



The Chemours Company  
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Louisville, KY 40202

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July 20, 2020

Mr. Phil E. Richard  
Hydrogeologist  
Wisconsin Department of Natural Resources  
Park Falls Service Center  
875 4<sup>th</sup> Avenue South  
Park Falls, WI 54554-1130

**RE: Request for Extension and Modification  
Hazardous Waste Remediation Variance  
Former DuPont Barksdale Works  
72315 State Highway 13  
Town of Barksdale, Bayfield County, Wisconsin  
FID No.: 804009140  
EPA ID No.: WIR000133447  
BRRTS No.: 02-04-00156**

Dear Mr. Richard:

The Chemours Company FC, LLC (Chemours) is herein requesting a schedule extension and modification of the Hazardous Waste Remediation Variance (HWRV) issued for the Former DuPont Barksdale Works site (Site). The scope of the modification and rationale for the schedule extension are detailed in the following paragraphs.

### **HWRV Background and Progress**

The HWRV, which is scheduled to expire on May 18, 2022, was issued to allow Chemours to conduct field-scale testing of biodegradation of nitroaromatic and nitramine organic constituents (NNOCs) present in select Site soils. Currently testing is taking place at a number of different pilot cells, including a control, that were constructed to evaluate various combinations of NNOCs found in the former manufacturing areas.

Test results indicate that the predominant site-related constituents can be degraded aerobically via naturally occurring microorganisms if Site soil is periodically aerated and has sufficient soil moisture; however, it was also observed that elevated concentrations of 2,4,6-trinitrotoluene (TNT) inhibits the biodegradation process to the point that no or very slow degradation occurs. Due to this finding, Chemours undertook benchtop testing to evaluate how pH adjustment (permitted in the HWRV) using hydrated lime could be used to reduce TNT concentrations in soil to levels either below site-specific residual contaminant levels (SSRCLs) for direct contact as a first treatment step or to a point that would be conducive to subsequent biodegradation or phytoremediation as a second step, if necessary.

Chemours engaged staff at the United States Army Corps of Engineers (USACE), Engineer Research and Development Center (EDRC) in Vicksburg, Mississippi under a Cooperative Research and Development Agreement (CRADA) to perform soil pH adjustment testing at their laboratory. The results of the USACE's bench-scale work indicate that the addition of hydrated lime to Site soil create conditions that degrade TNT and other site-related constituents in former TNT manufacturing areas to concentrations below direct contact SSRCLs quite rapidly. The degradation process, known as alkaline hydrolysis (AH), occurs in the soil pore water through

dissolution of the targeted constituent. The rapid reduction of TNT from high concentrations to below direct contact RCLs indicates that AH alone has the potential to be the site remedy without need for follow-on treatment for many site-related constituents.

Subsequent field testing was initiated in several test cells at the site over time and, consistent with the USACE's benchtop results, AH was observed to reduce percentage level concentrations of TNT to low parts per million concentrations below SSRCLs for direct contact quite rapidly; however, it was noted in the field that where TNT particles were larger than sand grains, mass transfer to the aqueous phase is limited. Because the particle size of residual solid product (RSP) consisting of TNT in Site soil ranges from fine grained to pieces three inches in diameter and sometimes larger, several techniques to reduce RSP size were considered. Ultimately, low temperature, thermally assisted particle size reduction was identified as the most promising technique for further evaluation.

The conceptual approach developed consists of pre-treatment of soil with hydrated lime to reduce soil plasticity, followed by heating of the soil to the melt temperature of TNT. Once the desired temperature is reached, the soil and molten TNT are mixed to reduce particle size when the soil cools. From there, water is added if needed to ensure AH occurs in the soil/TNT/water mixture. Initial melt and mixing tests were performed in 2019 by the USACE ERDC staff, which indicate that:

- TNT can be safely melted and mixed with soil without risk of fire or explosion;
- TNT particle size after melting and mixing is small enough to allow AH to occur; and,
- The AH process is accelerated at elevated temperatures, with a general twofold increase in rate for every 10 degrees Celsius (°C) that temperature was increased. This rate increase is primarily because the solubility of the NNOCs was observed to increase with elevated temperature, and degradation via AH occurs in the aqueous phase.

