State of Wisconsin
DEPARTMENT OF NATURAL RESOURCES
101 S. Webster Street
Box 7921
Madison WI 53707-7921

Tony Evers, Governor
Adam N. Payne, Secretary
Telephone 608-266-2621
Toll Free 1-888-936-7463
TTY Access via relay - 711

February 2, 2024

MS. DENICE NELSON
JOHNSON CONTROLS, INC
5757 N. GREEN BAY AVENUE
MILWAUKEE, WI 53209

Via Email Only to denice.karen.nelson@jci.com

SUBJECT: Response to GETS Short-Term Monitoring Report #2
JCI/Tyco FTC PFAS, 2700 Industrial Parkway South, Marinette, WI
BRRTS #02-38-580694

Dear Ms. Nelson:

On Nov. 15, 2023, the Wisconsin Department of Natural Resources (DNR) received the *GETS*[1] *Short-Term Monitoring* report (the "GETS Progress Report #2") for the above-referenced site (the "Site"). The report was submitted by Arcadis U.S., Inc. (Arcadis) on behalf of Johnson Controls, Inc. and Tyco Fire Products LP (JCI/Tyco) and was accompanied by the fee required under Wisconsin Administrative Code (Wis. Admin. Code) § NR 749.04(1) for DNR review and response.

The DNR reviewed the GETS Progress Report #2. This letter includes a summary of the DNR's review on the first year of operations and performance of the GETS. In the letter, the DNR provides recommendations and notes a few missing data evaluations for JCI/Tyco to include in GETS Progress Report #3, which is to be submitted by June 28, 2024.

Background

JCI/Tyco is investigating and responding to the discharge of per- and polyfluoroalkyl substances (PFAS) to the environment at the JCI/Tyco Ansul Fire Technology Center (FTC), located at 2700 Industrial Parkway South in Marinette, Wisconsin. The discharge occurred as the result of fire suppressant training, testing, research and development of PFAS-containing aqueous film forming foams (AFFF) at the Site starting in the early 1960s.

JCI/Tyco's site investigation revealed PFAS concentrations greater than 10,000 parts per trillion (ppt) in groundwater beneath and to the east of the FTC property, which contributes to PFAS upwelling into the surface water in Ditch B and migration of PFAS to the Bay of Green Bay. In Feb. 2021, JCI/Tyco proposed an interim remedial action – the GETS – to capture and treat highly contaminated groundwater that is migrating east from the FTC and upwelling into Ditch B.

The GETS includes nine vertical groundwater extraction wells that pump and convey contaminated groundwater through buried pipes to a treatment building on the FTC property. Treatment includes oxidation, filtration, granular activated carbon (GAC) and ion exchange resins to remove PFAS from the groundwater. The treated water is discharged back to Ditch B surface water downstream of where the ditch crosses Pierce Avenue.

[1] GETS = Groundwater Extraction and Treatment System

NR 205 WPDES Permit

The discharge of treated water to Ditch B is done under a Wisconsin Pollutant Discharge Elimination System (WPDES) General Permit No. WI-0046566-07-0 and the associated coverage letter dated Oct. 15, 2021. The DNR's Wastewater Program administers the WPDES permit. A review of the reporting for the permit is not included with this letter.

Semi-Annual Progress Reports

Semi-annual progress reports are required for the GETS interim remedial action under Wis. Admin. Code § NR 724.13(3). On Oct. 7, 2021, the DNR approved JCI/Tyco's plans for monitoring and reporting on operations and performance of the GETS, as described in its July 12, 2021, *Long-Term Monitoring Plan for the Groundwater Extraction and Treatment System* (the "GETS LTMP").

Operation of the GETS began on Nov. 7, 2022, and the DNR received GETS Progress Report #1 on June 15, 2023. Much of the content describe in the GETS LTMP was not included in that first report. In a letter dated Aug. 11, 2023, the DNR requested that JCI/Tyco submit GETS Progress Report #2 within three months and include the missing information and appropriate Wis. Admin. Code ch. NR 749 review fee. JCI/Tyco's GETS Progress Report #2 was submitted per this request.

Summary and DNR Review of GETS Progress Report #2

The DNR reviewed GETS Progress Report #2 and compared the content to that described in the GETS LTMP. A copy of the performance parameters outlined in Table 4 of the GETS LTMP and a checklist relative to the data summaries in GETS Progress Report #2 is attached. The DNR has noted some missing items and requests that these, among a few other things, be included in GETS Progress Report #3. Inclusion of these items will help in JCI/Tyco's evaluation of performance and optimization of the GETS. (See footnote[2] below for request on submission of laboratory reports.)

