

D1 Stack Height Report

commissioned by Pennine Aggregates Ltd

Operator Name

Pennine Aggregates Ltd | Buxton

Operator Address

Waterswallows Lane
Buxton, Derbyshire
SK17 7JD
EPR Permit P202-3/18

Release Point

E2 - ST Dryer

Monitoring Organisation Name & Address

Atesta Ltd
Unit 2, Asher Court, Lyncastle Way
Appleton, Warrington
WA4 4ST

Report Written By

Matt Pendlebury | Technical Support Manager
MCERTS Level 2 | MM 04 535 | TE1 TE2 TE3 TE4 | expires on 17/06/2024

Report Approved By

James Harmer | Technical Quality Director
MCERTS Level 2 | MM 03 156 | TE1 TE2 TE3 TE4 | expires on 03/12/2023



Job Reference: JOB-748

Report Date | Version Number

07/07/2023 | Version 1

Atesta Ltd Primary Contact

Alastair Wolff | m: 07506 729 226
e: alastair.wolff@atesta.com



info@atesta.com
T: 0800 970 8945

atesta.com

Part 1: Aim and Overall Result

Aim of the Report

This report uses the calculations in HMIP's Technical Guidance Note (Dispersion) D1 to generate a minimum discharge stack height for the release point listed in the report. This stack height will ensure adequate dispersion of the pollutants prescribed with Emission Limit Values (ELVs) in the site's Permit to operate.

Overall Result of the Stack Height Calculation Exercise

The minimum discharge stack height calculated in this report is 13m, as measured from ground level.

Part 2: Raw Data and Calculation Inputs

2.1 Guideline Concentrations (G_d)

The guideline concentration/s are taken from the current statutory short-term Air Quality Strategy objectives which supersede the original default values from Table 1 in HMIP's D1 document.
Source: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69336/pb12654-air-quality-strategy-vol1-070712.pdf

parameter	guideline (G_d) mg/m ³	concentration as measured
Total Particulate Matter	0.05	24 hour mean

2.2 Background Concentrations (B_c)

The background pollutant concentration data was obtained from DEFRA's UK Air - Air Information Resource Background Maps. The x-y grid reference closest to the site of interest was chosen. Environment Agency Horizontal Guidance Note H1, Annex F suggests using a value of 2x the annual background concentration in the Background Maps. The most recent background concentrations for PM10 are from the 2018 background map.
Source: <https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2018>

parameter	background (B_c) mg/m ³	local authority	background year	x-grid coordinate	y-grid coordinate	annual background (from background map)
Total Particulate Matter	0.01808	High Peak Borough Council	2018	407896	375190	0.00904

2.3 Emission Limits (ELV) of the Principle Parameters (C_s)

parameter	ELV mg/m ³
Total Particulate Matter	50

2.4 Current Release Point Characteristics

characteristic	value	units
Stack Gas Temperature (T_d) ¹	119.8	°C
Stack Gas Velocity (V_s) ¹	14.2	m/s
Duct Diameter ¹	0.41	m
Duct Area ¹	0.13	m ²
Actual Volumetric Flow Rate (V) ¹	1.87	m ³ /s
Water Vapour Content (WV) ¹	4.80	% v/v
Ambient Temperature (T_a) ¹	25.0	°C

¹ Measured values at the sampling plane from the stack emissions monitoring reports [JOB-583]

characteristic	value	units
Duct Depth x Width ²	0.48	m
Duct Area ²	0.18	m ²
Discharge Velocity (W) ³	10.33	m/s

³ Values at the point of discharge to atmosphere

² Calculated from measured actual volumetric flow rate and area of the duct at point of discharge

Part 3: Stack Height Calculations

3.1 Dispersion Concentration at Stack Conditions (C_d)

parameter	value	units	equation for calculation
Total Particulate Matter	33.08	mg/m ³	$C_d = [C_s] \times [273/(T_d+273)] \times [(100-WV)/100]$

3.2 Discharge Rate (D)

parameter	value	Units	equation for calculation
Total Particulate Matter	0.062	g/s	$D = [V] \times [C_d]/1000$

3.3 Pollution Index (P_i)

parameter	value	Units	equation for calculation
Total Particulate Matter	1938.10	m ³ /s	$P_i = [D]/(G_d - B_c) \times 1000$
Major Pollutant (P_i)	1938.10	m ³ /s	

3.3 Heat Released (Q)

variable	value	Units	equation for calculation
Q	0.16	MW	$Q = V \times [1 - ((T_a+273)/(T_d+273))]/2.9$

3.4 Discharge Momentum (M)

variable	value	Units	equation for calculation
M	14.66	m ⁴ /s ²	$M = [(T_a+273)/(T_d+273)] \times V \times W$

3.5 Uncorrected Discharge Stack Height (U_b)

variable	value	Units	equation for calculation
a	-0.96	-	for $Q < 1$ MW, $a = -1.11 - 0.19 \cdot \log_{10}[Q]$, $b = 0.49 + 0.005 \cdot \log_{10}[Q]$
b	0.49	-	
U_b	4.38	m	$10^a \times P_i^b$

Part 3: Stack Height Calculations

3.6 Uncorrected Discharge Stack Height, due to momentum (U_m)

variable	value	Units	equation for calculation
X	-2.55	-	$-3.7 + [(\log_{10} M)^{0.9}]$
Y	5.17	-	$5.9 - [0.624 \times (\log_{10} M)]$
Z	-5.18	-	$4.24 - [9.7 \times (\log_{10} M)] + [1.47 \times (\log_{10} M)^2] - [0.07 \times (\log_{10} M)^3]$
log10Um	0.89	-	$X + (Y \times (\log_{10} P_i) + Z)^{0.5}$
U_m	7.70	m	$10^{\log_{10} U_m}$

3.7 Calculation of Minimum Value of U_m

variable	value	Units	equation for calculation
Minimum U_m	1.94	m	$0.82 \times [M^{0.32}]$
Reported U_m	7.70	m	Maximum of U_m or Minimum U_m
5 U_m (for building correction)	38.49	m	$5 \times U_m$

3.8 Final Discharge Stack Height (U), uncorrected for nearby buildings

variable	value	Units	equation for calculation
U	4.38	m	Minimum of U_m or U_b

3.6 Final Stack Height (C), corrected for nearby buildings

All buildings that fall within $5U_m$ of the stack must be considered for building correction.

variable	building 1	building 2	building 3	building 4	Units	equation for calculation
Building Name	Building A Warehouse	Warehouse Extension	Proposed Silos	Building B Warehouse	-	-
Distance from Stack	0.0	21.0	Various (< 5U _m)	42.0	m	-
Height (H)	6.7	7.0	9.3	6.7	m	-
Max Building Width (W _i)	56.0	56.0	3.0	58.8	m	-
Maximum Height (H _m)	9.3				m	-
K	6.7	7.0	3.0	6.7	m	Minimum of H or W _i
T	16.8	17.5	13.8	16.8	m	H + 1.5K
T _m	17.5				m	Maximum T for all buildings
A	1.8				m	U _m / U _b
Calculated Stack Height (C)	12.79				m	H _m + (1 - H _m / T _m)(U + (T _m - U)(1 - A ^{-U/H_m}))
Final Stack Height	13.0				m	Rounded up to the nearest metre