Subsequent evaluation of the USACE laboratory test results and independent numerical heat transfer modeling indicates that the heating approach has the potential to translate to the field; therefore, a conceptual design was developed. On February 6, 2020 Chemours submitted a HWRV modification request (including \$400 fee) to WDNR to allow soil heating to be evaluated in the 2020 field season (generally June to October 1<sup>st</sup> each year).

Unfortunately, COVID-19 related impacts delayed many of the prerequisite steps required to complete the planned soil heating field testing in 2020, thus Chemours deferred the work until 2021. WDNR was informed of this deferment in a meeting on April 17, 2020 and a follow-up letter dated April 23, 2020 (attached). Because TNT particle size attrition is a critical component of the currently planned remedial approach, deferment of the 2020 work means that Chemours will not be able to meet the schedule stipulated in Condition 9 of the May 2017 HWRV renewal. This topic was discussed in a meeting with the WDNR on May 6, 2020 and it was agreed that Chemours should submit a combined request for permit modification and schedule extension so that both subjects can be addressed in one request.

### **HWRV Modification**

The request for HWRV modification is provided as Attachment 1 for WDNR reference. Following submittal of the February 2020 modification request, WDNR requested more specifics about the conceptual cell design noting more specificity was required while recognizing Chemours' need for flexibility in the field testing. Revised design details were reviewed with WDNR in a series of



meetings, and the most recent conceptual design Chemours is proposing is provided as Attachment 2.

**HWRV Schedule Extension**

Condition 9 of the May 18, 2017 HWRV states, “Prior to the expiration of this remediation variance, an interim action and/or remedial action plan or plans shall be submitted to the Department in accordance with ch. NR 724, Wis. Adm. Code. The interim action and/or remedial action plans shall propose implementation of the findings of the bioremediation research covered by this remediation variance, to address areas of residual explosives-related contamination beyond the scale of the existing biopilot cells, and to address all or a subset of the site-related constituents of concern while site investigation is ongoing. The Department will work with Chemours to determine appropriate performance standards and/or residual contaminant levels. Discussions regarding applicability of the findings shall commence upon issuance of the June 2021 annual progress report.”

As stated previously, particle size attrition is one of the few remaining technical issues to address in order to be able to implement the bioremediation and AH processes to remediate soil in the former TNT production areas. Recognizing that Chemours cannot mandate experimental success, Chemours was targeting the dates shown below in the “Original Date or Period” to wrap up TNT treatment studies at the Site to fulfill the requirements of Condition 9 prior to the COVID-19 delays. To accommodate the loss of the 2020 field season, Chemours is requesting a one-year extension to the HWRV, which would move the expiration date of the permit to May 18, 2023. The timing of work that would occur with this extension is provided in the column labeled “Proposed Date or Period” below. All other hard dates within the HWRV would also be extended by one calendar year.

**HWRV Schedule for Remaining Work**

<b>Original Date or Period</b>	<b>Proposed Date or Period</b>	<b>Work Scope</b>	<b>Prerequisite Event(s)</b>
June 2020 to October 2020	June 2021 to October 2021	<ol style="list-style-type: none"> <li>Field test of thermal particle size attrition.</li> <li>Continuation of previous testing.</li> </ol>	<ol style="list-style-type: none"> <li>Modification of HWRV.</li> <li>Permitting, complete design, construction, and field study.</li> </ol>
October 2020 to June 2021	October 2021 to June 2022	<ol style="list-style-type: none"> <li>Evaluate field results.</li> <li>Plan for continued, modified, and/or enhanced scale thermal testing.</li> <li>Begin discussions with WDNR on applicability of findings.</li> </ol>	<ol style="list-style-type: none"> <li>Completion of initial thermal testing.</li> </ol>
June 2021 to October 2021	June 2022 to October 2022	<ol style="list-style-type: none"> <li>Refine results based on first round of field testing.</li> </ol>	<ol style="list-style-type: none"> <li>Completion of initial thermal testing.</li> </ol>
October 2021 to May 2022	October 2022 to May 2023	<ol style="list-style-type: none"> <li>Issuance of Final Progress/Comprehensive Study Report of Findings.</li> <li>Development of “interim action and/or remedial action plan or plans”</li> </ol>	<ol style="list-style-type: none"> <li>Successfully complete preceding work scopes. Assumes thermally assisted particle size approach is successful and scalable.</li> </ol>