GETS Operation Summary:

The data in Table 6 show that the GETS captured and treated approximately 97 million gallons of groundwater through Nov. 12, 2023. The data in Tables 2 and 3 show that largest removal volumes and consistently high pumping rates were achieved in extraction wells EX-5, -6, -7 and -8.

Biofouling in extraction wells EX-1, -2, -3, and -4 reduced each well's pumping capacity over the first year of operation. Extraction well EX-1 was rehabilitated in Aug. 2023; the pumping capacity was restored and the pumping rate increased after this repair. JCI/Tyco indicated that rehabilitation is planned for the other three affected wells and that extraction wells EX-1 and EX-2 will be reconstructed to allow for easier access for rehabilitation in the future. Minimal water was pumped from extraction well EX-9. This well was found to have very low concentrations of PFAS and has only been used for sampling purposes following its construction.

The GETS was effective at removing PFAS from water it treated. The influent groundwater captured and coming into the GETS for treatment had concentrations ranging between 6,300 to 18,000 ppt for perfluorooctanoic acid (PFOA) and 520 to 1,300 ppt for perfluorooctanesulfonic acid (PFOS). The concentrations of PFOA and PFOS in the weekly effluent (post-treatment) samples were below the limit of detection – all except for PFOA, which was detected at concentrations between 1 and 21 ppt in the period from Apr. to July 2023. All the concentrations in effluent samples were below the Wis. Admin. Code § NR 102.04 surface water standards for PFOA and PFOS.

[2] Submission of laboratory analytical reports is required under Wis. Admin. Code § NR 724.17(3m)(d). The DNR requests that JCI/Tyco propose a plan for submitting laboratory analytical reports to the DNR that keeps the GETS Progress Reports a reasonable and manageable size.

GETS Performance Evaluation:

The data presented in GETS Progress Report #2 are evaluated below relative to the performance parameters outlined in Table 4 of the GETS LTMP (see the attached checklist).

1. *Has GETS reduced upwelling of groundwater into the upper, middle, and lower reaches of Ditch B? What locations or conditions are contributing to continued upwelling if any are observed*?

   The water levels summarized in Table 10 indicate that upwelling of groundwater into Ditch B continued after startup of the GETS but diminished in the middle reach of Ditch B (in the zone of influence of the GETS) by June and Aug. 2023. Upwelling also diminished in Aug. 2023 in the lower reach at mini-piezometer L09 (anticipated to be outside the influence of the GETS). Upwelling of groundwater has not diminished in the upper reach of Ditch B, upstream of Pierce Avenue.

   The data summarized in Figure 2 and Tables 6 and 8 demonstrate that the flow rate in Ditch B was most strongly influenced by natural processes (e.g., spring melt and high precipitation events) and not by operation of the GETS. Since Jan. 2023, the average weekly flowrate in Ditch B fluctuated from approximately 500 gallons per minute (gpm) to 5,000 gpm; whereas, the GETS operated fairly steadily around 200 gpm throughout that time.

   Future monitoring will help determine if the reductions in upwelling of groundwater are sustained by operations of the GETS and if this is enough to reduce the PFAS concentrations in surface water in Ditch B. The upwelling of contaminated groundwater in the upstream reach and/or influence of spring melt and high precipitation events may be contributing to the PFAS detected in the surface water in Ditch B.

2. *How has GETS affected groundwater migration paths between the FTC and Ditch B?*

   Figures 3 through 5 show that the groundwater water levels went down in the summer months, that the shallow groundwater levels are strongly influenced by precipitation events and that pumping draws the water table down at each extraction well (as expected).

   The potentiometric surface maps in Figures 6 through 8 show that groundwater on the northeastern portion of the FTC continues to flow toward Ditch B. Operation of the GETS has not had a strong effect on the groundwater migration pathways toward Ditch B in the upper reach, north of the FTC. However, a localized zone on drawdown, which focuses groundwater migration and capture, appears to have developed to the east of the FTC in the area around extraction wells EX-5 and EX-7. (Note, these observations align with the findings on groundwater upwelling in Ditch B noted above).

   In the GETS LTMP, it stated that that water levels measured in Ditch B would be included in the potentiometric maps. The DNR recognizes that measurement from streambed piezometers may not be feasible during frozen conditions; however, water levels in Ditch B measured outside of frozen conditions should be included on the potentiometric surface maps (e.g., May 2023 on Figure 8). These data may help to refine the interpretation of capture zone and areas of upwelling in Ditch B.

