layer was encountered during the April 2014 IDNL groundwater investigation north of SWMU 15 at the predicted depths for the thicker clay unit. The thicker clay unit may be continuous at the scale of SWMU 15; offering potential for consideration as technical component of corrective measures. Borings SWMU15-SB10 and SWMU15-SB11 penetrated the clay surface to depths of 11 and 12 feet, respectively. AMEC proposes to penetrate clay a minimum of four feet to: (1) confirm that the lower, more substantial clay unit has been encountered; (2) provide the volume needed for the proposed geotechnical parameters; (3) provide extra volume for archiving in the event future geotechnical testing is desired; and, (4) continue the evaluation of the minimum thickness and lateral extent of the clay.

Down-hole equipment will be decontaminated using soapy water and clean potable water rinse prior to sampling. Of the 34 locations, 17 borings will be advanced in areas where the hard-packed, slag-covered ground surface may require additional equipment (e.g., jackhammer) to initiate the boring.

Geotechnical testing of CCR, subsoil, and clay parameters is proposed to support the initial evaluation of remedial alternatives. From prior investigations it is known that the material types of geotechnical interest are fine ash, coarse ash, dune sand, and clay, with dune sand having a fine-grained and coarser-grained distribution. Of these materials, the CCR is of greatest interest from a geotechnical perspective due to remedial focus, volume, and the influence of physical properties on potential corrective measures. Characterization of a limited number of samples is sufficient for defining geotechnical properties for the initial evaluation of remedial technologies.

Three samples each of fine and coarse CCR (6 total) will be selected observationally for geotechnical testing, two samples each of dune sand (one coarse one fine), and two samples of clay will be submitted for analysis. Results of prior site characterization indicate the sands and clays in the area of interest are relatively consistent. Therefore a lesser frequency of index testing is proposed for sands and clays than is proposed for ash. The objective for these 10 geotechnical samples is to span the range of field-discernable material properties expected to be encountered in the 34 borings, for the materials of interest. The following information provides the means and basis for geotechnical-focused sampling and testing to characterize ash and soil from the SWMU-15 area.

Test/Method	Basis	Number of Samples by Material Type			Sample Size
		Ash	Sand	Clay	
Standard test Method for Particle-Size Analysis of Soils (Grain Size with Hydrometer) ASTM D422	Index Testing	6	2	2	1 gallon zip lock bag
Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils (Atterberg Limits) ASTM D4318	Index Testing	6	2	2	(1)
Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass ASTM D2216	Index Testing	6	2	2	(1)
Standard Practices for Classification of Soil for Engineering Purposes (Unified Soil Classification System) ASTM D2487	Index Testing	6	2	2	-
Standard Test Methods for Specific Gravity of Soil Solids by Water Pycnometer (ASTM D854)	Index Testing	6	2	2	(1)
Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (ASTM D698)	Performance Testing	0	0	0	5 gallon bucket
Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter (ASTM D5084)	Performance Testing	0	0	0	Shelby Tube for Undisturbed 5 gallon bucket for remolded
Standard Test Method for Consolidated Undrained Triaxial Compression Test for Cohesive Soils (ASTM D4767)	Performance Testing	0	0	0	Shelby Tube for Undisturbed 5 gallon bucket for remolded

Note 1. The suite of index testing can be completed with one, one-gallon-sized, zip-lock bag of sample material.

Soil classifications and index testing results may be used to support CMS selection by evaluating other soil material properties (such as material strength and compressibility) based on well-established correlations to index test properties.

Once a corrective measures alternative is selected, more detailed information from performance testing (e.g., compaction characteristics, shear strength, and permeability) may be necessary to support remedial design at a frequency and from locations not currently known. As indicated in the table above, performance testing is not proposed for the initial geotechnical testing; however, if implemented the proposed methods are provided in the table above. Note that the SWMU 15 work plan includes the archiving of samples in an on-site freezer, and any of those samples may be candidates for future geotechnical testing.

The geotechnical data collection objectives will be met if sample collection is representative and testing and analysis conforms to the methods cited in the table above. The data will be evaluated for reasonableness by a qualified geotechnical engineer. The geotechnical laboratory will provide documentation of conformance to test procedures with test results. The need for additional geotechnical data will not be defined by the data completeness and quality of this activity but any additional design data requirements of yet to be proposed corrective measures alternatives.

