Pollutant concentration fall-off from the roadside, measured in a SSSI

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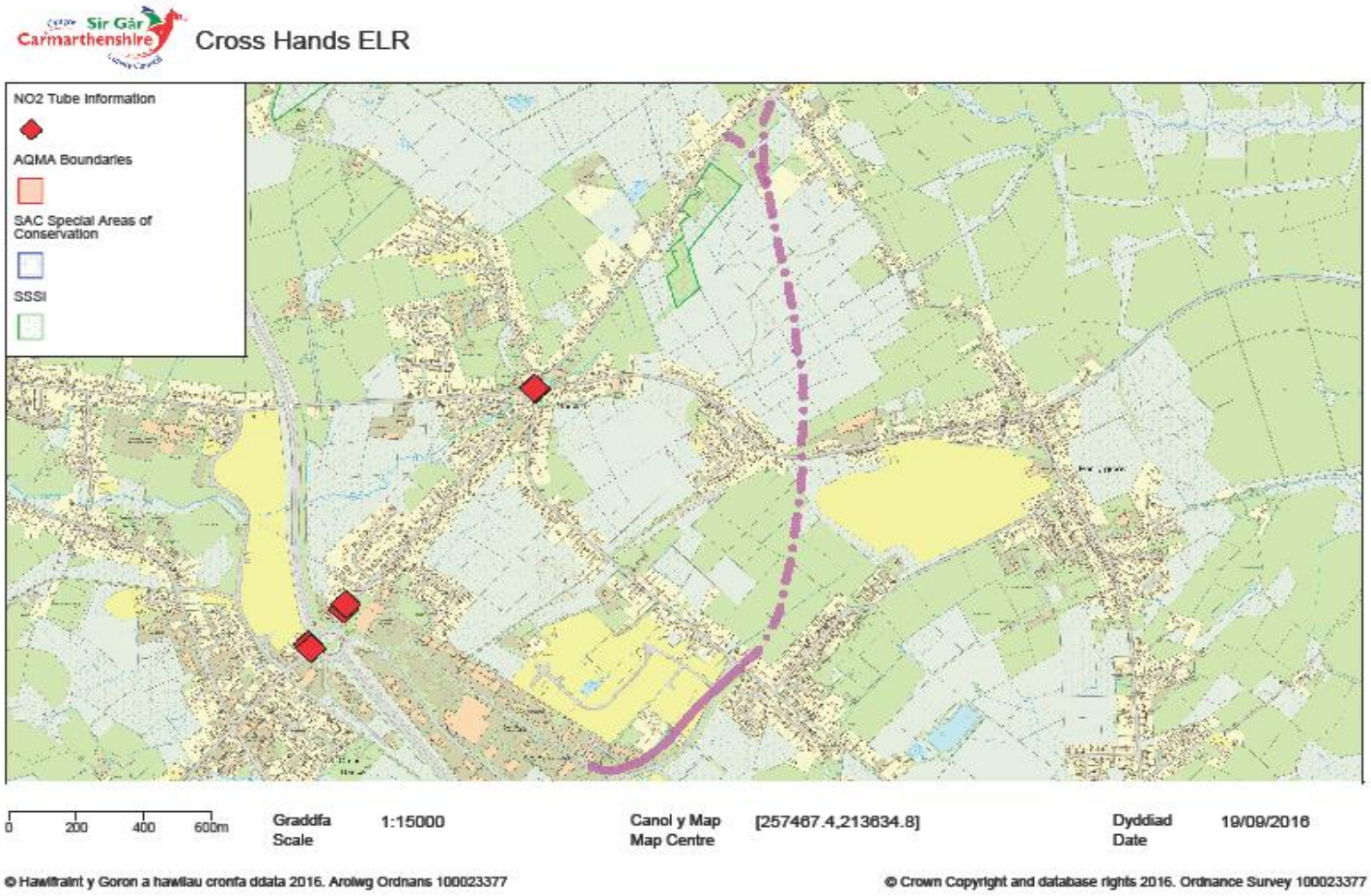
06th October 2016

Indicative ELR Route



Cross Hands - NO2 Tube Locations

AQA Tube Data

Tube Number	x	y	Annual Mean NO_2 ($\mu g/m^3$) [BAF 1.0]
1	257342	212745	9.4
2	257555	212942	12.6
3	257757	213562	14.8
4	258093	214196	11.0
5	257824	214616	10.7
6	257930	214867	15.5
7	257686	214690	23.1
8	257303	214139	24.3
9	257086	213853	28.8
10	257396	213804	14.3

AQA Conclusions

Public Health

- Negligible impact on public health.
- Potential benefits for those along existing routes as traffic should be reduced.
- Increased noise for those closest to junctions.

