



Joint Committee Meeting  
Airport Commission  
Environment, Agriculture & Natural Resources

4000 International Lane  
Madison, WI 53704

Questions submitted following PFAS remediation:

1. Is the test done, or are other areas going to be treated?

Response: The Bioremediation Pilot Project is ongoing. We're in the process of exploring other areas of airport property this project can be extended to.

2. Was the test successful, how do we measure if it was successful, what would be the line between successful and not successful?

Response: The three-part remediation process reduced concentrations of PFAS in controlled, long-term tests on airport grounds an average of 97% at the down gradient testing well.

3. Why are we not using a Groundwater Extraction Treatment System in either of the former firefighter training areas?

Response: Early in the airport site investigation process, the WI DNR advocated for the responsible parties to install a groundwater extraction treatment system on the airport property to remove PFAS from storm water. The Airport's consultant advised that several factors make such a system impractical and infeasible. These include very large peak and total storm water flows, the complex matrix of constituents in storm water and several operational considerations. Since then, a similar system that was implemented in Marinette has been proven to be ineffective at removing PFAS from groundwater. Read more about Marinette's system here:  
<https://www.ehextra.com/5687609a-9845-11ed-88b7-03c46f84b253.html>

4. How controllable are these microbes to prevent them from consuming beneficial compounds in the soil?

Response: The microbes utilized were previously isolated from Dane County Regional Airport and are already present in the soil in small quantities, making them unlikely to act in an invasive or problematic way. At the depths they have been deployed they are unlikely to cause significant changes to surface soil

chemistry and there is no evidence at this time that the microbes would consume anything beneficial in the soil.

5. Has the safety of the microbes for plant and animal life been tested?

Response: The microbes utilized were collected from the area where the treatment was performed and would already be present in soil in small quantities. This method of utilizing microbes is specifically chosen as it makes them less likely to be invasive or harmful to the local ecosystem. While no testing has been specifically done at this point on the safety of the microbes, they have only been utilized at depths where exposure to humans and animals is highly unlikely.

6. How quickly do the microbes work and is it quickly enough to break down PFAS before the chemical migrates from a contaminated site?

Response: In both previous lab and field studies measurable PFAS breakdown is typically observed within one to two weeks. In some cases this alone will be fast enough to degrade PFAS before it moves from the contaminated area. In nearly all cases the microbes will be deployed with BAM which will limit the mobility of the PFAS in soil and groundwater and allow the microbes the time required for breakdown and to prevent PFAS from migrating beyond the treated area.

7. Why was it decided to inject microbes directly into the ground rather than removing contaminated soil to a treatment facility?

Response: In-situ injection is much more cost effective than digging, hauling, and disposing of the site soil. Few treatment facilities exist that can accept PFAS-impacted soil and either treat the required amount of soil in reasonable timeframes (i.e. super critical water oxidation), safely store it (i.e. landfills), or otherwise dispose of it in a manner that does not cause further environmental impacts (i.e. incineration of soil).

8. Would these microbes be able to break down PFAS collected in water filters since PFAS contamination is already significant in our lakes?

Response: There is a good chance they would be effective in breaking down PFAS collected in water filters but further lab testing would be required to verify this and determine the best approach.

9. There are over 12,000 PFAS compounds- which class or classes of PFAS have they been testing and have they seen the same rate of successful remediation across all the classes they have tested? If it is not possible to disclose the exact compounds being tested due to intellectual property concerns, could they share how many compounds or classes have been tested and how many have been as successful as the 97% reduction touted in past press releases?

Response: The compounds tested have been under the WI DNR list of 33 PFAS compounds. (WI DNR PFAS List 1.1.21). Water samples were also analyzed using a method known as Total Adsorbable Fluorine (TAF) which is a method that accounts for other PFAS species and precursors not specifically analyzed for by EPA Method 537. The results of this analysis indicate that TAF also significantly decreases when water is treated by this method, suggesting that numerous PFAS species in the sample are degraded. This result is also supported by previous lab studies which analyzed samples via TAF and Total Oxidable Precursor (TOP) assays to confirm that precursors are not generated.

10. Is there a way to get a better idea of where the boundaries of treatment areas are?

Response:



Pilot Project Study Area - Overview



Pilot Project Study Area



Pilot Project Site Layout – *Locations are approximate*

11. What are the byproducts of this process, how quickly do the microbes move as compared to PFAS movement? Could microbes migrate in unwanted areas? What is the lifespan of these microbes?