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Assuming the extension is granted, Chemours would continue to honor all other stipulations of the HWRV, including providing an additional annual progress report. Please note that no fee is included as a \$400 document review fee was previously sent to WDNR in February of this year.

I appreciate you considering this request. If you have any questions or comments, please feel free to contact me by telephone at (812) 923-1136 or by email at [Bradley.S.Nave@chemours.com](mailto:Bradley.S.Nave@chemours.com).

Sincerely,

A handwritten signature in blue ink that reads 'Bradley S. Nave'.

Bradley S. Nave  
Chemours Corporate Remediation Group

Attachments: Attachment 1: HWRV Modification Request letter dated February 6, 2020  
Attachment 2: Above Grade Soil Heating Concept Figure  
Attachment 3: COVID-19 Related Project Impacts letter dated April 23, 2020

cc: Mr. Chris Saari, WDNR  
Mr. Doug Coenen, WDNR  
Mr. Cary Pooler, AECOM  
Mr. Eric Schmidt, AECOM

# **Attachment 1**

**Hazardous Waste Remediation  
Variance Modification Request letter  
dated February 6, 2020**



The Chemours Company  
500 West Jefferson Street  
Suite 1600  
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February 6, 2020

Mr. Phil E. Richard  
Hydrogeologist  
Wisconsin Department of Natural Resources  
Park Falls Service Center  
875 4<sup>th</sup> Avenue South  
Park Falls, WI 54554-1130

**RE: Hazardous Waste Remediation Variance Modification Request  
Former DuPont Barksdale Explosives Plant  
72315 State Highway 13  
Town of Barksdale, Bayfield County, Wisconsin  
FID No.: 804009140  
EPA ID No.: WIR000133447  
BRRTS No. 02-04-00156**

Dear Mr. Richard:

This letter comprises The Chemours Company FC, LLC's (Chemours') request for modification to the May 2015 Hazardous Waste Remediation Variance (HWRV) issued for the Former DuPont Barksdale Works site in Barksdale, Wisconsin (site). The modification will allow for the use of thermal heating methods to enhance degradation of nitroaromatic and nitramine organic constituents (NNOCs) in pilot test cells at the site. This modification request is being submitted as a condition of issuance (Condition 6) of the HWRV, which specifies the following:

- *Any changes in hazardous waste remediation activities which are not identified in the Revised Remediation Variance Request for Removal of Residual Product and Debris, dated February 17, 2012, or the Remediation Variance Renewal Request, dated February 22, 2017, will constitute a remediation variance modification. Modifications to this remediation variance shall be submitted as a Class 1 modification request requiring Department review and approval in accordance with s. NR 670.042(1), Wis. Admin. Code. The submittal shall include the appropriate fee stated in ch. NR 670, Wis. Adm. Code, Appendix II.*

#### Background

Chemours has been conducting in-situ pilot testing of bioremediation methods within test cells at the site as permitted in the May 2015 HWRV to study NNOC degradation processes in soil. As allowed in the permit, the in-situ mechanisms of constituent reduction within the test cells involve a combination of aerobic degradation via indigenous microorganisms and transformation via pH adjustment using lime amendments to promote alkaline hydrolysis (AH). Elevating the soil pH allows for degradation of high concentrations of 2,4,6-trinitrotoluene (TNT) and other NNOCs, which can limit biodegradation. The transformation via AH occurs in the soil pore water through dissolution of the NNOCs. It has been observed in lab and field studies that TNT particle size limits mass transfer to the aqueous phase.