Ecology

- Potential significant negative impact on ecology, particularly for Marsh Fritillary Butterfly whose habitat may be affected by traffic related air pollution. (based on modelled data)

Mitigation

- Environmental bunds (noise & view)
- Proposed 50m buffer zone along the length of the Phase 2 road.
- Translocation of areas containing good quality food species vegetation (Devil's-bit scabious) for the butterfly.

Issues

- Buffer zone land take (road footprint 9ha)
- Why 50m?
- Buffer zone land could be deemed ‘baron’ for butterfly – loss of feeding & improvement land.
- Potential breach of Directive requirements?

Additional Issues

- Land Management Agreements – potential breeches
- Poor management practices – deterioration of land quality
- Land ownership
- Financial / compensation issues
- Land access issues
- Land purchase – practicalities & costs

Planning / Ecology

- Concerned with AQA Conclusions
- How to interpret ‘significant’ impact (Critical Loads already exceeded?)
- Lack of understanding with respect to AQ

- Asked for assistance & whether any monitoring could be performed.

Monitoring Project

- About 4 weeks to plan, specify and arrange implementation
- Needed to assess current situation to inform future impacts
- Ascertain impact over distance from road source
- Needed results ASAP!

Image – Crafthub.com

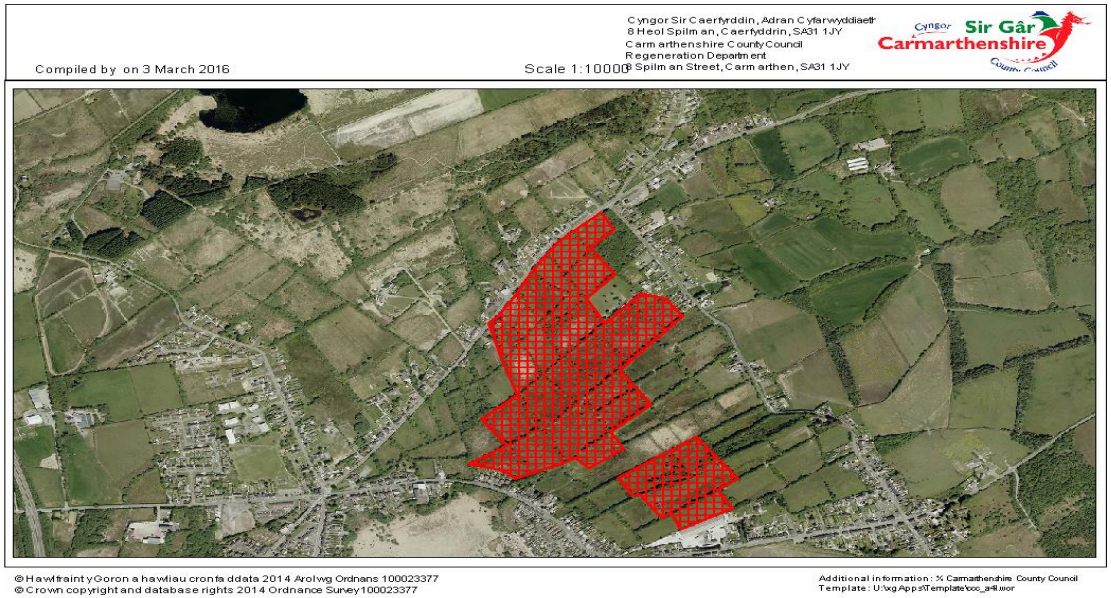
Ricardo to the rescue!

Project Overview

- Ricardo E&E undertook a mobile monitoring survey across 5 days on behalf of Carmarthenshire CC in March 2016 measuring NO_2, UFP's, MET and GPS. A traffic survey was also set up to run alongside.

