

**Ministry of the Environment,
Conservation and Parks**

**Ministère de l'Environnement, de la
Protection de la nature et des Parcs**



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Branch

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May 12, 2025

To: Celeste Dugas, Manager
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Central Region

From: Ellen Klupfel, A/Supervisor
Terrestrial Assessment and Field Services Unit
Air Monitoring and Modelling Section
Environmental Monitoring and Reporting Branch (EMRB)

**Re: Review of the York Durham Energy Centre Soil Assessment Report
2023**

At the request of Central Region, York Durham District Office, the Terrestrial Assessment and Field Services Unit (TAFSU) of the Environmental Monitoring and Reporting Branch (EMRB) has reviewed the report prepared by RWDI Consulting Engineers (RWDI) entitled Regional Municipality of Durham Whitby, Ontario Durham York Energy Centre: 2023 Soil Testing Report RWDI# 2301083 and offers the following for consideration.

The Report was prepared as part of an ongoing Durham and York municipal government monitoring programme designed to measure the potential effects of select trace elements, polycyclic aromatic hydrocarbons, dioxin, and furans deposition from the Durham York Energy Centre.

The Report provides a detailed description of the soil sampling methodology and quality assurance and quality control measures undertaken up- and down-wind of the Durham York Energy Centre. By and large, RWDI followed all traditional procedures and methods established under the programme and the TAFSU does not take issue with their sampling methodology. The results indicate that soil concentrations for the parameters considered do not exceed the

provincial Table 1 background soil standards under *Ontario Regulation 153/04 - Record of Site Condition (O.Reg. 153/04)* and that soil quality at these two sites is in good standing. The report, however, does not include statistical analysis of the results and as such some of the conclusions should be interpreted with caution.

For example, RWDI concluded there were no issues with trace element concentrations in soil, considering all values were below the Table 1 of background soil standards under *O. Reg. 153/04*. RWDI noted, in generic terms, that the 2023 data were reasonably comparable to the historical results. Importantly, there was no mathematical/statistical interpretation presented to support this position. While it is encouraging that all trace element concentrations were found below the Table 1 soil standards, the lack of meaningful interpretation of trends over time ought to be addressed in the future. For example, depending on the statistical approach taken, barium (Ba), and vanadium (V) concentrations in soil may have increased at the downwind soil location with time (Figure 1). To reach this conclusion, the TAFSU used the data reported by RWDI to conduct a linear regression analysis between the reported trace element concentrations in soil (y-axis) and time (x-axis). When regression was applied, there were significant effects of time on concentrations of Ba ($p = 0.01$, $r^2 = 0.79$) and V ($p = 0.02$, $r^2 = 0.8$) at the downwind location, but there was no such relationship upwind of the facility ($p > 0.05$). However, when a Mann Kendall test was applied, no significant relationship ($p > 0.05$) was found for Ba and V, but there was a muted trend response approaching significance for the downwind locations. For example, Ba showed a stronger positive increase trend at the downwind location ($p = 0.13$, Sen's slope = 6), when compared to the upwind location ($p = 0.71$, Sen's slope = 2.3). Similarly, V downwind of the facility nominally increased ($p = 0.06$, Sen's slope = 1.3) but upwind, the slope was flat ($p = 0.84$, Sen's slope = 0).

Applying the theoretical basis of the current sampling design - soil concentrations downwind will respond accordingly to deposition from the facility- the two sampling sites may not be truly independent from one another. They are both tethered to their proximity to the facility for interpretation. The question of independence has an impact on the statistical test selected for interpreting results. This is why, both tests were applied (linear regression and Mann Kendall) in this case. For example, Mann Kendall is generally considered a strong test to identify monotonic trends over time; however, an assumption of the model requires data independence (Waldner *et al.*, 2014). If one makes the argument that the monitoring sites are not independent, then linear regression could apply. Regardless of the statistical nuance, there may have been an impact on soil by Ba and V downwind of the facility, albeit small and inconsequential to date. If these relationships and trends are real, RWDI should be able to identify them in the future as more data are available and statistical methodology is applied. This type of analysis should encompass all parameters being monitored, not simply those noted above.