Chemours' investigation of the site has identified that TNT is present in soil over a range of particle sizes from fine, sand grain sized to several inches or greater. The field process appears to address most fine-grained particles in soil. However, it has been determined that attrition (i.e. size reduction of residual solid product [RSP]) of the larger particles is necessary to increase

transfer to the aqueous phase by reducing particle size and increasing surface area of larger pieces of RSP in soil.

Several techniques to reduce RSP size have been evaluated to date. Based on the results of these evaluations, the project team has identified low temperature, thermally assisted particle size reduction as a focus area for further evaluation. The approach developed for this technique included pre-treatment of soil with hydrated lime to reduce soil plasticity, followed by heating of the soil to the melt temperature of TNT. Once the desired temperature is reached, the soil and molten TNT would be mixed. Initial melt and mixing tests were performed by the United States Army Corps of Engineers (USACE) at their Engineer Research and Development Center in Vicksburg, Mississippi under a Cooperative Research and Development Agreement. The results of the testing indicated that:

- TNT can be safely melted and mixed with soil without risk of fire or explosion,
- TNT particle size after melting and mixing was small enough to allow AH to occur, and,
- The AH process is accelerated at elevated temperatures, with a general twofold increase in rate for every 10 degrees Celsius ( $^{\circ}$  C) that temperature was increased. This rate increase is primarily because the solubility of the NNOCs was observed to increase with elevated temperature, and degradation via AH occurs in the aqueous phase.

#### Proposed Pilot Test at Site

Based on the results of the work completed to date, Chemours requests a modification to include in-situ heating, in addition to, water and pH amendments currently being used. Chemours proposes to conduct a pilot test at the site to evaluate the feasibility of heating soil, RSP, hydrated lime, and water mix in a test cell. Cell contents will be heated to temperatures above the TNT melt temperature of 176° Fahrenheit (F) (80° C). After heating, the contents of the cell will be mixed using a rotary mix-head attached to an excavator.

Chemours is currently evaluating soil heating mechanisms and conceptual designs for heating the soil at the Barksdale site. Although the specific heating process, duration and temperatures utilized during the pilot test has not yet been determined, the addition of heat will be the only change to the current field pilot testing. All other pilot work, permitted as part of the current HWRV, will remain the same, with the exception of cell configuration/construction. In order to efficiently distribute heat evenly, slight modification of the cell design may be required.

One of the conceptual designs being considered includes the use of a closed loop system of pipes installed in a treatment cell as shown on Figure 1. Heat to the pipes would be supplied by a fluid heating system positioned outside the test cell and heat would be transferred from the pipes to the soil through conduction. The test cells will be constructed with a clay base, berms, and a stormwater/sediment containment basin as described in the HWRV. An insulating layer may be added to retain heat in the cell.

Chemours may also evaluate small ex-situ batch treatment systems performed in a small closed container, such as a 55-gallon drum.

The findings of the soil heating pilot test are anticipated to be incorporated into an interim action and/or remedial action plan(s) for the site, which is due to the WDNR prior to the expiration of the HWRV on May 18, 2022.



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If you have any questions or comments, please feel free to contact me by telephone at (812) 923-1136 or by email at [Bradley.S.Nave@chemours.com](mailto:Bradley.S.Nave@chemours.com).

Sincerely,

A handwritten signature in blue ink that reads 'Bradley S. Nave'.