3. *Have PFAS concentrations in Ditch B surface water diminished? What locations or conditions contribute to observed increases, if any?*

   Data in Tables 9 and 13 and on Figure 9 indicate that the concentration of PFAS in the surface water in Ditch B has followed a decreasing trend after startup of the GETS. Because spring melt, precipitation and upwelling of groundwater in some locations may continue to contribute PFAS to Ditch B, the missing data evaluations (noted in the attached checklist) should be included in future Progress Reports. These evaluations are expected to help in optimization of performance of the GETS. The missing evaluations included:

- Overlay the flowrate measured in Ditch B with the PFAS concentration trends shown on Figure 9. This contemporaneous look at the data will help to determine the effects that high streamflow has on the concentration of PFAS in surface water.
- Prepare trend plots and/or spatial plots of PFAS data from the streambed mini-piezometers. These data may help to identify where groundwater continues to contribute PFAS into Ditch B and where optimization of GETS may be considered.

4. *How has GETS affected trends of PFAS concentrations in groundwater near the GETS?*

   Data in Tables 5 and 12 indicate that the concentrations of PFAS in the aquifer have not changed appreciably since startup of the GETS. This is consistent with expectations for the period of operations.

   Data in Table 13 show that concentrations of PFAS in the groundwater in the streambed of Ditch B fluctuates, but that concentrations notably increased in mini-piezometers M01, M04 and M07 in the spring following startup of the GETS (e.g., the concentration of PFOA in mini-piezometer M04 jumped from a previously measured maximum of 3,500 ppt to a concentration of over 200,000 ppt in May 2023.)

   In future Progress Reports, JCI/Tyco must include a preliminary analysis of the cause and significance of increasing concentrations as required under Wis. Admin. Code. § NR 724.17(3m)(f). To aid in the analysis, the DNR recommends that PFAS monitoring in the streambed mini-piezometer L09 be added to the GETS LTMP. These data can be used as a point of comparison to upstream results and to evaluate if reductions in upwelling are causing PFAS to migrate downstream along the streambed.

   Figures 11, 12, and 13 provide data showing the current distribution of PFAS in the groundwater surrounding the GETS. The isoconcentrations lines/colors used in the cross-section in Figure 13 are very helpful in interpreting the data. The addition of isoconcentration lines/color to Figures 11 and 12 (noted in attached checklist) is recommended. This visual display of information will help depict any changes in the distribution of PFAS in the aquifer following startup of the GETS and help to evaluate the GETS capture zone relative to the groundwater contaminant plume. (For example, is EX-7 capturing the high concentrations of PFAS detected in groundwater at piezometers PZ-31-40 and PZ-58-50?)

5. *How much PFAS mass has been removed by the GETS over time?*

   Figure 10 and Table 14 document that the GETS removed approximately 3.74 kg of PFOA and PFOS in in operations through Oct. 29, 2023. Over 90 percent of the mass removed is PFOA.

   Please note, it appears that the "Volume Discharged to Ditch B" is used to calculate the mass removed by the GETS rather than the "GETS Effluent Volume." Should the "Gallons Treated" in Table 14 be equivalent to the "Effluent Volume" in Table 6? If so, this would increase the mass of PFOA and PFOS removed through Oct. 29, 2023, to approximately 3.91 kg. Please revise the gallons treated in Table 14, if needed, in future Progress Reports.

   Tables 2 and 5 establish that the majority (around 80 percent) of the mass of PFOA and PFOS removed by the GETS to date has come from groundwater captured from extraction wells EX-5, -6, -7 and -8. This is a result of the higher concentrations of PFAS present in groundwater at these well locations and the sustained higher pumping rates achieved at these four wells.

6. *Evaluate sustainability of the GETS operation in accordance with NR 722.09(2m).*

   The performance parameters (e.g., kilowatt hours and GAC usage during the reporting period) were included in the report. This information is helpful and JCI/Tyco may consider having similar summaries

completed for the Ditch A and Ditch B interim actions to assist in future decision making on remedial actions at the Site.

Next Steps

Submit the GETS Progress Report #3 by June 28, 2024, in accordance with the schedule outlined in the GETS LTMP and as stated in GETS Progress Report #2. In GETS Progress Report #3, please include the missing data evaluations discussed in this letter and attached checklist, which are also summarized below:

- Include water levels in Ditch B (when available) on the potentiometric surface maps.
- Overlay the flowrate measured in Ditch B with the PFAS concentration trends shown on Figure 9.
- Prepare trend plots and/or spatial plots using the PFAS data from the streambed mini-piezometers.
- Include a preliminary analysis of the cause and significance of increasing concentrations as required under Wis. Admin. Code. § NR 724.17(3m)(f). (To aid in the analysis for PFAS increases that were detected in the streambed groundwater in the middle reach of Ditch B, the DNR recommends JCI/Tyco also sample streambed at mini-piezometer L09 for PFAS.)
- Add isoconcentration lines/color to Figures 11 and 12.
- Check the value used for "Gallons Treated" in Table 14 and update, if needed.

