

## Short note

To:	Dave Wadsworth	Lee Adcock
Copy:	David Anderson	Peter Quinn
TechSource No.:	112593	
Author:	Neil Haines	
Approved by:	Peter Quinn	
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**Subject:                    Assessment of the potential impact of proposed rebuild of stack A58 at Scunthorpe BOS plant**

### 1.        Introduction

Due to the deteriorating condition of the West Secondary Vent stack (A58) at Scunthorpe BOS Plant, parts of the stack were removed for safety reasons in December 2019 and the height was reduced from 45.7 metres to 27 metres. It is now proposed to partially rebuild the stack to a height of 36 metres. This note assesses the potential impact of this change on local air quality.

### 2.        Stack and emission characteristics

The West Secondary Vent stack is not normally in use as it is only a backup in case of unavailability of the main secondary ventilation system; in the period 01/09/18 to 29/11/19 the West Secondary Vent system was in operation on 120 days (26% of the days), though not necessarily for the whole day. It would normally be expected that the backup system would be required to operate on around 30 days a year. Because the stack is not in constant use, and because of the difficulties of continuously measuring dust levels where droplets from the wet scrubber may be present, there is no continuous monitoring of emissions from the stack and dust concentrations are only measured on an annual basis.

The average volume flowrate, based on the annual emissions monitoring results, is 38.7 Nm<sup>3</sup>/s. For the purposes of this assessment, it is assumed that emissions are continuously at the ELV of 50 mg/Nm<sup>3</sup>, which gives an emission rate of 1.9 g/s. A further assumption is made that 100% of the dust emitted is below 10 µm aerodynamic diameter, so the emission rate of PM<sub>10</sub> is also 1.9 g/s. The stack diameter is 2.58 metres and the stack is located at grid reference 492923,408642. The emission temperature (after wet scrubbing) is around 28 °C.

### 3. Dispersion modelling

The modelling approach for this assessment (including the weather data used and the treatment of buildings) is the same as was used for a previous study prior to removing part of the stack[1]. The model version used for the current exercise was ADMS 5.2.1.0, released in November 2016. For the purposes of this report, ambient dust concentrations were evaluated at eight current and former monitoring stations around Scunthorpe (see Section 5.1) plus two local SSSIs. Appendix 1 shows the locations of all the specific receptors.

### 4. Modelling results

Table 1 shows the predicted ambient dust concentration attributable to emissions from the West Secondary Vent stack at the specific receptors for the original height, the current height and the proposed rebuilt height. As a worst case, the annual average concentration is calculated assuming that the West Secondary Vent operates continuously throughout the year, which will overestimate the actual impact. The maximum daily average concentration is calculated based on a worst case assumption that operation of the West Secondary Vent coincides with the weather conditions that are least favourable for dispersion; this will also overestimate the actual impact.

		Contribution to ambient dust concentration ( $\mu\text{g}/\text{m}^3$ )						
		Stack height	Annual Average			Maximum Daily Average		
			Original 45.7 m	Current 27 m	Proposed 36 m	Original 45.7 m	Current 27 m	Proposed 36 m
Receptor	Rowland Road AURN	0.017	0.026	0.021	0.70	1.12	0.83	
	East Common Lane	0.021	0.027	0.024	1.37	1.52	1.45	
	Low Santon	0.150	0.297	0.218	2.31	2.95	2.49	
	Redbourn Club	0.016	0.021	0.018	0.97	1.05	1.02	
	Lakeside	0.227	0.286	0.258	5.34	7.18	6.34	
	Amvale	0.106	0.162	0.136	2.10	3.26	2.73	
	High Street East	0.020	0.030	0.025	0.85	1.20	1.03	
	Appleby monitor	0.125	0.231	0.175	1.12	2.12	1.61	
	Risby Warren SSSI	0.091	0.165	0.126	1.29	2.30	1.78	
	Broughton Far Wood SSSI	0.264	0.387	0.326	2.82	4.35	3.60	
	<b>Maximum</b>	<b>0.26</b>	<b>0.39</b>	<b>0.33</b>	<b>5.3</b>	<b>7.2</b>	<b>6.3</b>	

**Table 1: Dispersion modelling results**

In all cases, the proposed rebuilt stack height of 36 metres would lead to lower impacts than the current 27 metre stack, but the ground level concentrations would not be as low as for the original stack height.