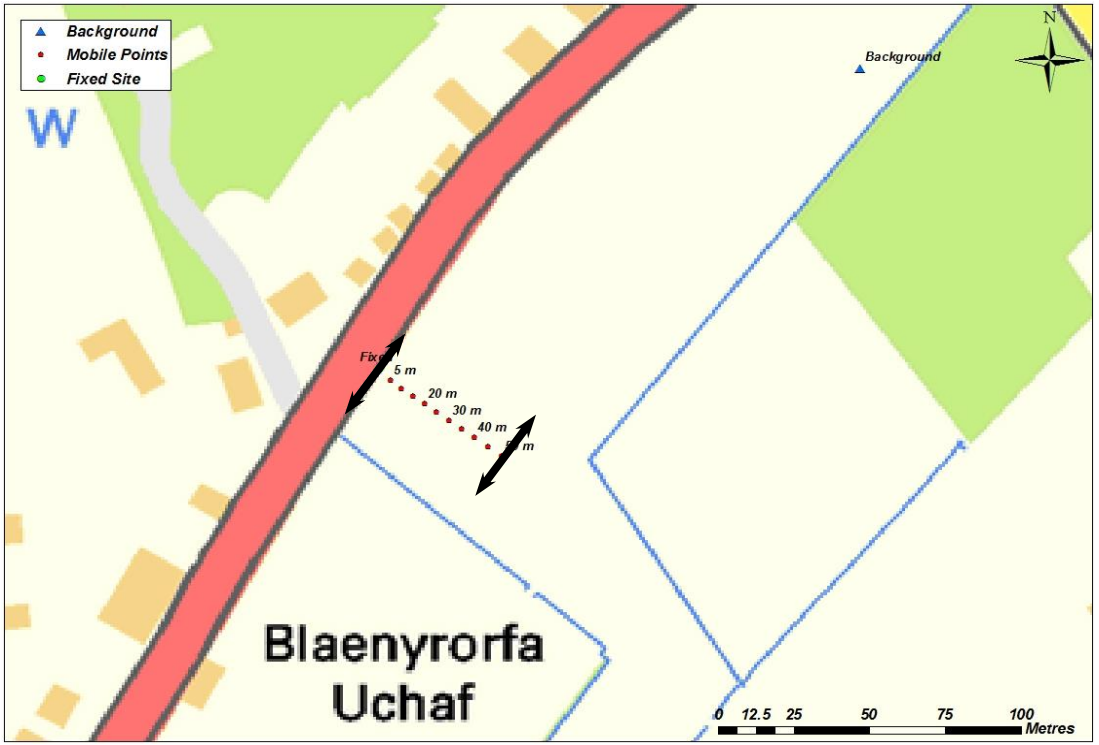
- The overall aim was to assess pollutant concentration fall-off in a SSSI area in Gorslas, Carmarthenshire, designated for the protection of the marsh fritillary butterfly and marshy grassland habitat.

- Evidence from a previous study by Natural England and Ricardo E&E concluded that vegetation was being impacted by exposure to motor vehicle pollution at distances of up to 200m.