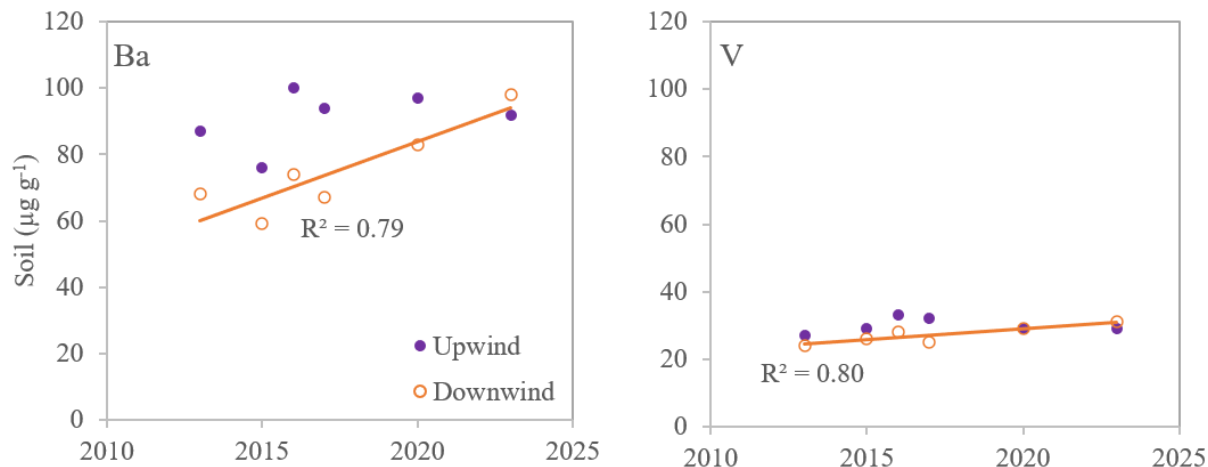


Figure 1: Barium (Ba), and vanadium (V) concentrations in soil (y-axis), compared with time (year, x-axis) upwind (solid purple circles) and downwind (open orange circles) of the Durham York Energy Centre.

With respect to polycyclic aromatic hydrocarbons (PAHs), the TAFSU agrees with RWDI that there were no issues with concentrations in soil up- or downwind of the facility. It should be noted that only five PAHs were reported, and that the Record of Site Condition regulation includes many more. It is recognized that the Terrestrial Assessment and Field Services Unit may not have complete information regarding the PAH congeners that require monitoring under the facility's Environmental Compliance Approval.

Like trace elements, RWDI's interpretation of total dioxin and furan toxic equivalent quotient (TEQ) requires some discussion. Most of the discussion by RWDI in their report dismisses the notion that dioxin and furan concentrations in soil are from the facility. RWDI conjectures that concentrations have increased at both up- and downwind locations. Despite this, there is little quantified evidence to support that claim. For example, using linear regression, there is evidence that nominal concentrations of total dioxin and furan TEQ may have increased over time at the downwind location ($p = 0.06$, $r^2 = 0.63$), while the trend at the upwind location remained largely flat ($p = 0.9$, $r^2 = 0.00$). Regardless, because both groups (upwind and downwind) do not meet the threshold to be classified as statistically significant (which is $\alpha = 0.05$) there is only a perception of the steepness of the curve at the downwind location, as again, the concentration of total dioxin and furan TEQ in soil was not significantly related to time ($p = 0.06$, $r^2 = 0.63$) (Figure 2) (same trend when the Mann Kendall was applied). Therefore, based on the data presented here, RWDI was correct to highlight there was a nominally elevated concentration at the downwind location (2.4 pg g^{-1}), but they were incorrect when they said there was an increase at the upwind location. As such, the general conclusion by RWDI that the nominal increase of dioxin and furans were not attributed to the facility should be interpreted with some caution. Caution is urged here because of RWDI's interpretation of the data, not because of degraded soil quality. There is no evidence that soil quality has been compromised and the concentrations do not exceed the provincial soil standards.