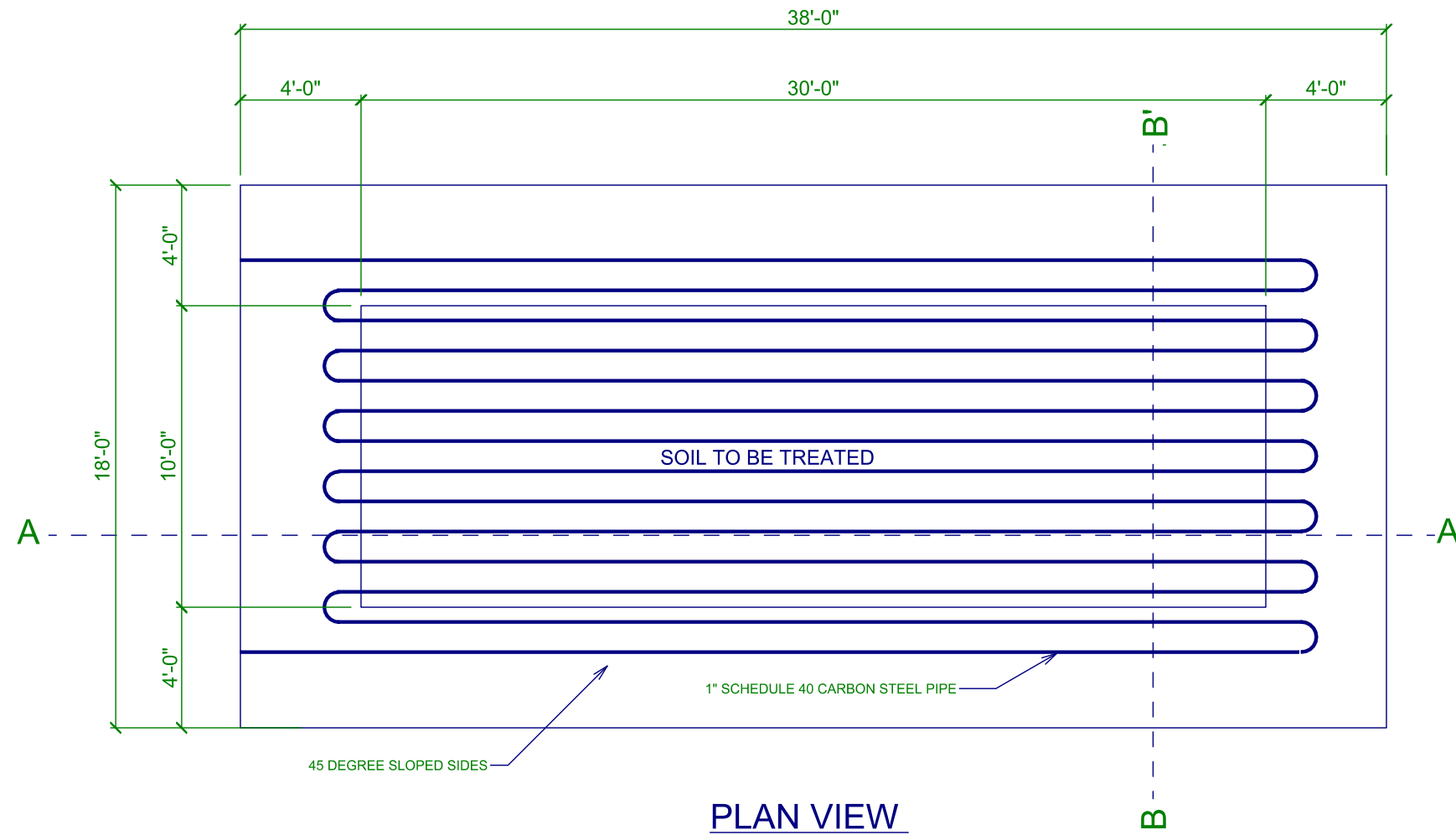
Bradley S. Nave  
Chemours Corporate Remediation Group

Attachments: Figure 1 – Modular Closed Loop Steam Conductive Soil Heating Concept  
Check for \$400 (NR 670 Review of Class 1 Modification Fee)