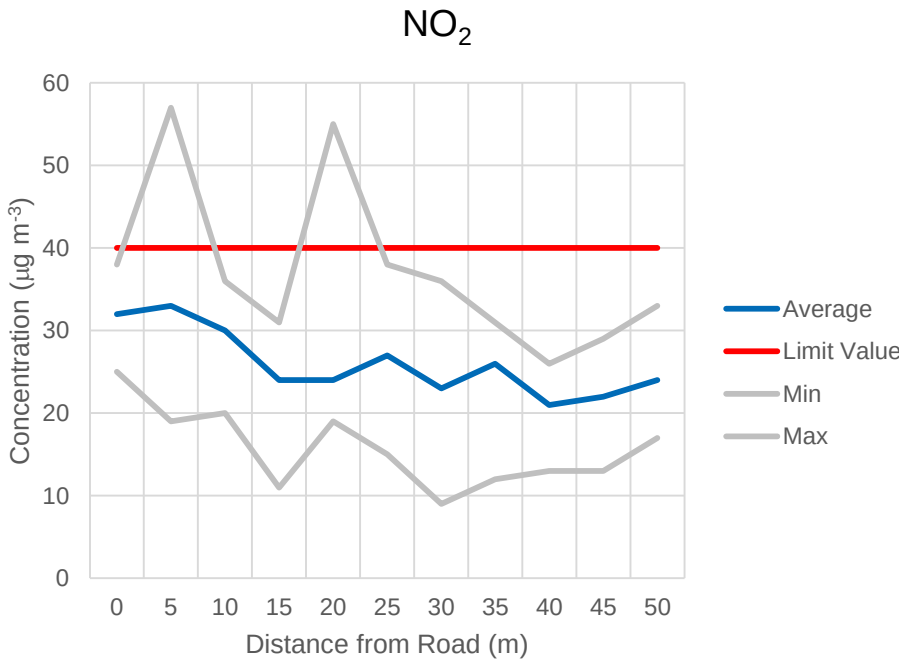
Monitoring Overview

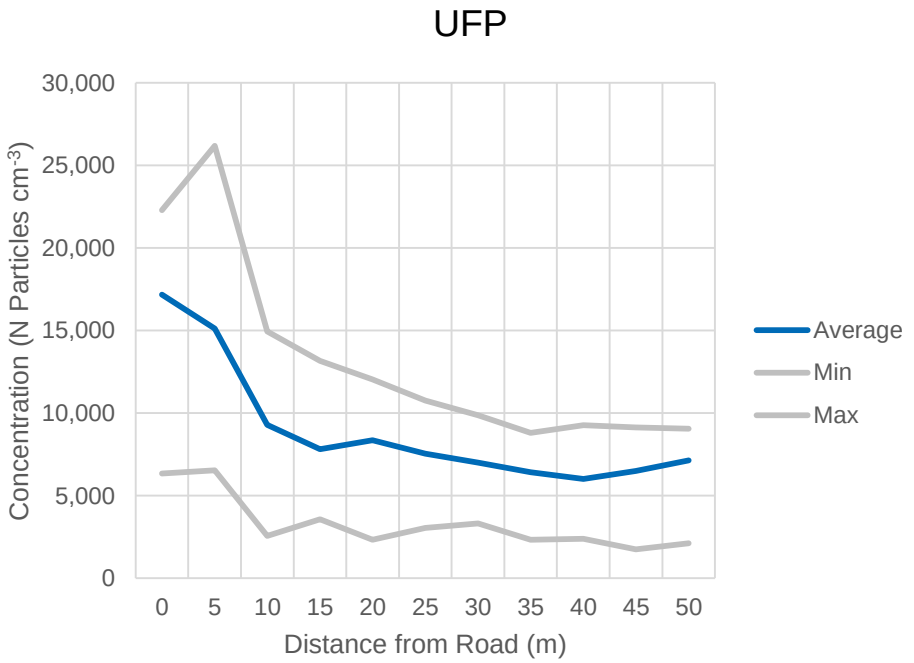
- Fixed point monitoring at roadside.
- A second set of mobile samplers, roadside and at 5 m intervals up to 50 m.
- Further monitoring at background location for 1 hour daily.
- A total of 5,495 1-minute average measurements recorded. Colocation exercises previously carried out to understand correction factors for the NO_2 equipment.



Results – Concentration Fall-Off

- NO_2 and UFP Graphs, concentration vs distance from the road.



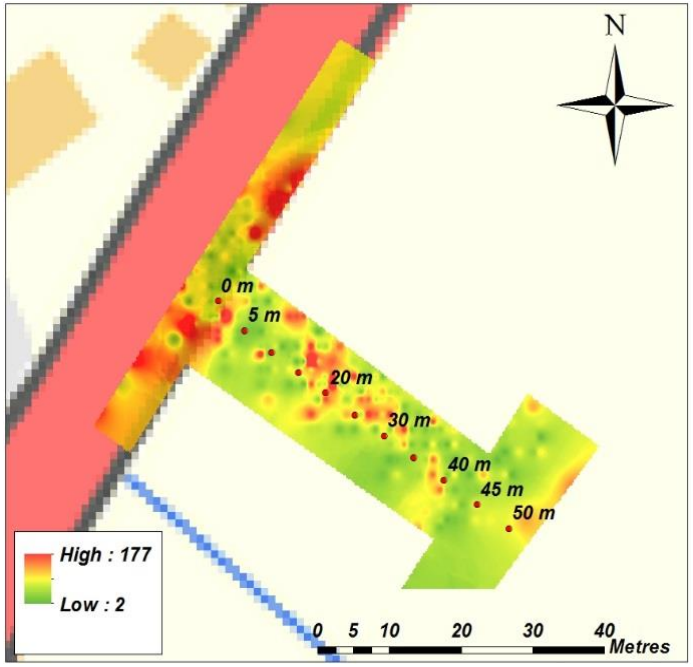


- Average 25% drop in NO_2, and 54% drop in UFP concentrations was seen over all monitoring exercises within 15 m of the roadside.
- Concentrations still seen up to 50m, but at Background Levels.

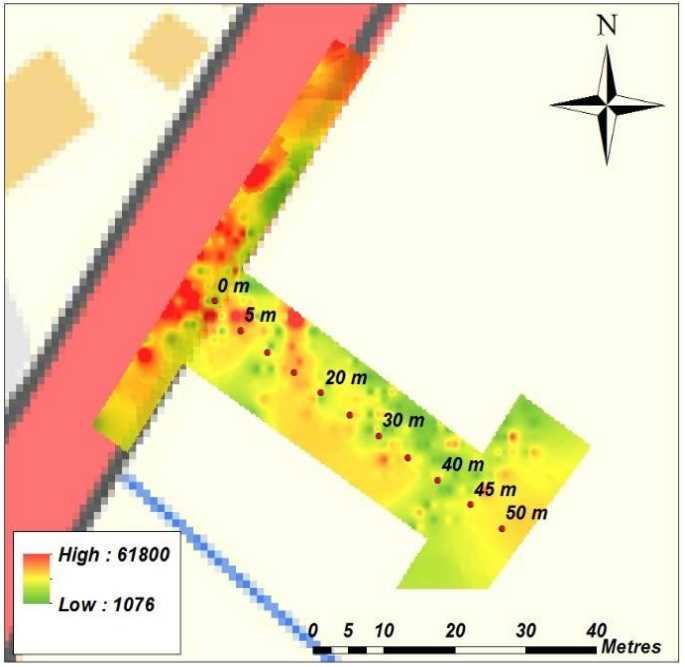
Results – Visual Distribution of Concentrations

- Spatial Distribution of 1-minute NO_2 and UFP Concentrations, taken from 10/03/2016.