The purpose of the designed study is to compare differences between down- and upwind locations of the facility; therefore, there is an inherent assumption that differences of concentrations between the two locations are the result of emissions from the facility. From the

TAFSU's understanding, while the concentration of dioxin and furans were measured in air, deposition ($\text{g m}^{-2} \text{yr}^{-1}$) was not measured at the site. Note, that atmospheric concentrations have been reviewed separately by the ministry. Importantly, atmospheric concentrations – on their own provide an incomplete picture of the total mass of dioxins and furans deposited to the soil surface; however, based on RWDI's monitoring design, it would be logical to assume that differences between the sites are likely the result of emissions from the facility. To summarize, based on the current design of the monitoring programme, the TAFSU believes a portion of the concentrations of dioxins and furans detected in soil downwind may be the result of emissions from the facility, but more time is needed before a discernible trend can be accepted or refuted mathematically. While RWDI reported that dioxin and furan concentrations increased at both sites, this is simply conjecture, as they have not provided statistical evidence for this claim. The statistical work here suggests that there was no real increase in the soil concentrations upwind of the facility, but there may have been downwind, as results over time are trending towards significance. Future monitoring should be able to reconcile this question.

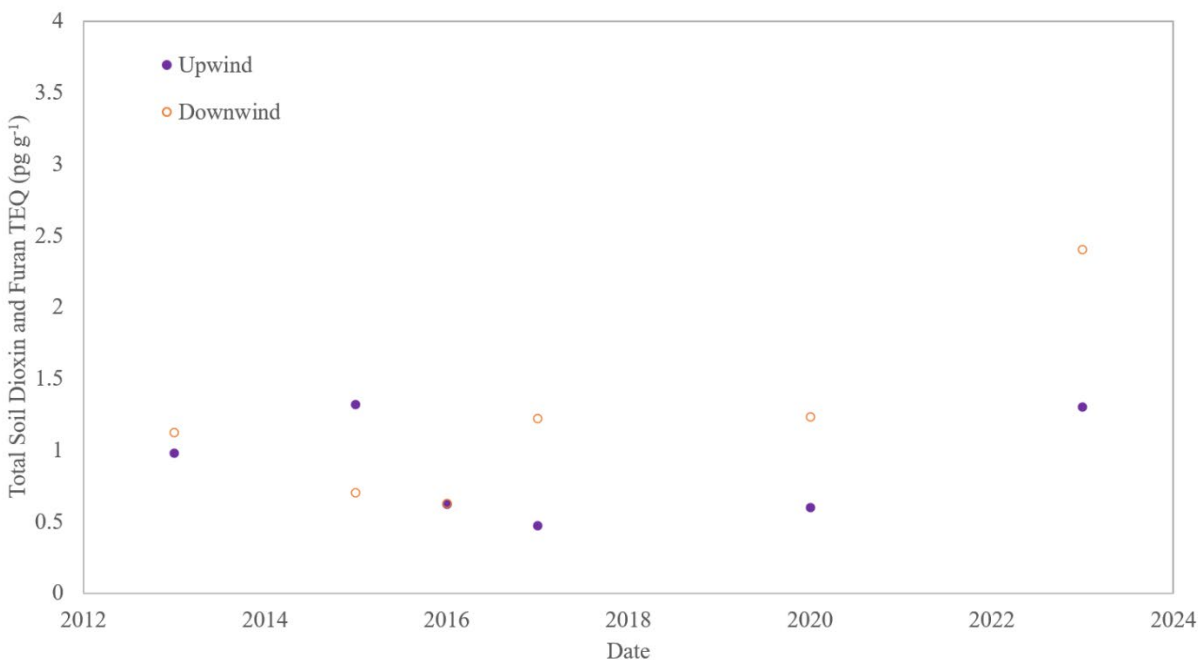


Figure 2: Total dioxin and furan TEQ (pg g^{-1}) (y-axis) in soil compared with time (x-axis) for upwind and downwind locations at the York Durham Energy Centre.

Conclusion

The concentrations of the various parameters reported by RWDI are well within the Table 1 background soil standards established under *O.Reg. 153/04*, and the TAFSU believes soil quality at these sites remains in good standing. The TAFSU can confirm that RWDI has followed the established soil sampling protocols properly. Nevertheless, it is the opinion of the TAFSU that the results need to be interpreted with caution, as RWDI has not provided statistical analysis to support their conclusions. Based on the limited analysis by the TAFSU, there could be trends emerging that future monitoring and analysis should consider.

If you have any further questions or would like to discuss further, please feel free to contact me by e-mail (ellen.klupfel@ontario.ca) or by phone 437-995-8828.

Regards,



Ellen Klupfel

On behalf of Chris Charron, Manager
Air Monitoring and Reporting Section, EMRB

References

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