Soil and CCR cores will be logged using a modified Burmeister soil classification system. A Unified Soil Classification System (USCS) code will be assigned to each lithological unit, while any CCR material encountered will be designated as CCR fill. Field sedimentological parameters (grain size and type, mineralogy, bedding, color, cementation) will be recorded.

Samples for geotechnical index testing will be sectioned from 5-foot sleeves at an appropriate length to meet sample volume requirements. Material properties will be checked and logged for each sample. Samples will be sealed in plastic bags to prevent moisture loss during handling and transport. Unused geomedia remaining from soil borings after geotechnical sampling will be used for SPLP testing, or wrapped, labeled, and frozen to form an archive for potential, as yet unspecified testing.

SPLP analysis of CCR and unsaturated native soil immediately underlying the CCR is needed to guide CMS evaluation. The objective of CCR SPLP testing is to understand the residual source concentration for consideration in the CMS (e.g., handling, onsite consolidation, offsite disposal). The objective of native soil SPLP testing is to verify the expected condition; that SPLP leachate concentrations from native soil will be below levels of regulatory concern. If not, these data will be evaluated to better understand the potential amount of additional native material requiring remediation. The information this investigation is designed to provide is an estimate of the range of expected metals leaching for SWMU 15 CCR and affected soils for comparison to site-specific, leaching based standards for SWMU 15, which are currently under development. At six locations, CCR fill will be collected for SPLP extraction and analysis of:

- Aluminum
- Arsenic
- Barium
- Boron
- Cadmium
- Chromium
- Copper
- Lead
- Manganese
- Mercury
- Molybdenum
- Selenium

The six CCR SPLP samples will be selected observationally to be representative of both coarse and fine CCR, and to span the area and vertical interval of CCR at SWMU 15.

At six locations where ash covers native soil above the water table, native soil will be collected in two one-foot increments for analysis of metals using the SPLP procedure (12 total samples). Sample selection will be observational and biased towards boring locations with the greatest thickness of CCR above native soils. To access sample material the acetate sleeve will be cut longitudinally for inspection and logging. One half-sleeve will be wrapped in plastic to secure the material in place. This half sleeve will be labeled, frozen, and stored in a locked and secured freezer at the site. Contents from the first 1-foot increment of the other half-sleeve (i.e., that portion directly below the CCR) will be emptied into a plastic bowl and mixed before transferring the aliquot of sample to the sample jar. After the SPLP samples are collected, a 10- to 20-ml aliquot of the core will be mixed 1/1 with deionized water for measuring and recording field pH and ORP. The same procedure will be employed for the second one-foot increment. Frozen core will be discarded one year after collection or after conclusion of task, whichever is sooner.

The SPLP data collection objectives will be met if sample collection is representative and testing and analysis conforms to the objectives stated above. Sample acceptance criteria are based on the project QAPP. The proposed sample collection and analysis of CCR will quadruple the available CCR SPLP data for SWMU 14/15. The SPLP tests of native soil will guide the CMS decisions on volume of material (CCR and soil) that will need to be addressed during the corrective action. The need for additional SPLP analysis will be defined by the precision required in design data for yet to be proposed CMAs.

As required by the QAPP, two field duplicate samples and additional volume for one matrix spike/matrix spike duplicate (MS/MSD) will be collected for analysis using the SPLP procedure. This may require use of all of a core interval; retaining none for archive. Plastic sampling and compositing materials will be discarded rather than decontaminated and reused. Duplicate analysis will not be conducted for geotechnical parameters.

Once each boring is completed, soil cuttings not containing visible CCR will be returned to the borehole. Any excess soil cuttings, as well as any soil containing a significant amount of visible CCR, will be stored in 55-gallon steel drums in a secure location designated by BGS personnel. Drums generated during the drilling activities will be properly labeled and sampled for waste disposal characteristics. Once profiled, the drummed soil/CCR will be transported to an appropriate receiving facility for disposal. Decontamination water will be emptied into the BGS settling ponds.

SPLP results will be compared to GLI groundwater standards multiplied by a factor of 10 to identify CCR or underlying soil that has the potential to be a continuing source of metals to groundwater. In theory, the leachable fraction of metals from native soils underlying the CCR should decrease with increasing depth, thus defining the required limit of remediation. If additional information on the leachable characteristics of deeper soil below CCR is needed, sample aliquots from the frozen cores may be sent to the laboratory for SPLP analysis.