NO_2



UFP



Results – Averaged Concentrations

- Average UFP and NO_2 Concentrations at the Roadside

Pollutant	ALL	07/03/2016	08/03/2016	09/03/2016	10/03/2016	11/03/2016
NO_2 (µg m^{-3})	19	16	15	13	22	20
AQMesh NO_2 (µg m^{-3})	13	-	-	13	12	15
UFP (N Particles cm^{-3})	12,033	9,259	11,290	7,745	15,652	9,806

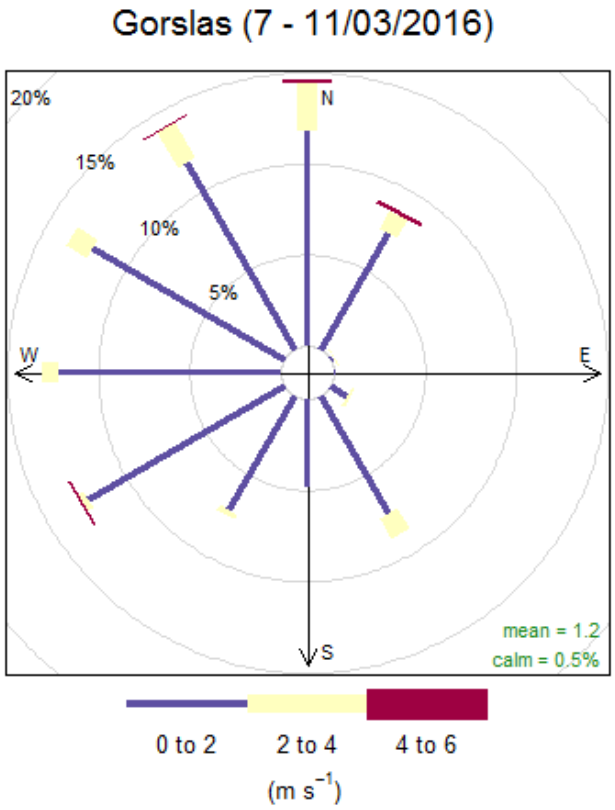
- Average NO_2 and UFP Concentrations at Background

Pollutant	ALL	07/03/2016	08/03/2016	09/03/2016	10/03/2016	11/03/2016
NO_2 (µg m^{-3})	25	n/a	21	n/a	28	23
UFP (N Particles cm^{-3})	7,961	n/a	2,864	n/a	11,657	5,293

- We found NO_2 concentrations were higher at the background location. This was not completely expected, although likely due to residential sources and subsequent oxidisation of NO to NO_2 from the road . UFP were higher at roadside as expected, predominantly due to diesel traffic.

Results – MET Data

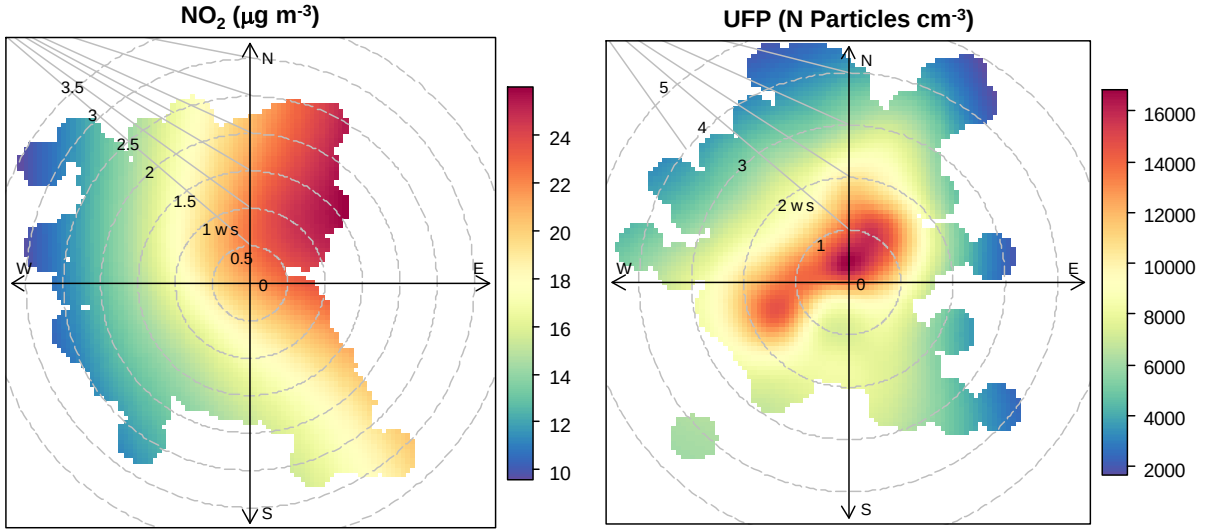
- The average wind direction varied from 182° to 286° during the monitoring program. Our MET data was verified by a local MET at Sennybridge location 42km North East of the monitoring location.



