Indoor Air Quality Monitoring in Manufacturing

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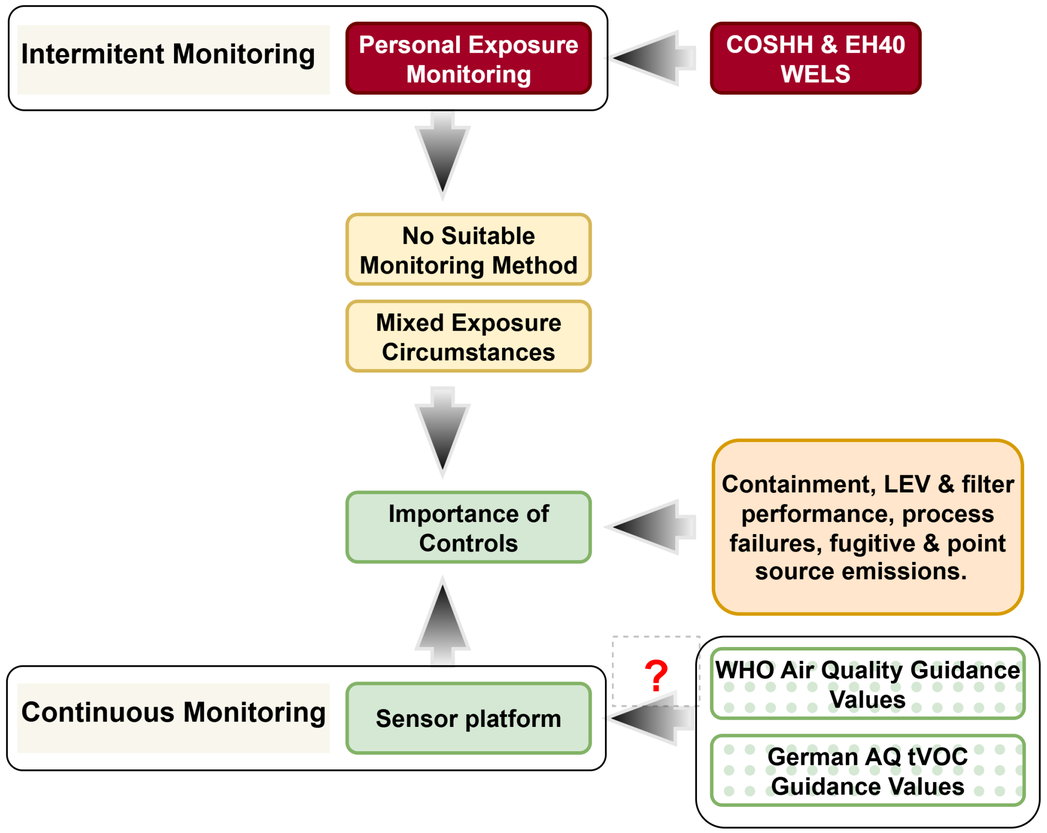
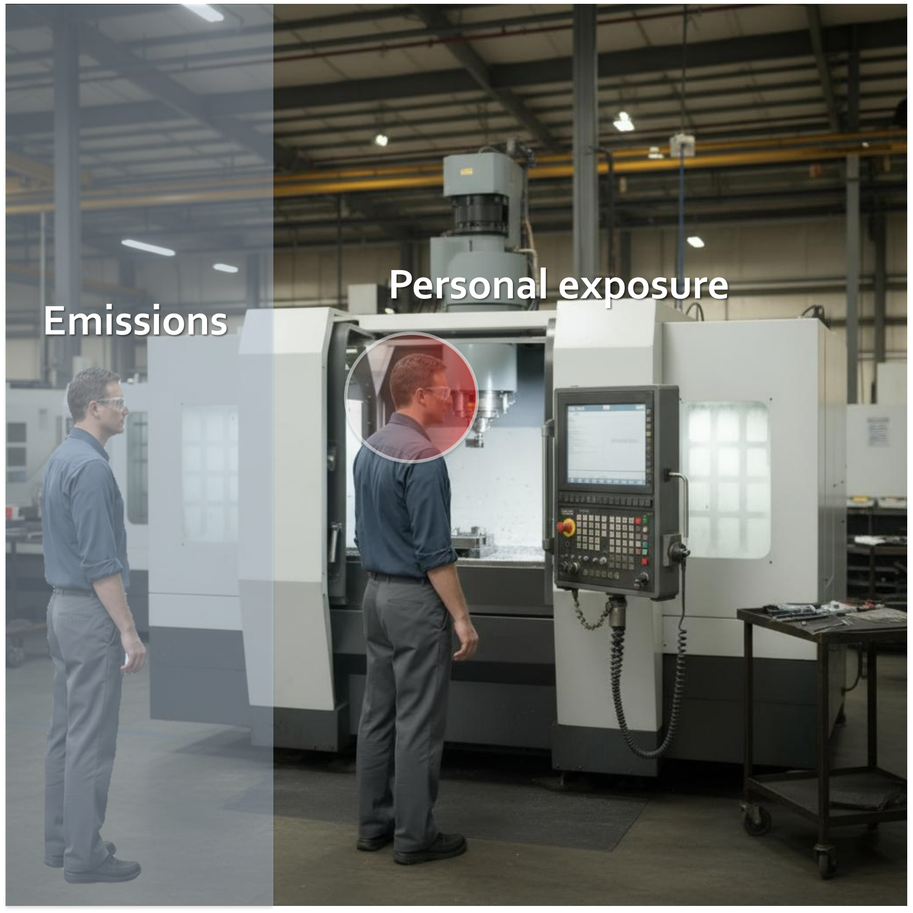
Using Sensors To Monitor Environmental Emissions