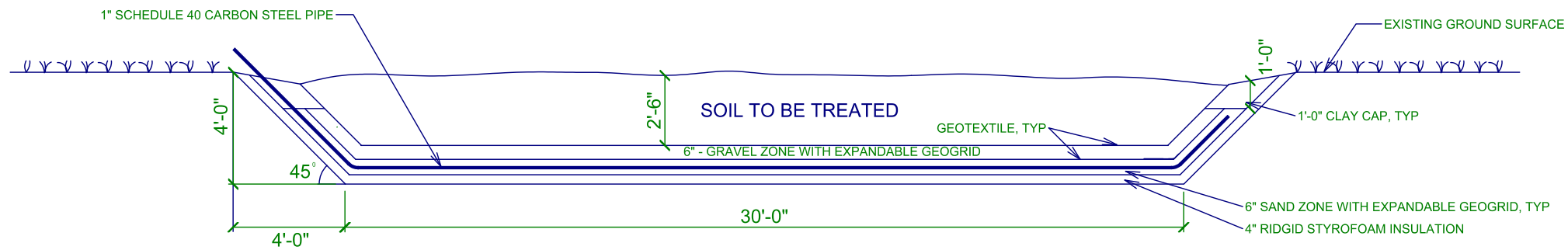
Cc: Chris Saari, WDNR  
Jill Schoen, WDNR  
Cary Pooler, AECOM  
Eric Schmidt, AECOM



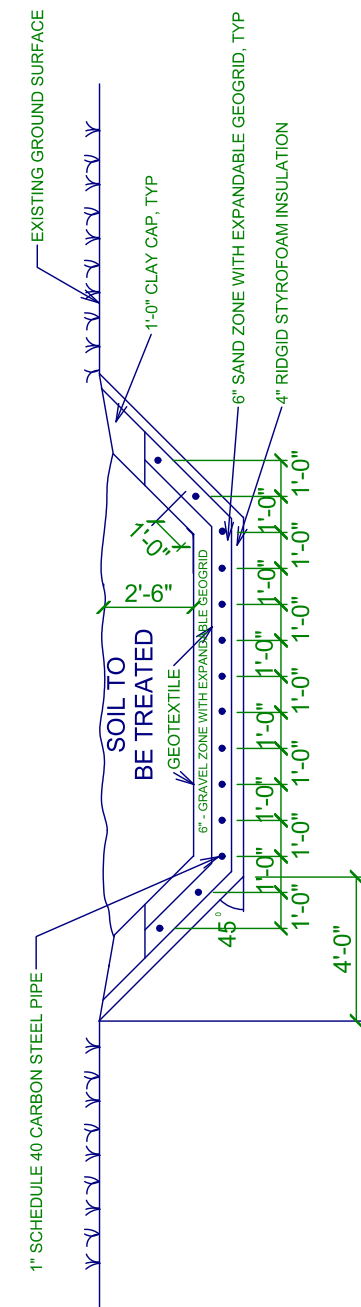
G:\Projects\Barksdale\GIS\Mapa\Maps 2020\Jan\Conductive Soil Heating Concept.mxd



**PLAN VIEW**



**SECTION AA'**



**SECTION BB'**

Notes:  
Conceptual arrangement; actual layout may be modified as needed.

Scale: 3/16" = 1'  
MAP FORMATTED FOR "B" (11" X 17") SIZE SHEET.  
SCALE NOT VALID FOR DIFFERENT PAGE SIZE.