Frequency of counts by wind direction (%)

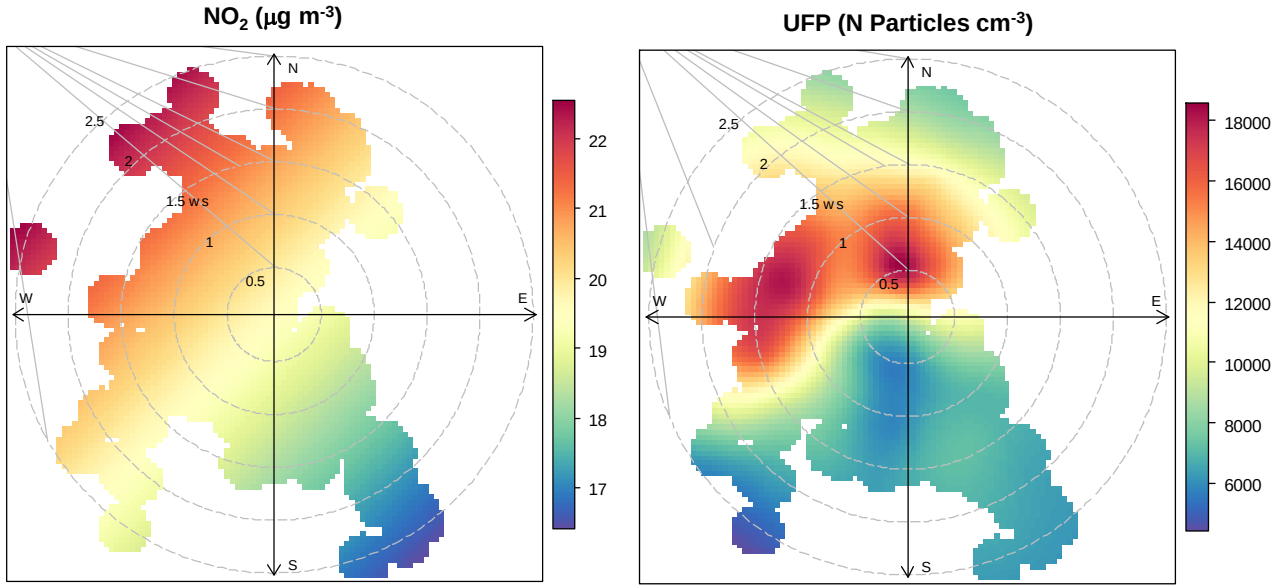
Results – Mobile Sensor Polar Plot

- Polar plots of mobile NO_2 and UFP 1-minute average concentrations
- NO_2, shows higher concentrations North Easterly between 0 and 3 m s^{-1}, consistent with poor dispersion at lower wind speeds. Road traffic and residential.
- UFP, shows higher concentrations West to North, with wind speeds between 0 and 1 m s^{-1}, consistent with the direction of the road. Road traffic and diesel emissions.



