

**APPENDIX D
RECORD OF DECISION
AND SELECTION OF REMEDY FOR CORRECTIVE ACTION AREA I**

I. SELECTION OF REMEDY

1. The Agency of Natural Resources (ANR) has reviewed the Conceptual Site Model (CSM) prepared by Barr Engineering on behalf of Settling Defendant dated February 2017, and the revised Comparative Analysis of Corrective Actions prepared by Barr Engineering dated April 2017. On June 30, 2017 Barr Engineering provided a revision to the CSM and a response to ANR comments.

2. Based on a review of information identified in Paragraph 1, and subject to the conditions of this Appendix, active soil and groundwater remediation of area-wide perfluorooctanoic acid (PFOA) in Corrective Action Area (CAA) I, as identified in Appendix B, is not cost effective or technically feasible.

3. Based on a review of information identified in Paragraph 1, and subject to the conditions of this Appendix, the cost effective and technically feasible corrective action selected by the ANR for CAA I is:

a. *Corrective Action options that eliminate impacted receptors from drinking water with PFOA at or above 20 ppt.*

- Connect impacted persons with municipal water where technically feasible and cost-effective.
- Where connection to municipal line is not technically feasible or cost-effective, install a replacement drinking water well for impacted residents/businesses, where technically feasible. If a

replacement well is determined not technically feasible, then long-term point-of-entry treatment (POET) will be the long-term corrective action option.

b. *Corrective Action options that remediate groundwater and restrict groundwater use.*

- o Monitored natural attenuation. This will require the sampling of monitoring wells and drinking water wells over time. The locations and criteria for monitoring will be provided in the Corrective Action Plan.
- o Institutional Controls. Develop an institutional control plan to restrict groundwater use and minimize potential exposure to PFOA. This institutional control plan shall be submitted as a part of the Corrective Action Plan for CAA I. For areas that are connected to municipal water, propose to reclassify groundwater to prohibit the installation of new potable water supply wells or an equivalent alternative institutional control at a minimum of 200 feet from a municipal water line. For all other areas in CAA I, propose well design and installation standards for new or replacement wells. When designing these standards, Settling Defendant shall also provide a cost estimate for implementation of the proposed design and installation standards. The ANR shall take cost to

homeowners into consideration when approving any alternate design and installation standard.

4. This Appendix is limited to CAA I and does not apply to any decision with respect to CAA II or the Site.

5. The ANR's use of the CSM does not constitute an approval of the CSM nor does it imply the ANR concurs with the conclusions drawn by the CSM. The ANR believes that additional investigation is necessary in Corrective Action Area II to determine the fate and transport of PFOA from the Chemfab/Saint-Gobain facilities. The ANR believes that additional effort is required to validate modeling efforts and conclusions of the CSM.

6. The ANR reserves the right to require active remediation/corrective action in localized areas, such as the two former Chemfab facilities.

7. This Remedy Selection is contingent on the ANR's approval of a Corrective Action Plan(s) (CAPs), prior to the implementation of any remedy within CAA I.

II. BASIS FOR THIS DECISION DOCUMENT AND REMEDY SELECTION FOR CAA I

8. This Section describes the process that the Agency used to determine that the CSM was adequate for making a decision about the remedy or remedies to be implemented within the area shown as CAA I. Further, this document explains how Settling Defendant has met the requirements for site investigation for CAA I as provided in the Vermont Department of Environmental Conservation procedure

“Investigation and Remediation of Contaminated Properties Rule”, effective July 2017,” (hereinafter “IROCPR”).

9. Site investigation requirements in IROCPR. The IROCPR procedure requires the following to be addressed in a Site Investigation:

- a. Identification of contaminants of concern and identify contaminant sources and potential sources (Contaminant/Source);
- b. Description of Physical Setting (including, but not limited to, geology, land use, surficial geology, surface water features, and hydrogeology);
- c. The degree and extent of the contamination (Plume Definition);
- d. Contaminant fate and transport of the contaminant or contaminants of concern;
- e. Identification of all at risk or potentially threatened sensitive receptors (including but not limited to, water supply wells, water supply source projection areas, surface waters, wetlands, direct contact threat, etc.;
- f. CSM (A description of site conditions incorporating available site characterization information and data). The CSM is the Site investigation tool that provides context and guidance for further activities, that is, further site investigation, corrective action or both. As stated above, the ANR’s use of the CSM does not constitute an approval of the CSM nor does it imply the ANR concurs with the conclusions drawn by the CSM.