- Using sensors to monitor personal 'exposure' to workplace hazards can be challenging.
- Sensors are, however, widely used for environmental monitoring, including indoors*.
  - PM2.5 and PM10 & total Volatile Organic Compounds (tVOC).
  - Environmental data: noise, temperature, humidity, and atmospheric pressure provide contextual insight.
- Continuous monitoring may provide insight about emissions in relation to containment, extraction, filtration, manufacturing processes and employee actions.

** BS40102, air quality in non-domestic environments https://standardsdevelopment.bsigroup.com/projects/9021-05970*

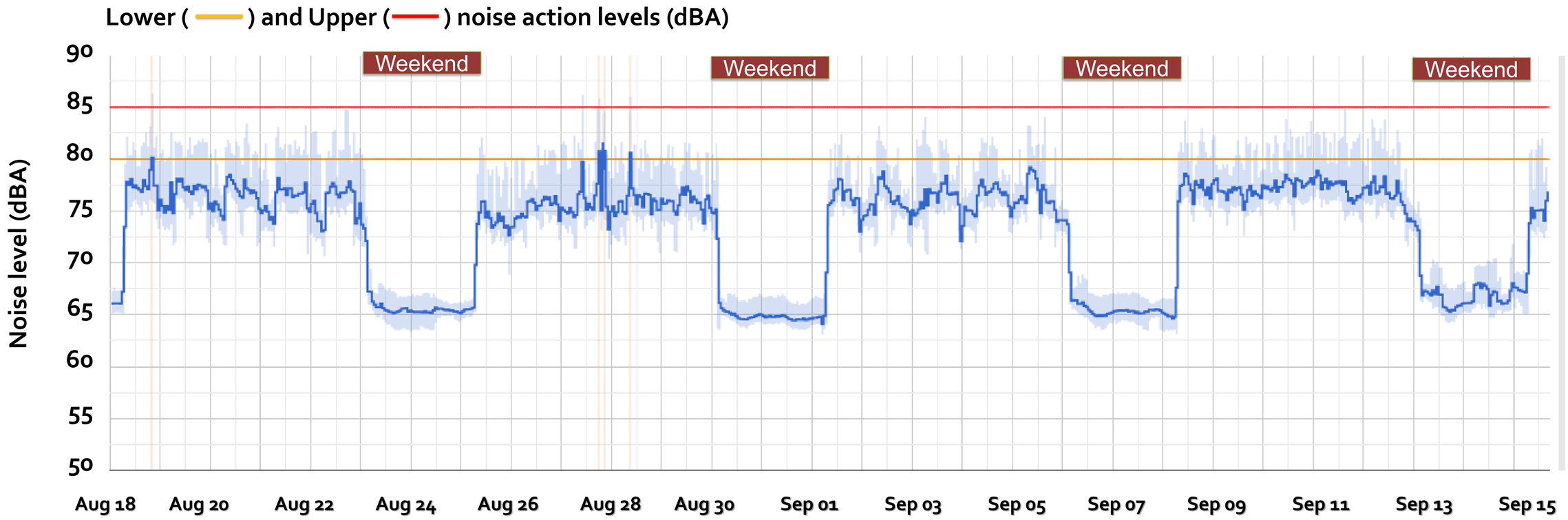
Occupational Exposure Monitoring vs Emission Monitoring