Response: Previous lab studies of these and other microbes have shown generation of fluoride ions when the carbon-fluorine bond is broken. The expected by-products of this treatment method would be carbon dioxide, fluoride ions, and microbial biomass. The fluoride ions will quickly react with calcium and magnesium in soil to become inert minerals while the microbial biomass will remain as soil carbon. In our experience with these microbes in lab and field studies, they tend not to be very mobile in soil and will typically remain close to areas where they are injected. This means very few of them will migrate with groundwater and makes it unlikely they will end up in unintended areas. However, it should be noted the microbes utilized on the site were already present on the site in small quantities. These microbes require oxygen to thrive, so in injections where microbes are placed deeper into the soil it is anticipated that they will live until oxygen is no longer supplied or is depleted or until their food source (PFAS) is no longer present.

12. What are the occupational risks with this pilot project, construction projects, etc?

Response: According to the National Institutes of Health, "Epidemiological studies have revealed associations between exposure to specific PFAS and a variety of health effects, including altered immune and thyroid function, liver disease, lipid and insulin dysregulation, kidney disease, adverse reproductive and developmental outcomes, and cancer."

Workers involved with the pilot project wear proper protective equipment while handling materials and completing tasks associated with the work.

13. What is target area of the initial pilot project that produced 97% reduction?

Response: A 40' by 40' grassy area of the airfield, adjacent to the 115<sup>th</sup> WI Air National Guard base.

14. Where has the pilot project been extended to?

Response: The airport is in the process of gaining approval from county and DNR officials to focus the next stage of the Bioremediation Pilot Project on the area formerly known as the Darwin Firefighting Training Area.



15. How do the microbes actually break down the chemicals and does this process create any unexpected issues?

Response: The microbes utilize the PFAS as their food source. The exact mechanism by which this occurred is currently being investigated by one of our university partners in Wisconsin and will eventually be published. Our current understanding of the breakdown mechanisms through lab and field studies has not shown the generation of unanticipated by-products. We have previously analyzed for volatile fluorinated compounds, precursor compounds, and other PFAS species that might be generated. The main intermediates in the breakdown of PFAS observed so far are short chain carboxylates such as PFBA and PFPeA, which are eventually consumed by the microbes themselves.

16. How is the field study being controlled so that any unexpected byproducts don't have a chance to escape?

Response: By pairing the microbes with a sorptive material like BAM we are minimizing the migration of PFAS and by-products out of the treatment area. Monitoring of the site was also done at a higher frequency at the start of the study so any concerns or unexpected results could be quickly identified and rectified prior to spreading of the problem.

17. Have the techniques used here to do remediation had any peer review done on them?

Response: While these methods have been made available to the public through whitepapers and have been presented at several conferences, they have not been published in a peer reviewed journal. However, we are currently undertaking two lab studies with universities and consulting firms with the intent of publishing these studies in peer reviewed journals when they are complete.

18. What data has been provided to the DNR on the current pilot and can we make that all available on the Dane County public PFAS website?

Response: The data provided to the DNR is posted on the BRRTS site. It is under BRRTS case number 02-13-581254. The document is dated 2022-10-20.

19. What is the total budget for the remediation pilot project, which government entities are involved and how is that being split up by the different agencies?

Response: The airport is pursuing a bid waiver to enable ORIN Technologies to begin the first phase of a remediation effort for the site commonly referred to as the Darwin Firefighting Training Area. The bid waiver is in the amount of \$75,265.50. These funds are made up entirely from airport funds.

20. Can County Supervisors get the raw data behind the presentation charts and visualizations?

Response: Yes. This data has been provided to County Supervisors upon request. The data was also provided to the DNR and is posted on the BRRTS site. It is under BRRTS case number 02-13-581254. The document is dated 2022-10-20. The Airport PFAS webpage provides quick access to the BRRTS website and relevant case numbers. That page can be found here: <https://www.msnairport.com/about/ecomentality/PFAS-Information>

21. Has there been an effort to map area affected by PFAS, showing gradient of contamination?

Response: Yes. The DNR has an interactive, data-driven map on PFAS around the state. The map and other useful information can be found here: <https://dnr.wisconsin.gov/topic/PFAS/DataViewer>

Additionally, an understanding of the locations and concentrations of PFAS at the Airport is being developed through the ongoing remedial investigation process.