FILE NUMBER:  
DESIGNED BY: RL  
DRAWN BY: VN  
DATA QUALITY CHECK BY: ES

**Conductive Soil Heating Concept**

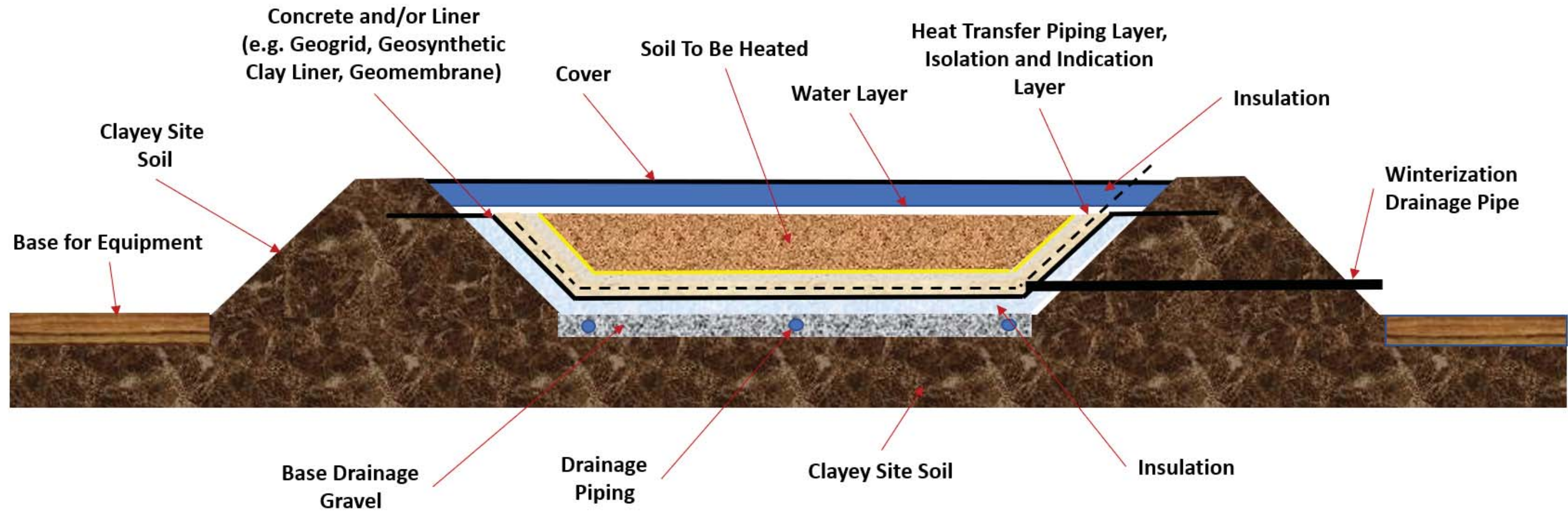
Former DuPont Barksdale Works  
Barksdale, Wisconsin 54806

PROJECT NUMBER:  
60525652  
DATE:  
01/15/2020  
FIGURE NUMBER:

**1**

# **Attachment 2**

## **Above Grade Soil Heating Concept Figure**



Notes:  
Conceptual arrangement; actual layout may be modified as needed.

Not to Scale

FILE NUMBER:	
DESIGNED BY:	RL
DRAWN BY:	RL
DATA QUALITY CHECK BY:	ES

### Above Grade Soil Heating Cell Concept

Former DuPont Barksdale Works  
Barksdale, Wisconsin 54806

PROJECT NUMBER:	60525652
DATE:	04/14/2020
FIGURE NUMBER:	1

# **Attachment 3**

**COVID-19 Related Project Impacts letter  
dated April 23, 2020**



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April 23, 2020

Mr. Phil E. Richard  
Hydrogeologist  
Wisconsin Department of Natural Resources  
Park Falls Service Center  
875 4<sup>th</sup> Avenue South  
Park Falls, WI 54554-1130

**RE: COVID-19 Related Project Impacts  
Former DuPont Barksdale Works  
72315 State Highway 13  
Town of Barksdale, Bayfield County, Wisconsin  
FID No.: 804009140  
EPA ID No.: WIR000133447  
BRRTS No. 02-04-00156**

Dear Mr. Richard:

I appreciate you and Chris Saari taking the time on Friday, April 17, 2020 to discuss work The Chemours Company FC, LLC's (Chemours) will undertake at the Former DuPont Barksdale Works (site) during the 2020 field season. As we discussed, Chemours plans to continue to focus on high priorities at the site in 2020, which will include:

- Ongoing investigation of former manufacturing areas, including identification and removal of residual solid product;
- Sampling surface water/sediment at the site perimeter;
- Maintaining existing biopilot test cells;
- Holding a public meeting;
- Requesting modification of the existing hazardous remediation variance (HWRV) to allow a soil heating pilot;
- Fulfilling reporting commitments associated with site investigation and hazardous remediation variance (HWRV) work; and,
- Fulfilling obligations associated with the WisDOT soil relocation project.