Caveat: PM2.5 and PM10 particle measures used for environment monitoring, differ from the 'respirable' and 'inhalable' fractions that apply to occupational exposure to airborne hazards.

Sensor Monitoring Demonstrates Emissions from a Partially Enclosed CNC



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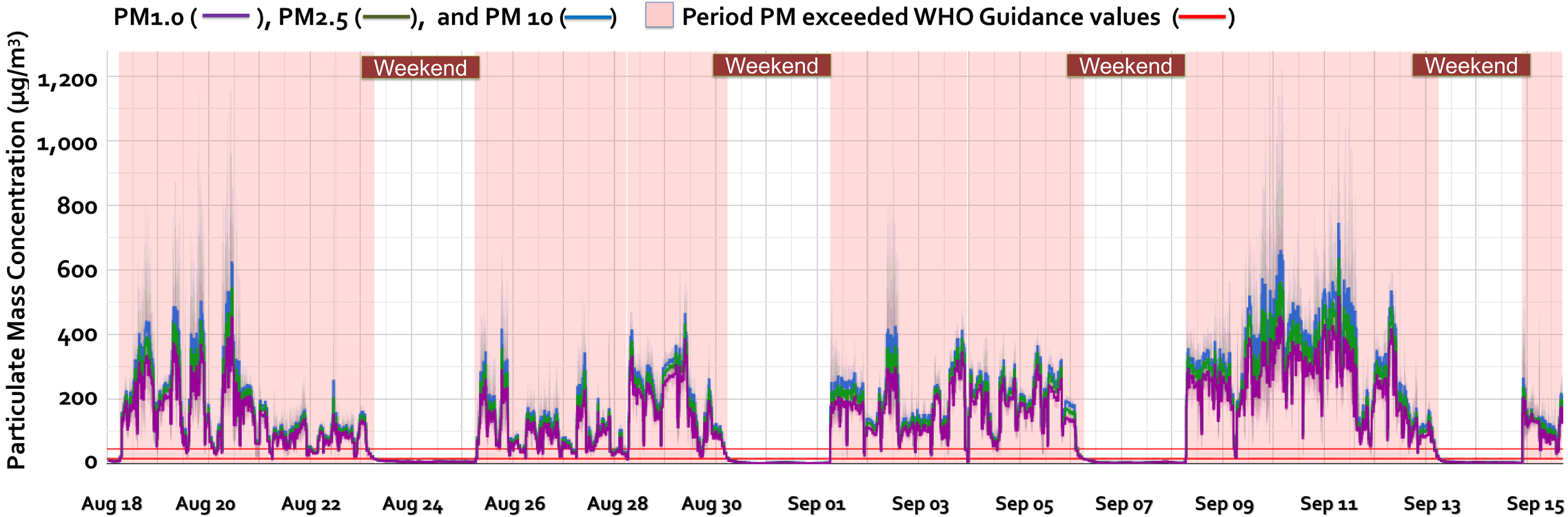
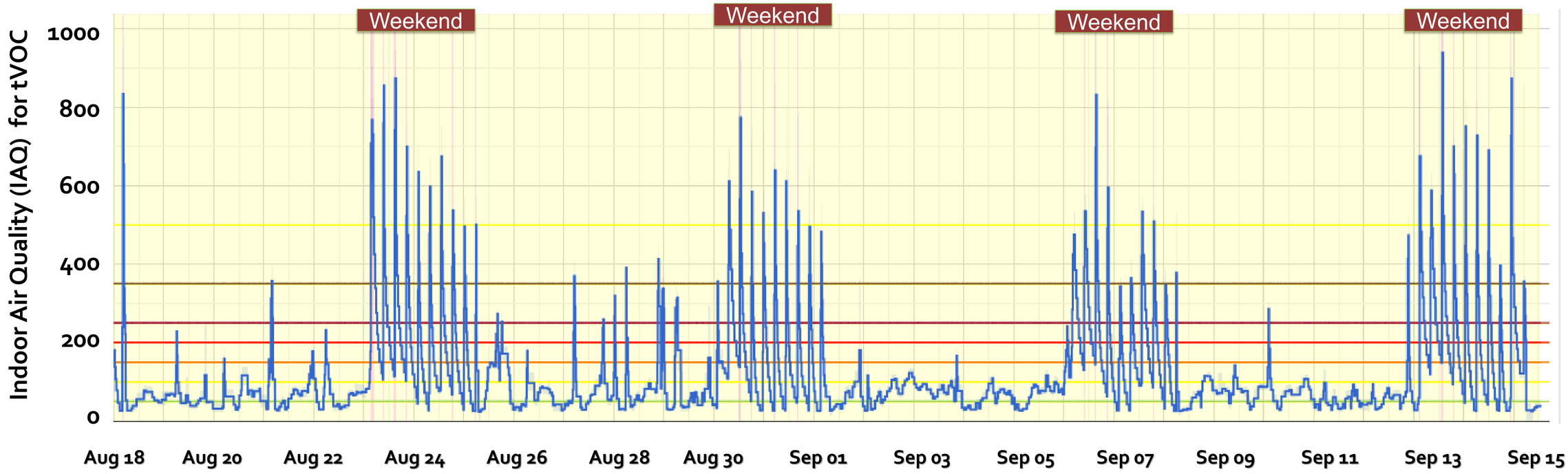