10. Site investigation activities and information to date. The following is a summary of the site investigation activities that have been performed to date in

response to the presence of PFOA, found in groundwater in the North Bennington and Bennington area at or above the Consent Order Specific Cleanup Value of 20 parts per trillion (ppt):

a. *PFOA/Source*: The CSM identified some potential sources and pathways for PFOA based on information provided by Settling Defendant. This information included facility information and historical records and site investigation data collected by others, including EPA and ANR. Sources of PFOA identified in the CSM include:

i. Emissions of PFOA through stacks at the former Chemfab facility on Water Street (1978-2002) and the former Chemfab facility on Northside Drive (1969-1978). PFOA-containing dispersants were used at both facilities; and

ii. Former disposal facilities, including the Bennington Landfill; other industrial sources; and Wastewater Treatment Plant Sludge.

b. *Physical Setting Description*: The CSM provided a description of physical setting primarily using existing geologic and hydrogeologic data and studies for the region, for the former Chemfab facility located on Water Street in North Bennington, and for the Bennington Landfill.

c. *Plume Definition*: The CSM used the following data to assess plume definition of the area-wide contamination as described on the attached map:

i. Drinking water well results for water samples collected primarily from ANR and their contractor. Over 592 samples from drinking water

wells were collected. Approximately 298 samples had PFOA concentrations at or above 20 ppt.

ii. Sediment and surface water results for samples collected by ANR. Seven sediment and ten surface water samples were collected. Sediment samples ranged from non-detect to 2.4 parts per billion (ppb). Surface water levels ranged from non-detect to 79 ppt.

iii. PFOA analytical results from soil samples collected by Settling Defendant at the facility on Water Street and its surrounding area. Results summarized in the report titled “Draft Shallow Soil Sampling Report Former Chem Fab Site & Surrounding Areas,” dated July 20, 2016. One hundred forty-five (145) soil samples were collected. Results ranged from non-detect to 45 ppb.

d. *PFC Fate and Transport*: The CSM provided information about the fate and transport of PFOA and other PFCs based primarily from literature review (reports and studies at other sites with PFCs and research on the fate and transport of PFOA).

i. Airborne transport is a pathway and airborne deposition is a source for PFOA;

ii. PFOA is stable and persistent in the environment;

iii. PFOA’s movement is slowed through the vadose zone, however, studies vary about the degree of retention in the soil; and

iv. When PFOA is present in groundwater, there is some retardation that occurs, but it is difficult to quantify given the complexity and uncertainty of the system.

e. *Identification of impacted or potentially impacted sensitive receptors:* The following sensitive receptors have been identified:

i. Impacted or potentially impacted drinking water wells within CAA I and Corrective Action Area II as identified in Appendix B. At this time, approximately 298 drinking water wells have PFOA concentrations at or above 20 ppt.

ii. Water supply source protection areas. Based on the investigation to date, the water sources for the two major water supplies (Town of Bennington and North Bennington Water District) have not tested at or above 20 ppt for PFOA. There are currently four public transient non-community water systems that have PFOA concentrations at or above 20 ppt.

iii. Aquatic features (surface waters, sediment, and wetlands): Surface water, sediment, and fish sampling results were not at levels considered by the State of Vermont to be a potential concern to human health. Further, results were not at a level that ANR considered requiring remediation for recreational use of these waters and the most sensitive aquatic species.

iv. Human direct contact with soil: All soil samples were below the Vermont soil screening level (300 ppb) for direct contact.

v. Agricultural farms and gardens: The Vermont Agency of Agriculture, Food, and Markets indicated that they do not expect to find detectable amounts of PFOA in home or commercially grown produce, with the caveat that water with PFOA below 20 ppt should be used to irrigate crops.

f. *Initial Conceptual Site Model*: A CSM was created based on existing data and available information as specified in this Paragraph. The CSM used several numerical environmental models to evaluate where air emissions from the two Chemfab facilities are a potential source of the PFOA found, primarily in groundwater within the North Bennington and Bennington areas. The evaluation to simulate the complete PFOA transport pathway from source to sensitive receptors included the following models to evaluate fate and transport through the air, unsaturated zone, and groundwater:

i. AERMOD: Air dispersion and deposition from the two former Chemfab facilities was estimated using this model. This model provided an estimate of the aerial extent and mass of PFOA emissions that deposited around the facility.

ii. Soil-Water Balance Water (SWB): This model was used to estimate infiltration rates of PFOA into the ground.

iii. MODFLOW-NWT and MT3D-USGS: These models were used to simulate the leaching and retention of PFOA through the unsaturated zone and PFOA movement in groundwater. This model incorporates the infiltration rates from the SWB Model and mass deposition rates estimated from the AERMOD.

10. Assumptions and limitation of the CSM.
 - a. Existing data and standard model input values were used to the extent this information is available.
 - b. Uncertainty in all parameter values and the lack of complete site-wide data.
 - c. Uncertainty in assumptions used in the numerical models to simulate transport from source to receptor.