SAMPLE ARCHIVE ANALYSIS

The sampling and testing program will provide the data needed to define the physical extent of the CCR to the precision required for the CMS. The SPLP sampling and analysis will define the extent of material that has continuing potential to dissolve metals into groundwater above the GLI standards (multiplied by a factor of 10). The geotechnical testing will provide enough data to conduct the CMS for capping, physical isolation, removal and relocation, and stabilization alternatives. Some alternatives may require closure of geotechnical data gaps identified during the CMS process. If frozen archive samples are suitable for those needs (as determined by a geotechnical engineer) they will be used. Similarly, and as previously described, evaluation of additional samples for SPLP may be required. Again, these samples will be obtained from the frozen archive. Testing is not proposed yet for evaluation of chemical or physical stabilization. Test-tube to bench-scale testing of chemical and physical stabilization admixtures will be conducted on samples from the frozen archive. Depending on the geotechnical, chemical, or test parameter, frozen archive samples are suitable for use from 6 months to many years after sampling.

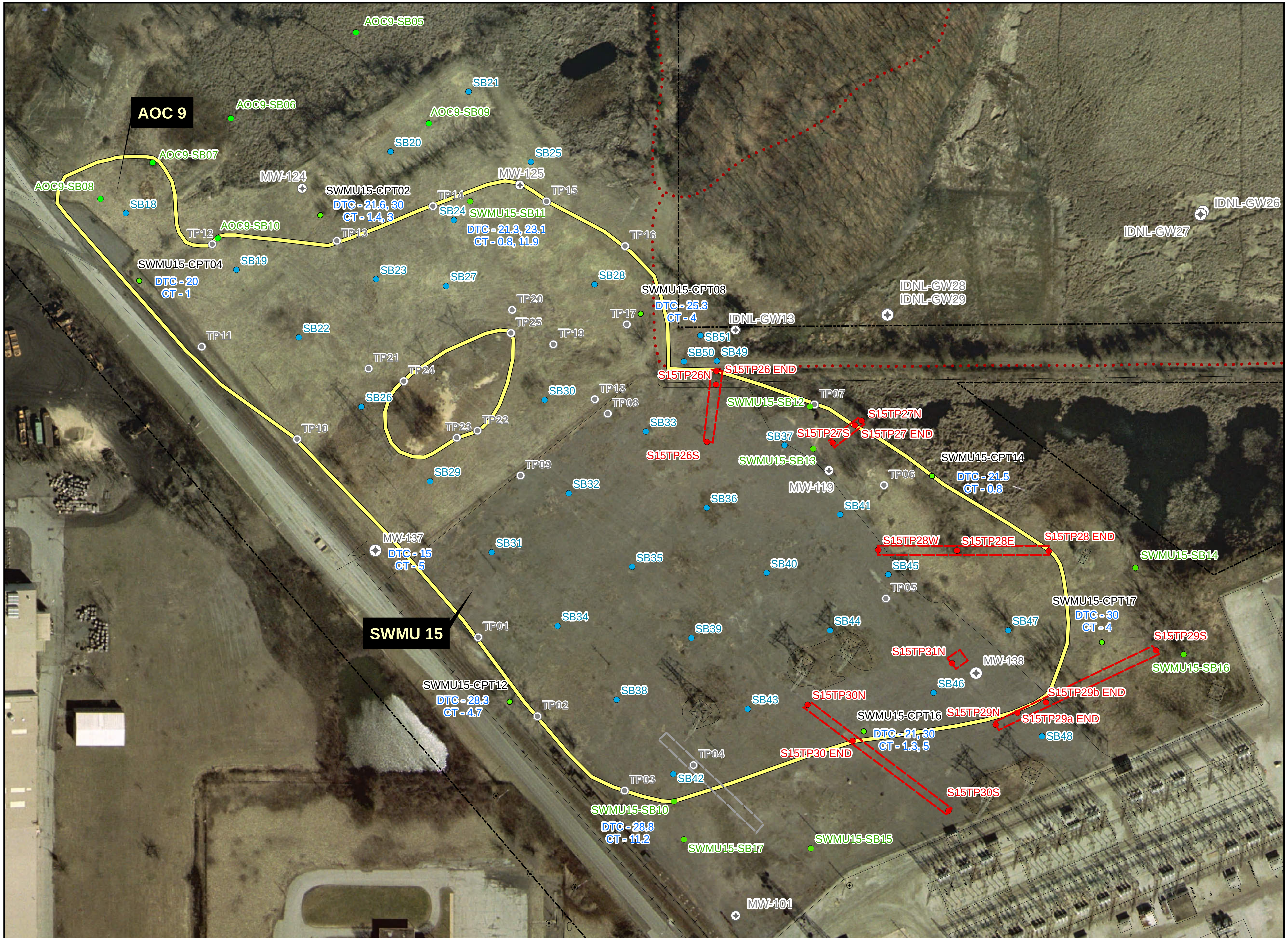
DATA MANAGEMENT

Dimensional information (e.g., CCR thickness, depth to water, lithology) collected during the proposed boring program will be incorporated into the existing three-dimensional EVS model of SWMU 15. The updated model will be used to estimate remediation volumes in the Area C CMS. Field measurements and laboratory analytical results will be loaded into the project database. It will only be necessary to validate the metals data. Once the validation is completed, the field and laboratory results will be used to evaluate the proposed remedial technologies.

SWMU 15
Proposed Direct-Push Borings

Northern Indiana Public Service Company

Bailly Generating Station
Chesterton, Indiana



Legend