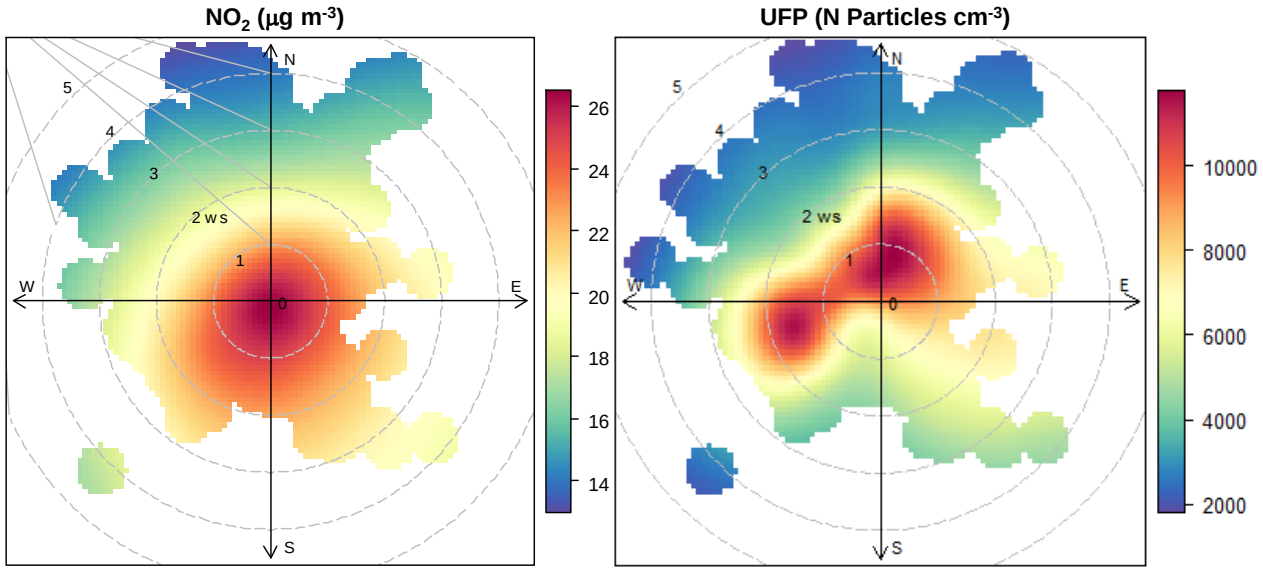
Results – Background Location Polar Plot

- Polar plots of Background NO_2 and UFP 1-minute average concentrations.
- NO_2, shows higher concentrations with Northerly and Westerly winds between 1 and 2.5 m s^{-1}, consistent with poor dispersion at lower wind speeds. Road traffic and residential.
- UFP, shows higher concentrations with Northerly and Westerly winds, with wind speeds between 0 and 2 m s^{-1}. Consistent with the direction of the road. Road traffic and residential.



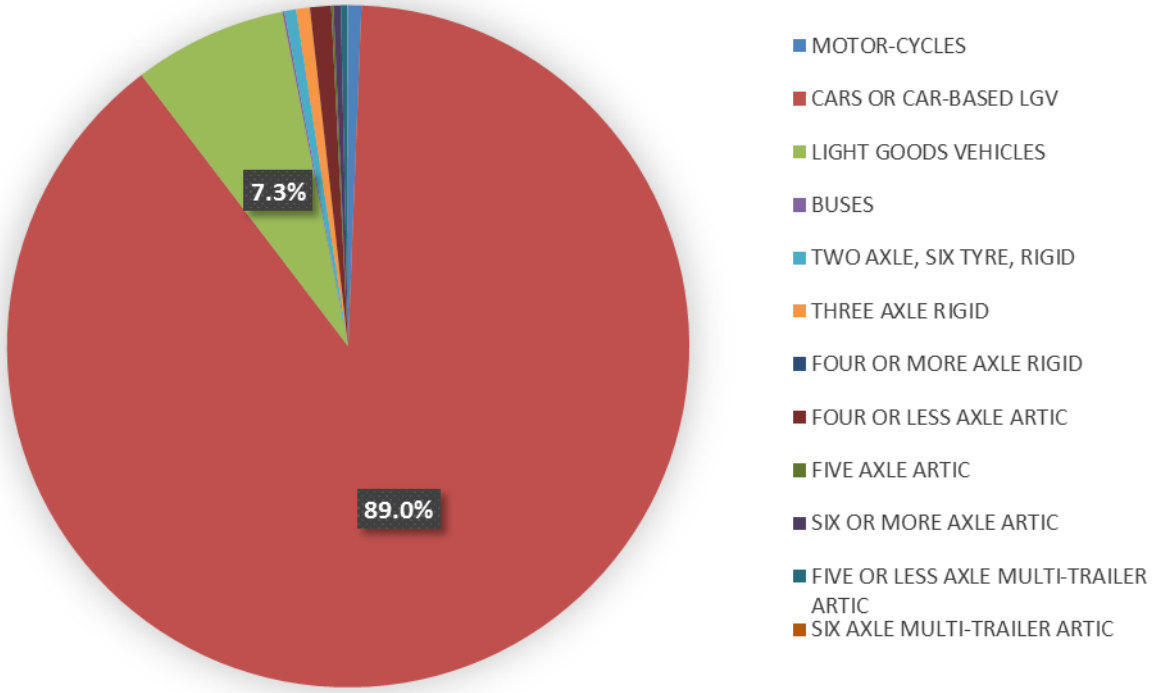
Results – Roadside Location Polar Plot

- Polar plots of Roadside NO_2 and UFP 1-minute average concentrations.
- NO_2, shows higher concentrations close to 0 m s^{-1}, consistent with poor dispersion of this pollutant at lower wind speeds. Road traffic.
- UFP, shows higher concentrations with Northerly and Westerly winds, consistent with the direction of the road.