Unfortunately, Chemours is experiencing several COVID-19 related impacts that will prevent completion of some of our previously planned work at the site this field season. This work includes:

- **Soil Heating Field Pilot Testing:** Based on successful benchtop testing and thermal modeling in late 2019 and early 2020, Chemours was planning to conduct a field pilot to test the scalability of soil heating as a means to reduce larger pieces of residual solid product (RSP) in soil to a size that could be treated using the current alkaline hydrolysis techniques that have been successful elsewhere on the site (see attached HWRV Modification Request letter from Chemours to WDNR dated February 6, 2020). Addressing larger pieces of RSP is an integral part of the design of the final site remedy. Ongoing COVID-19 related delays will not allow Chemours enough time this summer to adequately complete design, construction, and initial testing of the heating field pilot in what is an already short field season in northern Wisconsin.



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- **Final Placement of WisDOT Soil:** Soil to be imported from the WisDOT Boyd Creek Bridge replacement project was going to be used as final cover in a former sulfur storage area in 2020. However, COVID-19 related delays are affecting identification of wetlands by WDNR staff (see attached requests submitted on March 17, 2020 and further information below), field surveying, the development and design of a grading plan, and completion of an Interim Action Plan as requested by WDNR. The delays will mean that WDNR approval of the requested Interim Action Plan will not occur prior the start of the WisDOT Boyd Creek Bridge project, which is currently targeted for mid-May 2020.

We are requesting the following regulatory flexibility to accommodate these disruptions:

- **WDNR extension of existing HWRV permit:** An extension of the HWRV permit from May 18, 2022 to May 18, 2023 will allow additional time to refine a full site remedial approach. The design of the remedial approach has been impacted due to the delay of the soil heating pilot testing that was planned from 2020 to 2021.
- **WDNR approval to stockpile WisDOT soil onsite until 2021:** The soil to be imported and placed on the site has concentrations of site-related constituents that are generally consistent with those found in soil in the proposed placement area. The concentrations found in the soil to be imported are also below screening criteria that are protective of human health for direct contact. Current Wisconsin regulations include standards for the management of contaminated soil. To allow for the stockpiling of WisDOT soil onsite until 2021, we are requesting an exemption from:
  - The requirement to provide an Interim Action Plan/Soil Management Plan prior to receiving and stockpiling WisDOT soil. An Interim Action Plan will be developed and submitted prior to the final placement of the WisDOT soil.
  - The requirements for storage of contaminated soil as specified in NR 718.05, which includes storage duration and stockpiling cover/anchor requirements. The soil is proposed to be stockpiled in the same general area as where it will be spread for final placement.
  - The requirement that that soil be placed more than 100 feet from wetlands. Wetland identification requests were submitted to the WDNR in March 2020 for the proposed soil placement area. Travis Holte from the WDNR indicated that there may be potential delays with the identification requests due to COVID-19 related impacts. WDNR wetland maps do not show known wetlands in proposed stockpile locations; however, wetlands are mapped within 100 feet. The proposed soil placement location is located in a former production area and if any wetlands were found in the area, they would likely be considered artificial.



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Sincerely,

A handwritten signature in blue ink that reads 'Bradley S. Nave'.

Bradley S. Nave  
Chemours Corporate Remediation Group

Attachments: Hazardous Waste Remediation Variance Modification Request letter dated February 6, 2020  
Wetland Identification Requests dated March 17, 2020

Cc: Chris Saari, WDNR  
Cary Pooler, AECOM  
Eric Schmidt, AECOM