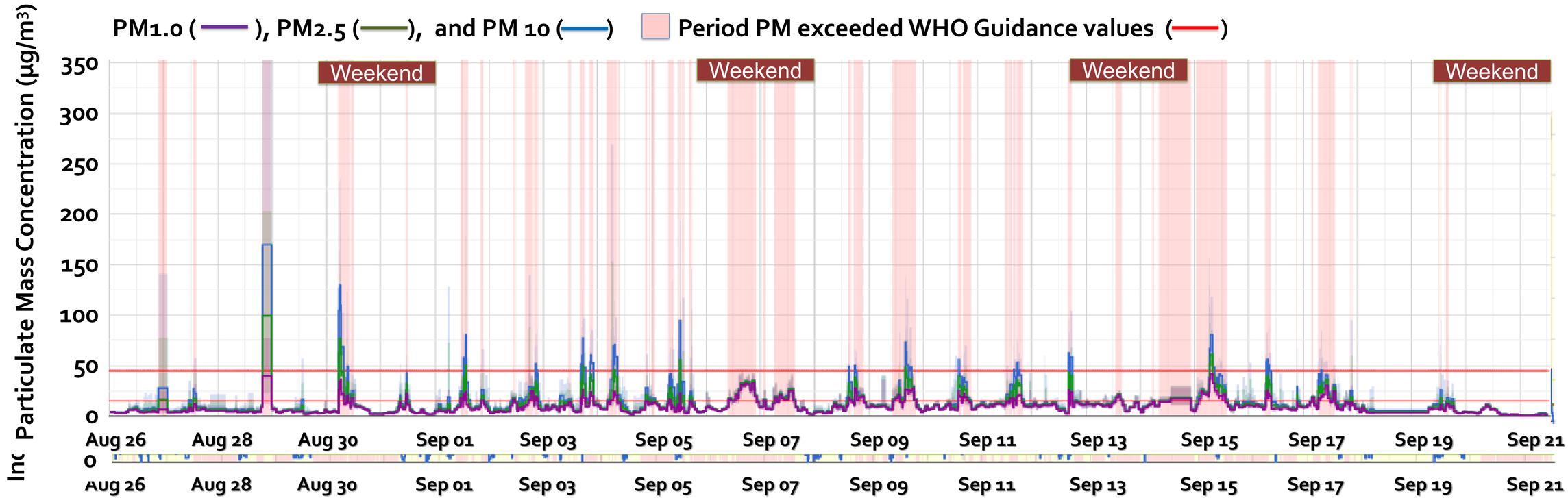
Sensor Monitoring Demonstrates Emissions from a Partially Enclosed CNC