### 5. Impact on local air quality

#### 5.1. Current air quality

There are a number of PM<sub>10</sub> monitors in the vicinity of Scunthorpe Works and results are available on the North Lincolnshire Air Quality web site[2]. Data for 2019 have been

downloaded and are summarised in Table 2. Three different types of equipment are used for this monitoring and only those identified as BAM or FDMS meet the requirements for equivalence with the gravimetric reference method. The TEOM data have been adjusted to give less accurate “gravimetric” results using data on the volatile content of PM<sub>10</sub> from other sites[3].

Monitor	Type	Annual average PM <sub>10</sub> (µg/m <sup>3</sup> )	No. of daily averages <sup>a</sup>	No. of daily averages exceeding 50 µg/m <sup>3</sup> <sup>a</sup>
Scunthorpe Town AURN	BAM	19.8	322	18
Scunthorpe Town TEOM	TEOM	21.7	357	23
Low Santon FDMS	FDMS	22.1	304	7
Low Santon TEOM	TEOM	29.5	315	35
High Street East	TEOM	21.3	360	14
East Common Lane	TEOM	22.1	361	23
Amvale	TEOM	21.1	319	14

a Excludes any days with fewer than 18 valid hours' data

**Table 2: Results of local air quality monitoring, 2019**

Comparing the results at the two locations where BAM/FDMS and standard TEOM monitors are co-located (Scunthorpe Town and Low Santon) shows that the TEOM results adjusted using the Volatile Correction Model still tend to overestimate the ambient concentrations compared to the more accurate monitors.

## 5.2. Potential increase in long-term average PM<sub>10</sub> concentrations

Table 3 shows, for each of the current monitoring locations, how the long-term average PM<sub>10</sub> concentration might increase compared to the original situation if the West Secondary Vent stack is rebuilt to a height of 36 metres. The figures in the table represent a worst-case situation, assuming that the West Secondary Vent stack is in use continuously throughout the year.

Monitor	Annual average PM <sub>10</sub> (µg/m <sup>3</sup> )					Increase (%)
	Measured (2019)	Original impact	Impact of 36 m stack	Potential increase	Predicted Environmental Concentration	
Scunthorpe Town BAM	19.76	0.017	0.021	0.004	19.77	0.02%
Low Santon FDMS	22.08	0.150	0.218	0.067	22.15	0.30%
High Street East TEOM	21.28	0.020	0.025	0.005	21.28	0.02%
East Common Lane TEOM	22.08	0.021	0.024	0.003	22.08	0.01%
Amvale TEOM	21.14	0.106	0.136	0.030	21.17	0.14%

**Table 3: Worst-case long-term impact, based on 2019 monitoring results**

The measured ambient concentrations for 2019 already include the impact of emissions from the BOS Secondary Ventilation System with the original stack height of 45.7 metres. To estimate the potential future Predicted Environmental Concentration, the difference between the impacts with the original stack height and those with the proposed 36 metre stack has been added to the measured levels.

Long-term PM<sub>10</sub> concentrations would not be expected to increase by more than 0.3% if the stack is rebuilt to a height of 36 metres, assuming that the West Secondary Vent stack was in constant use and emissions were continuously at the ELV. Since both of these assumptions are conservative, the actual increase in PM<sub>10</sub> concentrations will be less than 0.3%.