11. Findings of the CSM in which ANR concurs:
 - a. No municipally-operated public water supply wells have tested at or above 20 ppt.
 - b. The CSM states that airborne emissions of PFOA from the former Chemfab facilities may have contributed to the PFOA detected in water supply wells within CAA I. ANR has determined that airborne emissions of PFOA from the former Chemfab facilities contributed to the PFOA detected in CAA I.
 - c. Transport through the soil column likely produced a lag between the time PFOA was deposited on the ground surface and the time PFOA reached groundwater.
 - d. Additional investigation, including the regional sampling of soils and the installation of unconsolidated and bedrock wells, is warranted to further evaluate the potential source or sources of PFOA detected in water supply wells outside of CAA I.

12. Findings of the CSM in which ANR does not concur:

a. “The modeling indicates that concentrations of PFOA detected in private water supply wells outside of CAA I are likely not attributable to air emissions from the facilities, but additional investigation is warranted to further evaluate the potential source or sources of PFOA in wells outside of CAA I.” At this time, the ANR cannot conclude that airborne emissions from Saint-Gobain facilities did not impact groundwater in Corrective Action Area II, due to: (i) the uncertainty with the modeling assumptions; (ii) the fact that Settling Defendant has not provided the ANR inputs and documentation associated with the modeling; and (iii) the limited soil and groundwater data over time.

13. Based on the information above, the ANR has concluded that for the purposes of determining the appropriate corrective action remedies for CAA I, Settling Defendant has met the Site Investigation requirements of the IROCPR, subject to addressing data gaps and further comments and concerns identified in the CSM.

III. BASIS FOR CONDITIONAL CONCURRENCE OF COMPARATIVE ANALYSIS OF CORRECTIVE ACTION OPTIONS FOR CAA I

14. This Section describes the process that the ANR used to determine that the Comparative Analysis of Corrective Action Alternatives was adequate for making a decision about the remedy or remedies to be implemented within the area shown on Figure 1. This process meets the requirements for an evaluation of corrective action alternatives as provided in the IROCPR.

15. The IROCPR specifies the following technical elements that must be addressed in an Evaluation of Corrective Action Alternatives:

- a. Identification of the objectives and goals of the corrective action;
- b. Evaluation of the technical, regulatory (legal), cultural and economic feasibility of remedial alternatives capable of achieving the corrective action objectives, with a detailed evaluation of one or more remedial options, including a conceptual design of chosen remediation method;
- c. Discussion of waste stream treatment and/or disposal requirements (where applicable);
- d. Identification of need for institutional controls, such as deed restrictions, groundwater reclassification, municipal ordinance, etc.; and
- e. Environmental Impact of Proposed Remediation.

16. Comparative Analysis of Corrective Action Options and Selection of Remedy. The following is a summary of the Comparative Analysis of Corrective Action prepared by Barr Engineering dated April 2017.

This analysis evaluated eight remedial options, three of which to protect human health and the remaining five to remediate groundwater:

Remedies to Protect Human Health (Eliminate the Drinking Water Pathway)

- Long-term Operations of Point-of-Entry Treatment Systems (POETs)
- Expansion of Municipal Water Lines
- Drinking water replacement wells

Remedies to Remediate Groundwater Contaminated with PFOA

- Groundwater Pump-and-Treat using existing wells with POETs (operating existing drinking water wells at full capacity)
- Dedicated Groundwater Pump-and-Treat Wells with Re-injection
- Groundwater Pump-and-Treat using both existing wells and dedicated wells with Re-injection
- Surface Soil Removal
- Monitored Natural Attenuation

17. A comparative analysis was performed on these corrective action options using 40 C.F.R. § 300.430(e)(9)(iii):

- Overall protectiveness to human health and the environment;
- Compliance with applicable, relevant, and appropriate requirements;
- Short-term effectiveness;
- Long-term effectiveness and permanence;
- Reduction of contaminant mass, mobility, and toxicity through treatment;
- Implementability;
- Cost; and
- Community acceptance.

18. The ANR has determined that the comparative analysis using the above criteria to evaluate corrective action options adequately addresses the elements for an evaluation of corrective action alternatives as described in the ICROPR. Although this comparative analysis did not explicitly address the

environmental impact of remedial alternatives, the analysis implies that active remediation, such as soil removal and pump and treat, would cause significant disturbance and resources to implement, with questionable and uncertain cleanup benefit. The ANR concurs with this assessment. With respect to corrective actions to provide drinking water below 20 ppt, the ANR believes that long-term effectiveness/permanence and overall protectiveness are the most important criteria, but any remediation should be performed to minimize its environmental footprint, to the extent practical.