German IAQ guidance values for defining excellent (—) to unacceptable air quality (—).



Sensor Monitoring Demonstrates Unrecognised tVOC Emissions

- After an HSE Inspection, this company was told to fit LEV systems to their CNC machines. To inform their selection of LEV, the company used the **HEXmon** sensor platform.
- Increased PM2.5 and PM10 emissions occurred when the CNCs were not fitted with LEV, but they also found large increases in tVOC emissions, demonstrating the complexity of these emissions.



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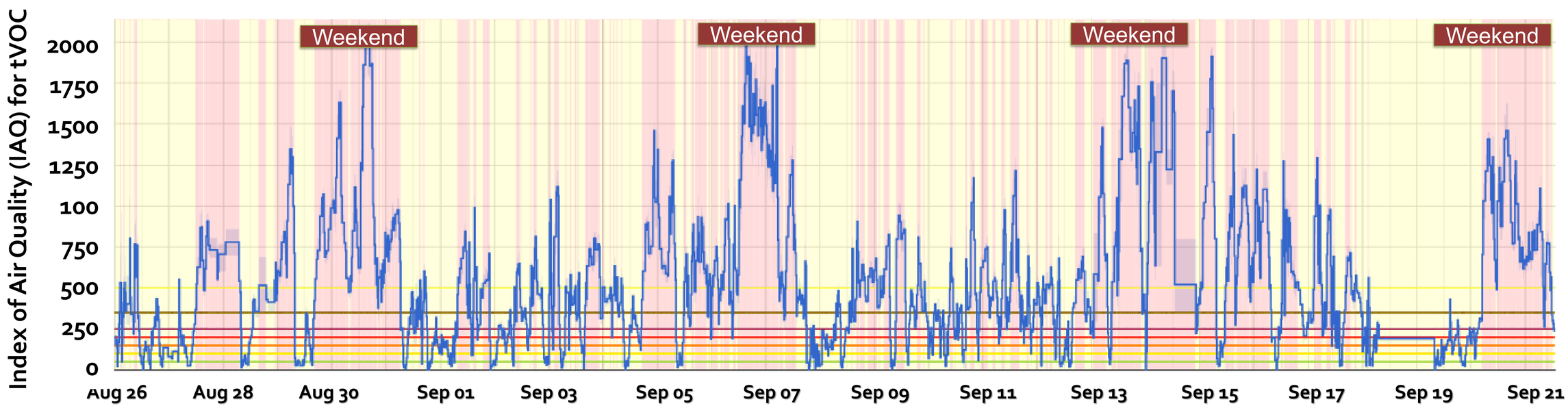
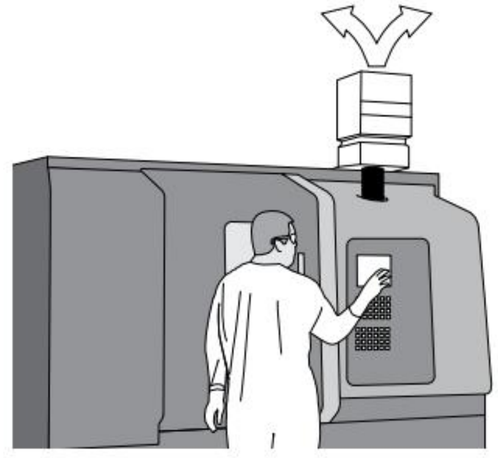
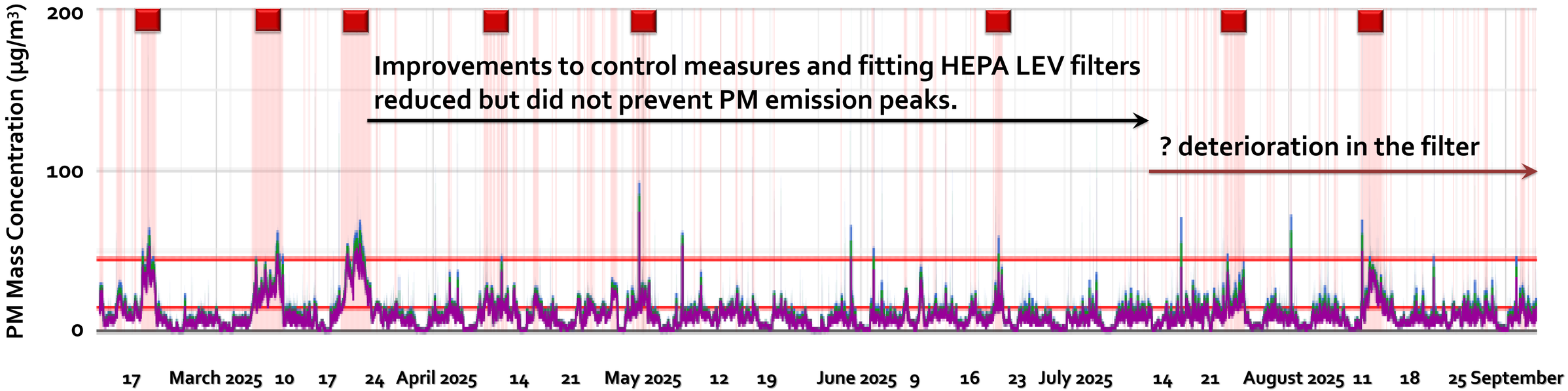