### 5.3. Potential increase in number of exceedance days

Table 1 shows that the maximum daily average PM<sub>10</sub> level attributable to the West Secondary Vent emissions at the Amvale monitoring site could increase from 2.1 µg/m<sup>3</sup> with the original stack to 2.7 µg/m<sup>3</sup> with the proposed 36 metre stack, if the least favourable conditions for dispersion coincide with operation of the stack. If this situation also coincided with a day when the average measured PM<sub>10</sub> concentration at Amvale was between 49.4 and 50 µg/m<sup>3</sup>, this would be sufficient to cause an additional exceedance day at that location. Over the course of 2019, there were no days when the PM<sub>10</sub> level was in this range, and so it would not be expected that a reduction in the stack height from the original 45.7 metres to the proposed 36 metres would have led to an increase in the number of exceedance days recorded. Table 4 shows, for each of the current monitoring stations, the potential impact on short-term concentrations.

Monitor	Maximum daily average PM <sub>10</sub> (µg/m <sup>3</sup> )			Additional exceedance possible if measured PM <sub>10</sub> is in this range	No. of times measured PM <sub>10</sub> was in this range in 2019
	Original impact	Impact of 36 m stack	Potential increase		
Scunthorpe Town BAM	0.70	0.83	0.14	49.86 - 50 µg/m <sup>3</sup>	0
Low Santon FDMS	2.31	2.49	0.19	49.81 - 50 µg/m <sup>3</sup>	0
High Street East TEOM	0.85	1.03	0.18	49.82 - 50 µg/m <sup>3</sup>	0
East Common Lane TEOM	1.37	1.45	0.08	49.92 - 50 µg/m <sup>3</sup>	0
Amvale TEOM	2.10	2.73	0.63	49.37 - 50 µg/m <sup>3</sup>	0

**Table 4: Worst-case short-term impact, based on 2019 monitoring results**

The receptor where the greatest potential increase in the maximum daily average PM<sub>10</sub> level is seen is Lakeside, where monitoring ceased in April 2018. The modelled results in Table 1 show that the worst-case additional impact would be 1.0 µg/m<sup>3</sup>. For the last full year of monitoring at this location, 2017, there was only one day when the measured PM<sub>10</sub> concentration was between 49 and 50 µg/m<sup>3</sup> and if this day coincided with operation of the West Secondary Vent and with the least favourable conditions for dispersion this could have been enough to cause one additional exceedance at that location.

### 5.4. Conclusions

Although rebuilding the West Secondary Vent stack to a height of 36 metres rather than the original height would increase the impact of emissions from that source on local PM<sub>10</sub> concentrations, the magnitude of the increase is small and would not be expected to lead to any significant deterioration in air quality.

The long-term average concentration at any of the current PM<sub>10</sub> monitoring locations would not be expected to increase by more than 0.3%. There is a low risk that the change in stack height would lead to an increase in the number of daily average PM<sub>10</sub> concentrations exceeding 50 µg/m<sup>3</sup> at any of the current monitoring stations. At Lakeside, where monitoring ceased in April 2018, there is a chance that there could have been one additional exceedance, based on 2017 monitoring data.

These conclusions are based on a number of worst case assumptions, and the actual impact would be expected to be less than described above. The assumptions are:

- The West Secondary Vent stack is in constant use throughout the year
- The emissions are continuously at the ELV of 50 mg/m<sup>3</sup>
- All the dust emitted is PM<sub>10</sub>
- The highest measured dust levels at the monitoring sites coincide with the least favourable conditions for dispersion

## 6. Reference

1. Haines, N., "Assessment of the potential impact of reducing the height of stack A58 at Scunthorpe BOS plant", Tata Steel TechSource Report No. 110438, December 2019
2. "Air Quality in North Lincolnshire", <http://www.nlincsair.info/Report/AutomaticData>
3. "Volatile Correction Model", <http://www.volatile-correction-model.info/>

## Appendix 1

Locations of specific receptors and West Secondary Vent stack