As a reminder, this Site is subject to an enforcement action and therefore all submittals to the DNR under Wis. Admin. Code chs. NR 700-799 and submittals directed by the DNR must be accompanied by an Wis. Admin. Code ch. NR 749 fee per Wis. Stat. § 292.94. These fees are not pro-ratable or refundable per Wis. Admin. Code § NR 749.04(1). If you have any questions about whether to include a fee with a submittal, please contact DNR staff prior to submitting a document without a fee.

If you have any questions, please contact me at Alyssa.Sellwood@wisconsin.gov or (608) 622-8606.

Sincerely,

Alyssa Sellwood, PE
Water Resources Engineer
Remediation & Redevelopment Program

Attachment: Table 4 from GETS LTMP with checklist comparing to content of GETS Progress Report #2

cc: Jodie Thistle, DNR (via email: Jodie.Thistle@wisconsin.gov)

Table 4 from GETS LTMP with checklist comparing to the content of GETS Progress Report #2

Performance Parameter	Evaluation Process	DNR's Comparison to Nov. 2023 Report
Document reductions of upwelling in upper, middle, and lower reaches of Ditch B and/or identify locations or conditions contributing to observed upwelling	Calculate and track (in a table) head differentials in mini-piezometers and surface water	✓
	Calculate and track (in a table) the average system effluent rate and stream flow rate (at the existing Ditch B system) on days that mini-piezometers and surface water are gauged	✓
	Calculate and track (in a table) daily average flow rate in Ditch B and daily average effluent discharge rate and stream gauge measurements (when available)	✓
Monitor and assess groundwater migration from the FTC (as it relates to the GETS and Ditch B specifically)	Create tables and graphical plots (as needed) to summarize groundwater and surface water levels within the area of the GETS	✓
	Create figures illustrating groundwater elevations and approximate capture zones of the extraction wells	✓ Add surface water levels when available
	Create cross-sections through the monitoring area (including Ditch B) illustrating wells, groundwater elevations, and approximate capture zones of the extraction wells	✓
Document PFAS reductions in Ditch B surface water and/or identify locations or conditions contributing to potential increases	Create tables summarizing PFAS concentrations detected in groundwater and surface water PFAS concentrations at mini-piezometers.	✓
	Create post-maps and trend plots illustrating PFOA and PFOS concentrations in groundwater and surface water at mini-piezometers over time.	Add *
	Create graphical trend plots showing contemporaneous flow rates and PFOA and PFOS concentrations for both GETS effluent and Ditch B surface water.	Add Ditch Flowrate to Fig. 9
Document PFAS trends in groundwater (decreasing, stable, increasing) within the area of the GETS	Create tables to summarize groundwater PFAS concentrations at monitoring wells over time	✓
	Create graphical plots (as needed) to track concentration trends of specific PFAS constituents (e.g., PFOA, PFOS, PFHxA, and FTSA) at monitoring wells	Add (when needed)
	Create figures (e.g., isoconcentrations and cross-sections) illustrating concentrations of specific PFAS constituents (e.g., PFOA) in groundwater within the area of the GETS	Add (e.g. PFOA +PFOS isoconcentration on Fig. 11 and 12)
Document PFAS mass removal over time	Create a tabular summary of the average operating flow rate, run time, and volume of groundwater removed per month in each extraction well	✓
	Calculate and track (in tables and graphical plots) estimates of PFAS mass extracted from each well for the reporting period, and include updated cumulative estimated mass of PFAS extracted from each well since startup	✓ * Tables 2 & 5 meet this goal
	Create a tabular summary of the total volume of groundwater extracted and treated per reporting period and cumulatively since GETS startup	✓
	Create a tabular summary of the influent and effluent concentrations of PFAS from the GETS during the reporting period	✓
	Calculate and track (in tables and graphical plots) estimates of PFAS mass removed by the GETS for the reporting period, and include updated cumulative estimated mass of PFAS removed since startup	✓
Evaluate sustainability of the GETS operation in accordance with NR 722.09(2m)	Create a tabular summary of run time and down time of the GETS during the reporting period	✓
	Estimate energy usage by the GETS per reporting period and cumulatively	✓
	Summarize the carbon regeneration volume/mass per reporting period and cumulatively	✓
	Summarize the disposal volume/mass for filters and ion exchange resin per reporting period and cumulatively	✓

DNR Notes

✓ = content was included in the Nov. 2023 GETS Short-Term Monitoring Report

"Add" = content not found in the Nov. 2023 GETS Short-Term Monitoring Report. Add as requested or when needed to document trends.

8 Recommend adding monitoring of PFAS in streambed groundwater at mini-piezometer L09 to the LTMP.