Sensor Monitoring of MWF Mist Extraction Unit Performance

- In a modern CNC shop running long cutting cycles, **HEXmon** data indicated that changing the filter type in a recirculating LEV system reduced PM2.5 and PM10 but only for about 3 months.

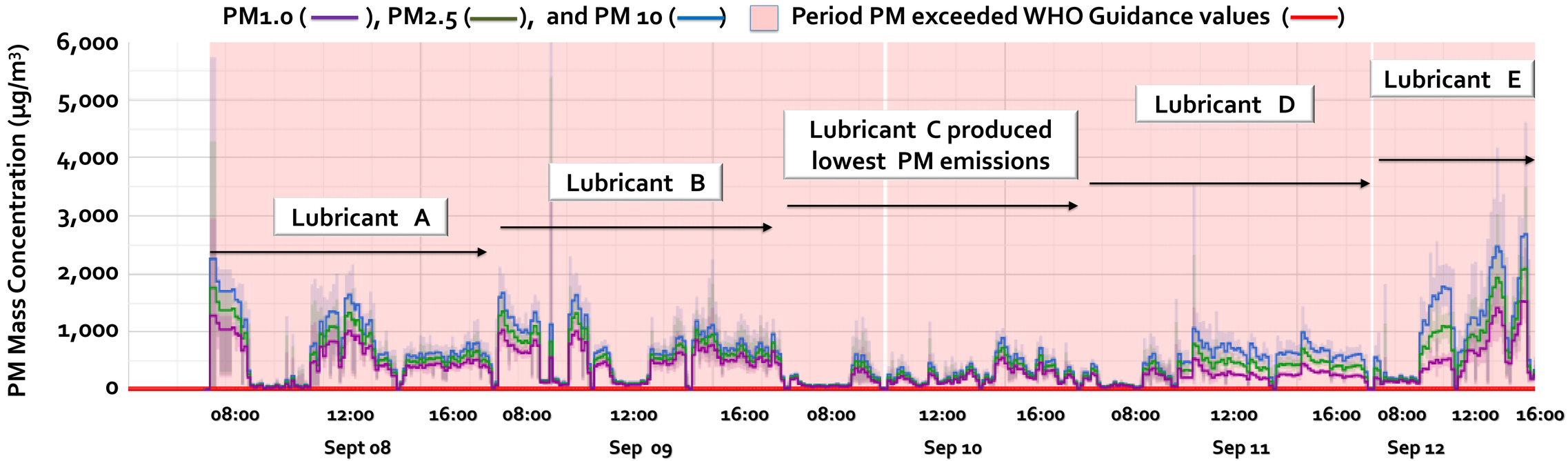


The duration of PM2.5 and PM10 emissions that exceeded the WHO guidance values.



Sensor Monitoring of PM Emissions from Different Lubricant Oils

- **HEXmon** was used to monitor the PM emissions from five 'Die Lubricant' oils over five days.
- The same components and processes were followed each day during the lubricant trial.



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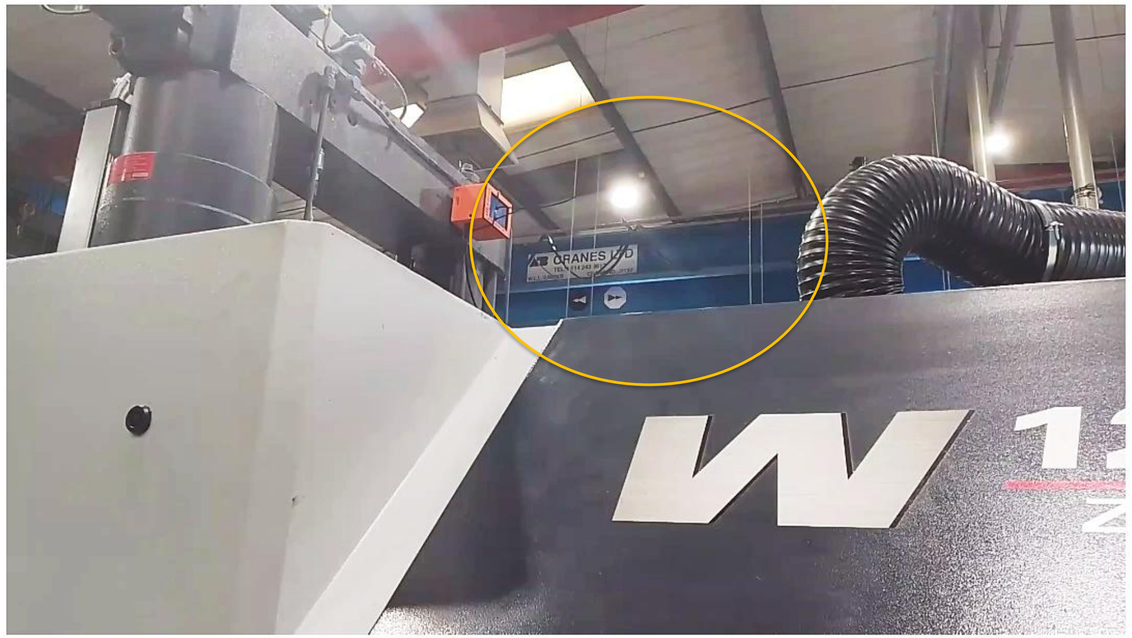

Conclusions

- Environmental sensors provide continuous data on emissions sources and may help to monitor the effect of control measures used in manufacturing.
- There is evidence that manufacturing companies using **HEXmon** are proactively using them to monitor control measures used to reduce hazardous emissions.
- This sensor platform is helping to identify unrecognised emissions/processes and supporting more comprehensive control measures.
- More research is needed to define good practice in using environmental sensors indoors in manufacturing settings, including for end users, advice about selecting appropriate sensors.