- Proposed Soil Boring Location
- Soil Boring Location
- 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
- DTC - 31 Depth to Clay (ft)
- CT - 3 Clay Thickness (ft)

Location of Site

Notes and Sources

FIGURE 1

Aerial Photo: 2005.
Courtesy of LizardTech, Inc.

- Area of SWMU 15 landfill is 16.55 acres.

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

N

0 150
Feet

amec

AMEC Environment & Infrastructure, Inc.
271 Mill Road
Chelmsford, MA 01824
(978) 692-9090

TABLE 1
SOIL BORING LOCATIONS
BAILLY GENERATING STATION
RCRA CORRECTIVE ACTION PROGRAM

Boring Location	X Coordinate	Y Coordinate
SWMU15-SB18	491216.165763	4609525.53533
SWMU15-SB19	491268.614912	4609498.70088
SWMU15-SB20	491341.799772	4609554.80927
SWMU15-SB21	491378.798784	4609583.27005
SWMU15-SB22	491298.295438	4609466.58086
SWMU15-SB23	491334.887868	4609494.22847
SWMU15-SB24	491371.886881	4609522.28267
SWMU15-SB25	491408.479310	4609549.93028
SWMU15-SB26	491327.975965	4609433.64767
SWMU15-SB27	491368.227638	4609490.97581
SWMU15-SB28	491438.566419	4609491.78897
SWMU15-SB29	491360.502569	4609398.27499
SWMU15-SB30	491414.984631	4609436.90033
SWMU15-SB31	491389.776513	4609364.52864
SWMU15-SB32	491426.368943	4609392.58283
SWMU15-SB33	491462.961372	4609421.85678
SWMU15-SB34	491421.083369	4609329.56254
SWMU15-SB35	491456.456052	4609357.61673
SWMU15-SB36	491491.828734	4609385.67093
SWMU15-SB37	491528.827746	4609415.35145
SWMU15-SB38	491449.137566	4609294.59644
SWMU15-SB39	491484.510248	4609323.87038
SWMU15-SB40	491520.289512	4609354.77065
SWMU15-SB41	491555.255612	4609382.41827
SWMU15-SB42	491475.972014	4609259.22375
SWMU15-SB43	491511.344696	4609290.12403
SWMU15-SB44	491550.376621	4609327.52962
SWMU15-SB45	491578.024235	4609353.95749
SWMU15-SB46	491599.573110	4609297.84910
SWMU15-SB47	491634.945792	4609327.52962
SWMU15-SB48	491650.964412	4609277.13331
SWMU15-SB49	491496.707000	4609455.34000
SWMU15-SB50	491480.972000	4609455.16000
SWMU15-SB51	491488.830000	4609467.46000

Note: Coordinates in Universal Transverse Mercator (UTM) 16N meters.