19. The ANR concurs with the following recommendations for the area shown on Figure 1 of the Comparative Analysis of Corrective Action:

a. Active remediation options, that is, the three corrective action alternatives that used active pump-and-treat system (either existing well, or dedicated well) or surficial soil excavation do not substantially reduce the PFOA mass, do not increase the overall protectiveness of human health and the environment and are not cost effective;

b. Monitored Natural Attenuation (MNA) with institutional controls is an appropriate remedial alternative for groundwater; and

c. POETs (provided that they are properly maintained), well replacement, and Expansion of Municipal Water Lines are options that are potentially viable to provide potable water to residents.

20. The ANR does not concur with the recommendation to continue operating POETs unless operating a POET is less expensive than connecting

municipal water. From the ANR's perspective, municipal connection is the preferred option for all areas unless connection for a given area is not technically feasible (such as unacceptable disinfectant by-products or not sufficient chlorine residual); costs for connection are significantly greater than the cost to operate a POET system long-term; or individuals located at the end of a water line do not want municipal water. The ANR's next preferred option, where technically appropriate, is the installation of a replacement well where POET operation and maintenance continue until the ANR has sufficient data to determine that PFOA levels for the new well will remain below 20 ppt in accordance with the protocol set forth in the Consent Order. The ANR's deviation from Settling Defendant's corrective action recommendations is based on the following:

a. Settling Defendant's comparative analysis evaluated each remedial option separately. A comparative analysis should consider several options in combination. This approach provides a better understanding of how these remedial approaches can work together to meet all of the needs for CAA I. Given the size of the corrective action area, it is not practical to consider that a given option will be viable for all locations within this area. In addition, ANR recommends that any future corrective action feasibility investigation separate the groundwater remedy from the drinking water remedy.

b. Table 1 (Summary of Estimated Costs for Corrective Action): Settling Defendant concludes that the O&M cost range is a 20-30 year treatment period for all POET systems installed to date. Based on the uncertainty of the

assumptions and parameters in Barr's CSM dated June 2017, the ANR believes that many POET systems, particularly closer to and in the dominant down-wind direction of the plant, will be impacted for longer than 20-30 years. Therefore, POETs O&M costs will likely be higher than those listed in Table 1.

c. Table 2 (Summary of Corrective Action Criteria Scoring), the Agency does not concur with the following scoring determinations:

i. Installation and Operation of POET Systems on Wells – Long-Term Effectiveness and Permanence: The Settling Defendant's score is High, the ANR considers the score as low (medium at best). The effectiveness and permanence of this remedy is contingent on diligent maintenance in perpetuity at least over the next 30 years. Typically, a remedy dependent on diligent long-term O&M for effectiveness is not considered desirable. Therefore, a scoring of high is not realistic.

ii. Installation and Operation of POET Systems on Wells – Community Acceptance: Settling Defendant scores as Medium-High, based on community feedback from the survey performed by the public water systems and from public meetings, the community is clear that POETs are not a desirable long-term option. Given the above, ANR believes that community acceptance for POETs as a long-term remedy are low.

iii. Installation of Municipal Water Lines – Community Acceptance: Settling Defendant scores as Medium-High, based on the feedback the public water systems received from residents, it was clear that in a majority

of cases, water line installation is the preferred alternative compared to long-term operation and maintenance of a POET system. Given the above, the ANR believes that community acceptance for a municipal water line would score as High.

iv. Well Replacement – Overall Protectiveness of Human Health and the Environment: Settling Defendant scores as Medium, the ANR considers the score as Medium-High because the replacement well will keep its POET system in operation until it can be shown in accordance with the protocol set forth in the Consent Order that PFOA levels are below 20 ppt of PFOA.

v. Well Replacement – Implementability: Settling Defendant scores as Low, the ANR believes that the score is High, provided that the proper characterization is done prior to well placement and the well is properly constructed. The ANR has had success at a number of sites in the installation of replacement well. It is not difficult to construct such wells and when done appropriately they are very successful at providing a potable water source.

vi. Well Replacement – Community Acceptance: Settling Defendant scores as Medium-High, where technically appropriate, the ANR believes that community acceptance would score as High.

23. With the exception of a revision of Figure 1 to mirror Appendix B of this Consent Order, the ANR is not requesting any revision to the corrective action feasibility investigation documents. Although the ANR does not agree

with all assumptions, statements, recommendations, and conclusions, the ANR believes that this document is adequate to select a remedy in CAA I.

24. The ANR reserves the right to require active remediation / corrective action in localized areas. The ANR reserves its rights to evaluate area-wide groundwater remediation outside CAA I and at the two facility operable units based on ongoing site investigations.