Results – Traffic Count

- The 5 day (Mon to Fri) average daily traffic count was 6257 vehicles with an average speed of 35 mph.
- Even though the traffic flow is relatively low, it can be seen from the monitoring results that this still has an impact on NO_2 and UFP concentrations within the SSSI.



Conclusions

- NO_2 concentrations dropped to background levels within 15 m of the roadside, with the exception on 10/03/2016, within 20 m. An average 25% drop in NO_2 concentrations, concentrations reducing from 32 to 24 $\mu g\ m^{-3}$ within 15 m of the roadside.

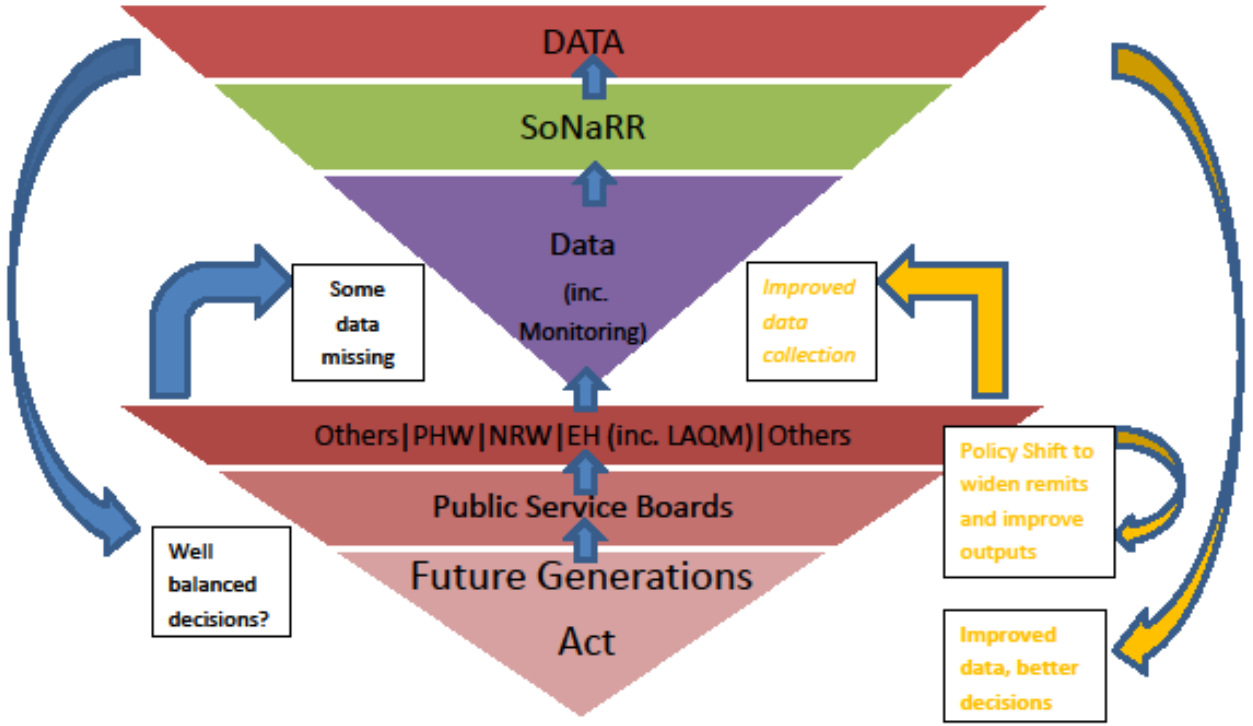
- UFP concentrations dropped close to background levels within 15 m of the roadside. An average 54% drop in UFP concentrations, measured concentrations reducing from 17,174 to 7,828 Particles cm^{-3} within 15 m of the roadside.

- Contour plots indicate that elevated short-term concentrations can be experienced at distances up to 50 m from the roadside. It is likely that this is a function of the emission sources that are in the local area and the meteorology.

Conclusions

- Maximum NO_2 concentrations were measured during the mobile exercises with a north easterly wind of between 0 and 3.0 m s^{-1}. This is consistent with poor dispersion of pollutants at lower wind speeds and indicates that there was a source of NO_2 located to the northeast of the mobile monitoring location (e.g. residential and commercial sources).

- Maximum UFP concentrations were measured when the wind was coming from the west to north, which is consistent with the direction of the roads (A476 and Gate Road) relative to the monitoring location with the main source of UFP in the area likely to be diesel road traffic.



Thank you for your attention.